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Performance Based Compensation in Chinese Public Hospitals

ZHOU Lei

Doctor of Management

Supervisor:
PhD José Paulo Esperança, Professor,
ISCTE University Institute of Lisbon

March, 2021

Marketing, Operations and General Management Department

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Jury:

PhD Leandro Luís Ferreira Pereira, Assistant Professor with Habilitation
ISCTE - Instituto Universitário de Lisboa
PhD Elisabete Gomes Santana Félix, Associate Professor
Universidade de Évora
PhD Virgínia Trigo, Emeritus Professor
ISCTE - Instituto Universitário de Lisboa
PhD José Paulo Afonso Esperança, Full Professor
ISCTE - Instituto Universitário de Lisboa
PhD Zhang Chichen, Full Professor
Southern Medical University

March, 2021

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Signed: *ZHOU Lei*　　　　　　　　　Date: *3/15 2021*

Name: *周嫘.*

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作者签名：*周嫘.*　　　　　　　　　日期：*2021·3.15*

姓名(拼音)：*ZHOU Lei*

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Abstract

This study was determined by innovatively integrating the equilibrium structure of "principal-agent- and beneficiary" in the principal-agent theory and Donabedian's "goal-process-result" theory.

The *Operational Manual for Performance Appraisal of National Tertiary Public Hospitals (2019 Ed.)* was used as the source of indicators, complemented by two questionnaire surveys. Frequency analysis and ANOVA enabled the performance management index system of public hospitals. Furthermore, the index system was verified by key information interviews (KIS) to form a three-dimensional (3D) equilibrium performance incentive system for public hospitals.

Selected professionals from First People's Hospital of R City participated in the survey, enabling the weight assignment of indicators in the 3D equilibrium performance incentive system of public hospitals by Analytic Hierarchy Process. In addition, the possible problems in the application of the system in public hospitals are discussed.

This study has found that the 3D equilibrium performance incentive system of public hospitals can contribute to modernize the hospital administration system, improving the quality management and performance. At the same time, it was verified that in the design process of performance management, not all factors could be regarded as performance indicators, including some invisible but vital factors such as values and humanistic spirit that could not be included in the evaluation indicators. In addition to the quality of objective data and the accuracy of subjective data, cognitive biases in different ages, job types and position levels in hospitals will bring greater challenges to performance management.

Keywords: public hospital performance management; performance incentives; parity value
JEL: D33; J33

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Resumo

Este estudo faz uma integração inovadora da estrutura de equilíbrio da relação entre o "principal-agente-e beneficiário" e a teoria de Donabed da "meta-processo-resultado".

O *Manual Operacional para a Avaliação do Desempenho dos Hospitais Públicos Nacionais (Ed. de 2019)*foi a fonte de indicadores, complementados por dois questionários. A análise de frequências e ANOVA permitiram construir um índice do desempenho dos hospitais públicos. Este índice foi validado com entrevistas chave para informação a partir das quais foi construído um modelo tridimensional (3D) de incentivos ao desempenho dos hospitais públicos.

Foram selecionados profissionais do Primeiro Hospital do Povo da Cidade R que participaram no questionário, permitindo testar o peso dos indicadores no modelo tridimensional (3D) de incentivos ao desempenho dos hospitais públicos através do Processo de Hierarquia Analítica. Adicionalmente, são discutidos os possíveis problemas da aplicação deste modelo nos hospitais públicos.

Este estudo permitiu concluir que o modelo tridimensional (3D) de incentivos ao desempenho dos hospitais públicos pode contribuir para a modernização do sistema de administração dos hospitais públicos, melhorando a qualidade da gestão e o desempenho. Foi também verificado que no processo de desenho da gestão do desempenho nem todos os fatores podem ser encarados como indicadores de desempenho. Fatores invisíveis mas vitais como valores e espírito humanístico não puderam ser incluídos nos indicadores de desempenho. Para além da qualidade de dados objetivos, e da adequação de dados subjetivos, as diferenças cognitivas em função da idade, tipo de função e e nível hierárquico nos hospitais trazem maiores desafios à gestão do desempenho.

Palavras-chave: gestão do desempenho nos hospitais públicos; incentivos ao desempenho; valor paritário

JEL: D33; J33

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摘 要

本研究开创性综合委托代理理论"委托人—代理人—受益人"的平衡结构及 Donabedian 的"目标—过程—结果"理论，构建了本研究的概念框模型和研究路径。

本研究通过建立绩效管理概念模型，选取《国家三级公立医院绩效考核操作手册（2019 版）》作为指标来源，进行了两次问卷调查，用频次分析法和单因素分析法，筛选出本研究的公立医院绩效管理指标体系；进步用关键人物访谈进行指标体系的校验，形成三维平衡公立医院绩效激励体系。

接着，以 R 市第一人民医院为研究对象，在医院选择专业人员参与调研，用层次分析法完成了三维平衡公立医绩效激励体系中指标权重的赋值工作。并且，进一步讨论了本体系在案例医院应用可能存在的问题并给出了解决方案。

本研究认为三维平衡公立医院绩效激励体系可以成为医院管理目标、质量管理、结果管理的重要抓手。但同时，验证了在绩效管理设计过程中，并非所有的因素都能纳入绩效指标的设计，更多看不见而起到至关重要的价值观、人文精神等等均无法纳入考核指标等；以及在绩效管理工作中，除了客观数据质量，主观数据准确性等问题以外，医院各年龄阶段、岗位类型、职位等级中存在的认知偏差将给绩效管理带来更大的挑战。

关键词：公立医院绩效管理；绩效激励；平衡价值
JEL: D33; J33

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Chapter 1: Introduction

1.1 Research background and significance

1.1.1 The development of pay-for-performance incentive mechanism in the context of state policies

The year 2018 marks the 40th anniversary of the reform of China's health undertakings. Some scholars divide the 40-year reform into four periods: initial exploration (from 1970s to the late 1990s), strengthened reform (from the early 1990s to the early 2000s), crucial adjustment (from the period of SARS epidemic in 2003 to 2009), and new medical reform (from 2009 on) (Li, Jiang, & Chen, 2008).

Public hospitals, as a vital part of the China's medical blueprint, take on the core responsibility of healing the sick and rescuing the dying. In the meantime, medical reform policies in different periods have been influencing the development of public hospitals. Some policies which were issued during the initial exploration period are still working nowadays.

(1) "Streamlining administration and delegating power to lower levels, operating by enterprises": The beginning of nationwide medical system reform

At the beginning of China's medical reform, the key concept was "streamlining administration and delegating power to lower levels, operating by enterprises". On January 13, 1979, a speech delivered by former Vice Minister of Health of P.R.C Qian Xinzhong was published on *People Daily,* pointing out that the main measure in the field medical and health lies in "complying with objective economic laws and managing the public health sector in the style of managing enterprises. Hospitals should be entitled to determine their expending, accounting, instrument purchasing, career promotion, performance assessment, rewards and punishments" (Li, Jiang, & Chen, 2008). In 1985, the *Report Concerning Some Policy Questions in the Reform of Health Work* issued by the State Council pointed out that "efforts must be made to conduct reform, adopt more flexible policies, streamline administration and delegate power to lower levels, develop multi-channels financing, widen the pathway of health service development, so as to achieve great results in health work" (Li, Jiang, & Chen, 2008). At that time, a comprehensive medical system reform was officially launched in China.

In this context, the operation mode of health institutions all over China was turned to

enterprise-style management. Hospitals adopted various responsibility systems for internal management, such as administrative chief responsibility system, management by objectives, task index, fixed quota by contract, economic accounting, post duty system, distribution system of "more pay for more work". Public hospitals took on the role of public institutions during the period of planned economy and began to operate and generate profits independently. The commercialized and market-oriented operating pattern which aims to boost profits is included in the internal incentive mechanism in public hospitals.

(2) During the period of strengthened reform, the pay-for-performance pattern continued to function with the absence of administrative management

From a financial perspective, most public hospitals in China have sufficient control right and even full claimant right. However, as public hospitals cannot draw extra profits, it seems to be not that important to maximize the profits shown in the financial statements; and hospital operators are motivated by maximizing gross profit and lifting expenditure at the same time, including the income of all workers in hospitals (managers included) and welfare expenses of human costs (Gu, 2006). The easiest way to increase gross profits is to adopt direct profit-sharing policies and even ladder-like incentive measures which are similar to sales commissions for front-line doctors. As doctors' income is composed of "basic salary, profit commission and project commission", their efforts in commission-oriented projects are directly related to their self-interest as well as reflected in the rise of hospitals' gross profits and patients' expenses (Zan, Zhou, & Zhu, 2017).

The enterprise-style operating mode focused on generating profits. The pay-for-performance distribution mechanism featuring revenue-minus-expenditure or profit-sharing system, which was the most direct and effective measure to stimulate gross profits, prevailed in hospitals. Since then, the economy had been stimulated, like Pandora's Box was opened. In the meantime, due to power decentralization, the government completely abandoned its responsibility for the health sector, which led to the lack of regulation and supervision on hospitals. Therefore, hospitals' mechanisms became more flexible and economic incentives more active, which on one hand, pushed forward the rapid development of health resources and technology level. And on the other hand, the induced consumption resulting from direct incentives became the main cause of expensive medical services. However, the policies failed to be adjusted in time.

Although the medical reform had been continuously strengthened during the period from late 1990s to early 2000s and the coordination of medical security, medical and health services

and medicine distribution was emphasized by of the *Decision of the Central Committee of the Communist Party of China and the State Council Concerning Public Health Reform and Development* which was issued in 1997. Dong (1997) considered that the nature and features of the health service industry, especially the key nature of medical and health services, was still not well recognized. The health service industry was subject to the joint supervision and control of various institutions, systems and departments, failing to make a concerted effort. The "expensive medical services" which resulted from boosting profits continued to be the bottleneck of China's medical and health reform.

(3) During the period of new medical reform, the payer of medical insurance emerged, and the pay-for-performance mechanism triggered conflicts

In April 2009, *Directives of the CPC Central Committee and the State Council on Deepening Reform of the Medical and Health Care System* (No. 6 [2009] of the CPC Central Committee) were issued, marking the beginning of the new medical reform (Bai & Wang, 2009). With "strengthening government's responsibility" as its leading thought, the new medical reform focused on health insurance for all, increasing investment in public health, medicine production and distribution management, promoting new medical insurance and the construction of medical ethics. However, on the macro level, it did not modify the "profit-motivated" operating mode in hospitals' internal departments which was the leftover of early-stage medical reforms aiming at "power decentralization". The internal incentive mechanism for generating profits still existed. The over-treatment problem which resulted from the mechanism became the expensive medical treatment problem, triggering public wrath. It was agreed by all walks of life to resume public benefit as the priority of public hospitals. For a long time, the over commercialized and market-oriented operating mode in public hospitals was against the natural laws of health care and established international practices. Public hospitals came from one extreme of lacking resources and incentives before medical reform to another extreme of over development and aggressive profiting (Li, Jiang, & Chen, 2008). Public hospitals were regarded as the "deep water" area of medical reform.

On December 26, 2013, National Health and Family Planning Commission and State Administration of Traditional Chinese Medicine of the People's Republic of China unveiled *the Nine Prohibitions on Strengthening the Construction of Medical Ethics* (hereinafter referred to as "Nine Prohibitions") (National Health And Family Planning Commission NHFPC & China, 2013).The "Nine Prohibitions" put an end to the bonus allocation model which took economic accounting and economic incentives as its core. Efforts should be made to deepen the reform of medical insurance payment system, promote the charging system based on the number of

patients and bed days and type of disease, establish a modern hospital management system, push forward the reform of staff salary system in public hospitals, and accelerate the reform based on the acts of public hospitals.

From the release of the Nine Prohibitions to 2018, 16 documents had been issued successively to repeatedly emphasize the direction of performance reform of public hospitals and prohibition of setting revenue targets for doctors. Since 2009, a total of 34 documents have been issued at the national level regarding the salary system reform (see Annex A).

1.1.2 The challenge of insufficient human resources due to the increasing demand for medical and health services and the growth of institutions during the new medical reform

Although the 10-year reform of the medical and health system from 2009 to 2019 has been difficult, it has still achieved remarkable results. In the next 10 years, China will improve its national health policy based on the "Healthy China" national strategy, and provide the people with comprehensive and full-life-cycle health services. The data shows that China is facing a growing demand for medical and health services: at the end of 2018, the number of outpatient and emergency services nationwide has reached 8.31 billion, with an average of 6 visits per year by residents and 254.53 million hospitalizations. The annual hospitalization rate has increased to 18.2 %, and the national hospital bed utilization rate has reached 84.2% (Hu, 2019).

Data concerning medical institutions shows that from 2008 to 2018, medical institutions increased from 19,712 to 33,009, an increase of 67.5%. Among them, medical institutions at grassroots level increased by 10%; among hospitals, tertiary hospitals increased by 113.8%, secondary hospitals increased by 33%, and primary hospitals increased by 117.1%; in terms of time, most of the changes in the number of medical institutions took place around 2013. The growth rate of tertiary hospitals decreased significantly after 2013, but the growth rate of secondary hospitals and primary hospitals increased significantly around 2013. The proportion of diagnosis and treatment in medical institutions of all levels continued to grow, from 37.6% to 44.8%, while the proportion of primary hospitals' diagnosis and treatment continued to decline, from 62.4% to 55.2%. And the proportion of diagnosis and treatment in tertiary hospitals continued to increase from 34.9% to 51.8%, which shows that the diagnosis and treatment are still concentrated in medical institutions of higher-level (Lu & Cai, 2020).

A similar trend to the increase in service volume is the increase in medical expenses. The medical expenses in hospitals increased by 210.1%, which was much higher than the 171.3% increase in the grassroots-level medical institutions. And the increase of medical expenses in

tertiary hospitals was greater than that in secondary and primary hospitals, which coincided with the increase in the number of medical institutions in terms of time. In 2013, the rapid growth of medical expenses in secondary public hospitals and above was brought under control, from around 20% around 2010 to around 9.1% in 2018　(Lu & Cai, 2020). In terms of the structure of medical expenses, the medical services income of medical and health institutions at all levels, such as surgery, treatment, and nursing that can reflect the value of medical personnel's technical services, has increased significantly, and the income structure has been further optimized. The proportion of outpatient medical expenses in public hospitals dropped from 51.5% in 2009 to 40.6%, and the proportion of inpatient expenses per capita dropped from 43.6% in 2009 to 27.5% in 2019. It can be seen from the data that the growth of business volume of grassroots-level medical institutions is much lower than that of secondary and tertiary hospitals. In 2018, the visits of diagnosis and treatment in public hospitals increased by 260 million times, while that number in grassroots-level medical and health institutions only increased by 120 million times. In 2019, the number of admissions to public hospitals increased by 11.66 million, and the number of admissions to primary medical and health institutions decreased by 810,000. It can be seen that there is still fierce competition of interests among medical institutions at different levels, in which large hospitals have a significant advantage.

Compared with the continuously increasing demand for medical services, there are multiple difficulties in the number, performance and structure of medical and health technicians. The most urgent problem in grassroots-level hospitals is the low ability of medical and health technicians. From the perspective of the educational structure, most of the grassroots-level medical and health technicians only have a college degree or below, and the number of personnel with a doctoral degree or above is small. The professional titles obtained are mostly physician/assistant and primary titles, with a small proportion of associate senior and above (Lu et al., 2018). Take Guangxi for example, its total amount of grassroots-level medical and health resources continues to grow, but the number of medical institutions per thousand population is still lower than that of the whole country (Lu et al., 2018). Tianjin also faces problems such as huge shortage of medical and health technicians, a low overall quality of talent structure, and an unreasonable internal structure (Liu & Chen, 2019). In addition to grassroots-level hospitals, big cities like Beijing are also facing difficulties in terms of medical personnel's number, capability and structure. The growth in demand for health services in Beijing does not match the growth of future medical staff, and the proportion of medical staff is unreasonable. The capability of talents needs to be improved, the talent team needs to be optimized, and high-level talents are still in short supply (Qin & Wang, 2014). The shortage of

medical and health technicians is also related to the hospitals' continuous search for development. When medical institutions are upgraded in terms of level, they will face the needs of more new personnel, and the requirements proposed to high-level talents, talent resources, and personnel structure.

Regarding the problem of insufficient human resources, Dong and Zhao (2020) believe that low salary, lack of social security, few opportunities to receive education, and lack of financial and non-financial incentives are the possible reasons. And medical technicians at grassroots level have low educational level, few educational opportunities, and lack of systematic and standardized training, which increases the risk of misdiagnosis in grassroots-level medical service. Therefore, it is a long-term solution to the problem of shortage in medical technicians through education. And in terms of salary, the internal assessment mechanism of medical institutions must be taken into consideration. The increase in patient medical expenses has no significant relationship with the quality of services when over-diagnosis and over-treatment as well as increased medical care appear in order to fulfill the hospital's due responsibility; the hospital's internal assessment mechanism cannot be used to fully deal with issues related to the human resources.

Cai (2011a) believes that medical personnel are the most important medical resource, and the reform of hospital personnel system must be fully liberalized. At present, China's public hospitals are managed under the system of official posts and ranks of administrative institutions. Most of the staff are managed under the CPC's organization department and labor and personnel department. Public hospitals have limited personnel autonomy, especially for personnel at the management level. Hospitals taking personnel system reform can enjoy the right to appoint, fire, and hire management personnel. Among them, in some pilot hospitals, the administrative level of the middle-level managers of the hospital is abolished, and the board of directors appoints the personnel at the management level, and explores the establishment of the incentive and restraint mechanism for the dean. Referring to the methods of state-owned enterprises in the reform of the personnel posts, the pilot hospitals can completely control the personnel rights of employees by canceling the administrative establishment of all employees, and realize unified management of employees through a unified employment system. On the basis of the reform of the personnel system, the improvement of hospitals' productivity can be promoted through the performance appraisal-centered system and income distribution system. And efforts can be made in actively exploring a performance appraisal system with workload, medical services quality and services quality as the main assessment aspects, and taking job responsibility and work performance into consideration in employee income.

Dai (2013), holding a different view from Cai on the reform of personnel system and the removal of the official post system, believes that official posts can play an important role in attracting talents. In his research, he discussed another aspect of the establishment of the personnel official post system. Beijing and Zhenjiang have increased the number of official posts after assessing the current usage of official posts and workload. Places such as Shenzhen have implemented a more flexible personnel system based on inquiry control, dynamic management and contract management. At the same time, these places have set aside part of their official posts to attract high-end talents. The reform of the performance wage system in the pilot hospitals focuses on the reform of the distribution system. The reform focuses on formulating income assessment standards for the medical staff, taking service volume and medical quality into the consideration of medical staff's income, removing service income out of consideration. It aims to distribute salary in accordance with the post and the personnel's performance. Salary distribution is inclined to high-risk, high-tech jobs, and personnel taking first-line clinical night shifts. And some hospitals are exploring the annual salary system.

1.1.3 The incentive demand in the reform of governance structure of public hospital

The most important task in the new medical reform period is the reform of the public hospital management system, including the exploration of effective ways of separating government affairs and administrative affairs, management and operations, and the establishment of a coordinated, unified and efficient public hospital management system. The public hospital management system involves the reform of the government administrative management system, the reform of the hospital organization or the reform of the hospital management governance, and the reform of the hospital's internal management system; the reform of the hospital's internal management system is related to the four external factors that affect the hospital's behavior: 1) governance structure; 2) government supervision; 3) payment arrangement; 4) market environment. Among the above four factors, the government, as the regulator of the medical industry, must perform an impartial supervision function for all medical institutions, including public and private hospitals. However, government departments are more likely to focus on the micro-management of public hospitals. Therefore, how to transform government functions is an extremely critical issue in the process of public hospital reform. If the government only unilaterally delegates powers without performing effective supervision function, then the decentralized hospitals are prone to only care about their own interests and ignore the quality of medical services and the interests of patients, thus failing to guarantee the

social and public welfare characteristics of medical services. At the same time, the payment arrangement is directly related to the hospital's interests and can directly affect the hospital's behavior. The payment unit and payment model can send out direct incentive signals for the hospital (Cai, 2011b).

Payment arrangement mainly refers to the reform of medical insurance payment methods. For example, family doctors implement per capita payment, and hospitals implement a multiple payment method reform with forward-looking payment-payment based on disease classification as the majority. Under this arrangement, the balance of medical expenses belongs to the hospital. The remaining part of the savings can also be used for labor subsidies, which can mobilize the hospital's motivation in controlling the cost (Dong & Zhao, 2020).

The reform of medical insurance payment at the hospital payment level plays a guiding role in mobilizing the motivation of hospital services. However, the pressure on the management of the medical insurance fund continues to increase. On the one hand, it is due to the difficulties in the existing financing model of the medical insurance fund for urban and rural residents. In 2017, there were more than 60 areas in which urban and rural residents' medical insurance had deficits, and the deficits continued to expand. Among them, Shanghai, Shandong, Shanxi, and Ningxia, these four provinces (autonomous regions, municipalities) as provincial-level units experienced deficits, and 56 prefecture-level cities and coordinating districts in 21 provinces (regions, cities) experienced deficits (Huang, 2019).

Under the hospital governance structure featuring budget-organize, the government usually adopts a two-line method of revenue and expenditure for hospitals, and all profits of the hospital are turned over to the government. Therefore, the hospital itself does not have the motivation to reduce costs and increase revenue. The current governance model of public hospitals will allow hospitals gradually enjoy the right to fully manage the profits, and keep the profits without turning it over to the government, which is an important incentive for the hospital (Cai, 2011b). However, the newly implemented "two permissive" policies that allow medical and health institutions to break through the current wage control level (performance wage level) of public institutions and allow medical service income to deduct costs, and withdraw various funds in accordance with regulations which can be used mainly for staff rewards. Through all these reforms, public hospitals will have a pioneering autonomy in the distribution of savings (Dong & Zhao, 2020).

It is not so easy to supervise and manage public hospitals for the government. The activity of public hospitals is basically observable. When the manager has clearly defined the development goals of the public hospital, its operating results can be measured and can be

distinguished to a certain extent. The output evaluation of public hospitals is unique, and its quality (patient's health status) is indistinguishable, which brings uncertainty to the evaluation of medical results. The hospital grade evaluation system defines the evaluation scope and framework for the public hospitals (Li & Zhou, 2005). The public hospital grade evaluation system is a long-term mechanism to ensure the hospital can focus on medical quality, which is being adopted in countries all over the world (Yu, 2014; Huang & Liang, 2021). The modern hospital management system requires public hospitals to establish a management system with clear distribution of power and responsibility, scientific management, improved governance, efficient operation, and strong supervision. And the grade evaluation system has laid the supervision foundation to implement the modern hospital management system, and established a management index system centered on patients, safety and quality as the main line and covering the whole process of medical management. Its standards have played a role in scientifically, objectively and accurately evaluating the level of hospital management, strengthening connotation construction, and improving hospital operation efficiency (Huang & Liang, 2021). However, at the implementation level, medical institutions often emphasize evaluation and neglect the assessment after the evaluation. The grade evaluation system has become an access system, which leads to the emergence of two important tasks for the evaluation of medical institutions: periodic reviews and irregular key inspections are just a mere formality, and they do not really play a supervisory role; the lack of a long-term management mechanism has led to the hospital's over-evaluation and promotion, laxity after the evaluation, and declining medical quality, which exacerbated the expectations of fraud in the evaluation and the moral hazard in the evaluation process (Li et al., 2010).

The core issue of the reform of public hospitals is to establish an incentive and restraint mechanism featuring incentive-compatible among all relevant stakeholders, especially the establishment of a new income distribution system for public hospitals, and the formation of personal interests when the reasonable and legal income of medical staff matches their expenditure and status to form the positive interaction with institutional performance and social benefits (Dai, 2013). The reform of the governance structure of public hospitals plays a vital role in the new medical reform. Every reform should include economic incentive mechanisms, and involve the redistribution of benefits. Only by mobilizing the motivation of the society, the government, the medical and health service industry and the people can China achieves the results of the medical and health reform (Dong & Zhao, 2020).

1.1.4 Research significance

The core deep-water zone of China's medical reform is the reform of public hospitals in China, which is at a point of no return. In fact, the reform of public hospitals is not just a problem faced by China. The trend of public hospital reform in other countries around the world is almost the same: introduction of competition, introduction of market mechanisms, and introduction of a new market-based regulatory mechanism. The reform of public hospitals is embodied in three major modes, namely, "independence, corporatization, and privatization" (Gu, 2006). China's public hospital reform will also face these big challenges. The government should "optimize the reform of public hospitals, and vigorously encourage social capital to participate in the reform and restructuring of public hospitals". In this round of public hospital reform, the relationship between hospitals and the government, the external policy environment of the hospitals, and the macro institutional environment and administrative governance rules will change. It is worth pondering that the performance model of deduction wage directly encourages doctors to take advantage of information superiority and induce patients to over-utilize medical services to seek private benefits. It has resulted in excessive medical treatment and also brought conflict of interest between the medical service provider and payer. A more important risk is direct influence on the safety of medical services.

Medical services have strong politicized externalities and serious information asymmetry (Gu, 2006). On the one hand, information asymmetry exists between buyers (patients) and sellers (doctors). In the medical service market, the information mismatch between the two results in the buyers' inability to make effective judgments on the quality and price of medical services (except for common diseases or frequently-occurring diseases with full disclosure of information). On the other hand, there is also information mismatch between medical managers and doctors. Subject to professional restrictions, managers cannot make timely and effective judgments on the quality of specific multi-disciplinary and inter-disciplinary medical services. The performance model of "income commission" directly triggers the most common agency problem in agency theory discussion, namely "supplier-induced demand" or "supplier-induced consumption". It means that doctors take advantage of information superiority to induce patients to over-utilize medical services, thereby seeking private benefits, which leads to undue medical treatment and threatens medical security.

On this issue, a large amount of literature and public directives generally give evaluation from the moral level, lacking in-depth analysis and research. To study the impact of "income commission" or "fee-for-service" on medical quality and medical technology is of great value

to improve the modern hospital management system. It requires in-depth analysis and exploration.

1.2 Research status

1.2.1 Current performance management in public hospitals

The internal performance management of public hospitals is the core issue closely linking to performance assessment policies adopted by public hospitals. Nowadays, public hospitals pay more attention to the distribution of performance bonus, and mostly adopt the hospital-department bonus distribution method, which mainly focuses on the balance of revenue and expenditure. In the past 15 years, the clinical department has gradually formed a bonus accounting method which takes the balance of revenue and expenditure multiplied by the percentage of commission as the bonus accounting base, and then combines with individual quality penalty or risk coefficient adjustment to obtain the total value of bonus. After that, there are often two or three subjective adjustments of the results usually by raising the accounting income of the department or reducing the accounting expenditure to get new value of bonus. This method is widely used in domestic public hospitals, and its disadvantages are not only reflected in the opacity of subjective adjustment, the unfair and unreasonable internal distribution, and thus the management failure. The more noticeable problem is that it will stimulate hospitals to pursue profits.

1.2.2 Performance assessment policy of public hospitals in Beijing and Shanghai

Performance assessment pilots of public hospitals in Beijing and Shanghai were relatively early in China, which attracted much attention of scholars and researchers. The author has participated in the related work of performance assessment of Beijing municipal public hospitals in the early stage and thus is familiar with corresponding work. Under the organizational framework of the Beijing Municipal Health Commission, Beijing Municipal Administration of Hospitals was set up in 2011 to manage 22 municipal tertiary hospitals. In 2012, the evaluation of municipal hospitals was started. In May 2019, Beijing Municipal Administration of Hospitals was removed and Beijing Hospitals Authority was set up. Take a look at Shanghai, Shanghai Shenkang Hospital Development Center was established in 2005 and began to implement the performance appraisal for directors of public hospitals in 2006. Shenkang Hospital Development Center is the main body to implement the performance

assessment of municipal hospitals in Shanghai and responsible for managing 27 municipal hospitals. The municipally owned public hospitals of Beijing and Shanghai are respectively subordinate to Beijing Hospitals Authority and Shanghai Shenkang Hospital Development Center.

Beijing Municipal Administration of Hospitals constructed a set of quantitative indicators to evaluate the performance of municipal public hospitals. Combined with qualitative and quantitative indicators, it was divided into four dimensions of social evaluation, internal management, operation efficiency and development potential including 25 indicators to evaluate the directors of municipal public hospitals based on a percentage system (Wei, 2012). By 2015, the indicators were reconstructed, to which the horizontal comparison score of the above indicators, the hospital's personalized indicators, process evaluation of medical quality and evaluation of the DRG inpatient services were added. Science and the application of results were the two key points of the 2015 program (Wei, 2012). From the perspective of practice, Feng et al. (2015) summarized operation experience and mentioned the importance of performance management in hospitals. Xie (2018) did a case study by comparing performance assessment between Beijing and Shanghai, focusing on the impact of hospital internal performance management reform. He believed that external performance assessment could promote the reform of hospital internal performance management. Internal performance management in hospitals will directly affect the medical staff and has a positive influence on regulating medical behavior, motivating the enthusiasm of medical staff and ensuring the safety of patients. Comparing performance assessment of hospital management centers in Beijing and Shanghai, we found that Shanghai did better than Beijing when it came to the following institutional change of performance management in the hospitals. In Shanghai, 24 municipal hospitals have all established a brand-new internal performance appraisal index system and income distribution system, while in Beijing, there is no evidence that the internal performance appraisal and distribution system of hospitals has changed with the external performance appraisal system implemented by the hospitals authority. The reform of hospital internal performance management mainly focuses on the reform of performance assessment, which has strengthened the medical process evaluation, spurred the application of DRGS platform, and improved the performance appraisal information system, the performance communication system and the evaluation of scientific research performance. The hospital internal performance management reform in Shanghai responds well to the requirements of performance assessment policy in public hospitals, which specifically reflected in the performance appraisal indicator system, the calculating method of performance salary, and the construction of performance

appraisal information system (Xie, 2018).

1.2.3 Performance appraisal policy of national public hospitals

With the implementation of the performance appraisal of national tertiary public hospitals in 2019, the index system proposed in the *Operational Manual for Performance Appraisal of National Tertiary Public Hospitals (2019 Ed.)* will become the wind vane affecting the internal performance management of public hospitals (Chen & Dong, 2020).On July 1st, 2020, the National Health Commission of the PRC issued the first performance assessment report of national tertiary public hospitals, which was finished in 2019 jointly with relevant departments based on the monitoring data of the national tertiary public hospitals in 2018 (Sun, 2020).

Jiao pointed out that the most important value of performance appraisal of national public hospitals is three key words, namely the baton, scale and management and that its most important goal at the national level is to transition to performance assessment and performance management which should be applied by hospitals, departments, doctors through several model hospitals and demonstration hospitals so as to promote the high-quality development of public hospitals (Liu, 2020). Besides, the impact of the National Civil Servant Examination on the internal performance management of public hospitals will gradually emerge.

1.2.4 Performance management of public hospitals

Li (2016) considers that performance management is a management model with distinct business objectives, and it is difficult for public hospitals to take public welfare into consideration when carrying out performance management, especially when performance management needs to combine the hospital development with the individual needs of employees, since it is difficult to balance the constantly increasing needs of individuals with the public needs of hospital development according to Maslow's hierarchy of needs. Although Huang (2019) recognized that public hospitals should not be limited to the distribution of performance salary and bonus, she also mentioned the existing problems in hospital performance management. For example, people only pay attention to the calculation and payment of bonuses in practice while ignoring the implementation of the performance system. However, she still stressed that performance should be linked to economic benefits. Guo (2016) and Cao (2018)also believed that hospital performance is closely related to everyone's personal interests and is a way of interest exchange between the hospital and employees. Income of employees should be positively correlated with their contribution to the hospital and

quantifiable economic indicators should be established to motivate them to create value for the hospital.

Pei and Cao (2020) observed that performance management of public hospitals emerged late in China but performance management of tertiary public hospitals now has become a focal point. However, empirical research is scarce, most of which only focus on revealing the existing problems of public hospitals and giving specific suggestions, but neglect the construction of a systematic performance management system in hospitals.

1.3 Research questions and relevant concepts

Incentive policy based on revenue sharing system is important for hospitals to pay incentive compensation for employees, and it is also a measure for public hospitals to ensure the stability of the overall revenue target. In China, most managers equate performance directly with bonus, while performance incentive policy can be directly understood as bonus and reward policy. Therefore, the following concepts must be clarified for the performance system research of public hospitals in China.

1.3.1 Public hospitals

There are no clear and accurate definitions of public hospitals in official documents. Zhou and Li (2005) reviewed relevant definitions of state-owned enterprises. In the *Dictionary of Market Economy* edited by Li et al., state-owned enterprises are organized by state investment, and owned and controlled by the country. For state-owned enterprises, the state determines the profit distribution ratio through laws and regulations, and the state ultimately bears the profits and losses. In the *Fundamental Reform Theory of State-owned Enterprises*, Jin defined the state-owned enterprises as those owned by all people and are funded by the state or the government. Typical state-owned enterprises are wholly state-funded enterprises, and absolutely state-holding enterprises are also state-owned enterprises. Zhou et al. believe that public hospitals and state-owned enterprises are consistent in the most essential feature of "state investment", but the difference is that public hospitals serve the whole population the disadvantaged, rather than seeking investment returns. This is the fundamental difference between public hospitals and state-owned enterprises.

Public hospitals are established by the state. All people are the ultimate owners of the hospitals. The hospitals undertake some public functions (such as public health emergency services, counterpart support, and correction of market failures. The hospitals do not implement

full cost accounting and do not bear ultimate responsibility for their own financial situation. The ultimate financial risks are borne by the state (Zhou & Li, 2005).

1.3.2 Performance boundary of public hospitals and definition of relevant concepts

To study the performance boundary issues of public hospitals, it is necessary to sort out the related issues of the governance structure of public hospitals. One of the main problems in the governance structure is the principal-agent problem between the owner and the operator, and the key factor to deal with this is how the residual claim of the owner and the residual control of the operator are coordinated and distributed to solve the problem of power distribution and performance assessment between the owner and the operator (Zhou & Li, 2005).

1.3.2.1 Residual claim

The financial revenue of public hospitals mainly includes three parts: government allocations and subsidies, medical service revenue, and drug revenues. At present, government budget allocations and special subsidies account for less than 10% of public hospital revenue; medical service fees and drug revenues are the main component of hospital operating revenue (Liu, 2011). Since public hospitals are not-for-profit organizations established by the country, they reap no profits and their net income cannot be calculated. The state bears the ultimate financial risk (Zhou & Li, 2005).The residue in public hospitals refers to the hospital's surplus of revenue, and it is not the net income of the hospital because it includes human resources costs, employee welfare funds and incentive funds or performance bonuses. The state does not take over the revenue surplus and leaves it to the hospitals for their own development. In other words, the state has actually transferred most residual claim to the hospitals so that the hospitals have relatively independent financial and economic power. Under the leadership system, the hospital presidents, as the ultimate agents, enjoy the decision-making power and residual control power (Liu, 2011).

1.3.2.2 Decision-making power

The decision-making power in the hospital president responsibility system mainly refers to the power of hiring and firing of public hospital personnel. First, the number and structure of staff in public hospitals are determined by the government's establishment department; second, the quota of new staff in the hospitals is also determined by the government planning department and labor and personnel department based on the growth of the labor force of the whole society and the demand reported by the hospital; third, hospital employees are assigned to work in

hospitals by higher-level departments, and individuals have basically no right to choose. The government implicitly promises employees life-long employment guarantees. Hospital presidents do not have the power to reduce redundant staff and improve efficiency, but according to residual claim, they have the power of employee performance distribution (Liu, 2011).

1.3.2.3 Performance incentive mechanism

The performance incentive mechanism refers to an important manifestation of the hospital's salary reform for doctors. It is designed based on the hospital targets to effectively evaluate the work value of medical staff, to motivate employees through performance assessment and performance pay, and to give play to incentives in performance assessment. In addition, performance can also affect employees, and promote employees to continuously improve their work. It is a management system that can ensure that the goals of incentives are consistent with the goals of the hospital (Sun, 2015). Generally, performance incentive mechanism is an important part of hospital salary management. It is a payment system that adjusts the income structure and distribution method to reflect the labor value of doctors.

The performance salary of doctors mainly refers to "salary calculation based on the doctor's technical content, labor intensity, responsibility and degree of risk as well as the reasonable expectation of hospital development and doctor's performance (Liu, 2015). The incentive mechanism is an operational process to ensure that the payment of performance pay is directly proportional to the development goals of the hospital.

1.4 Research purpose and research contents

This study takes the long-standing performance salary payment model featuring "revenue-based commission" in the context of China's public hospital reform as the research subject. Through research on incentive theory, principal-agent theory, and international experience on implementation of P4P, this thesis hopes to identify the impact of performance based incentives in order to offer advice and guidance on China's current performance management system and to build up a healthy performance management system.

Thus, it can help the Chinese hospitals to get the following tools that can be put into practice in their management:

(1) A performance management system is explored to be established for the hospitals, and a multi-dimensional perspective is built for the hospital management. A performance

framework suitable for the internal management of Chinese public hospitals is formed with the assistance of the previous research and the international experience.

(2) The internal performance framework of the hospitals is in line with the requirements of the national policies, and thus an index system that can be applied to the actual management is obtained.

1.5 Research method

1.5.1 Literature review

The literature research method is an approach to comprehensively and correctly understand the problem to be studied through surveying the literature to obtain data based on a certain research purpose or course.

The researcher uses relevant domestic and foreign literature databases to systematically retrieve relevant practical experience on motivation theory, principal-agent theory, P4P theory, and doctor performance issues in health care reform around the world, with an aim to identifying reference experience for the public hospital performance research in China so as to form research framework.

1.5.2 Key informant interview

Our goal is not to conduct extensive primary research, and the objects of the research we carry out are experienced domestic performance managers or hospital managers who provide us with good directions and guidance with their knowledge and experience. In addition, based on research needs, interview of stakeholders is also important to help us understand the issues related to performance management in a more comprehensive manner.

1.5.3 Survey method

The survey method is one of the most commonly used methods in scientific research. It is a method to collect the actual or historical status of the research objects in a purposeful, planned and systematical manner. The most commonly used approach in the survey method is the questionnaire method. It is a research method that collects data by raising questions in written form. Namely, the investigator compiles a table of survey items, distributes it to relevant respondents to fill in, and then sorts it out, count it up and measures the results.

1.5.4 Case study

As an important study method in social and scientific research, case study method is often used by researchers of social science. It includes a whole set of tasks and programs which are indispensable in a case study: designing the case study, collecting research data, analyzing the data, reporting study results. All case studies originate from the same obvious purpose: better understanding the case(s) in the real world. Case study is "a kind of empirical research in the context of real world, especially when there is no clear boundary between certain phenomenon and the societal environment". It focuses on present phenomenon. Doctor Yin's "Two Works of Case Study" laid the foundation for later case study method (Chen & Liu, 2010).

Case study is different from other research methods. The main difference between case study and experimental approach lies in the controllability of environment: experimental approach separates the phenomenon from its context, for instance, focuses on a minority of variables through controlling the environment in the laboratory. The main difference between case study and historical approach lies in the time point in which the research object stays: historical approach focuses on the past, and the relevant information and events cannot be obtained through direct interview and observation (Yin, 2010).

1.6 Technical roadmap

This study mainly focuses on establishing the theoretical model of in-hospital performance management in public hospitals by combing performance management theory and relevant experience and combining the industrial and administrative characteristics of public hospitals in China.

The research content and framework of the thesis are shown in Figure 1.1:
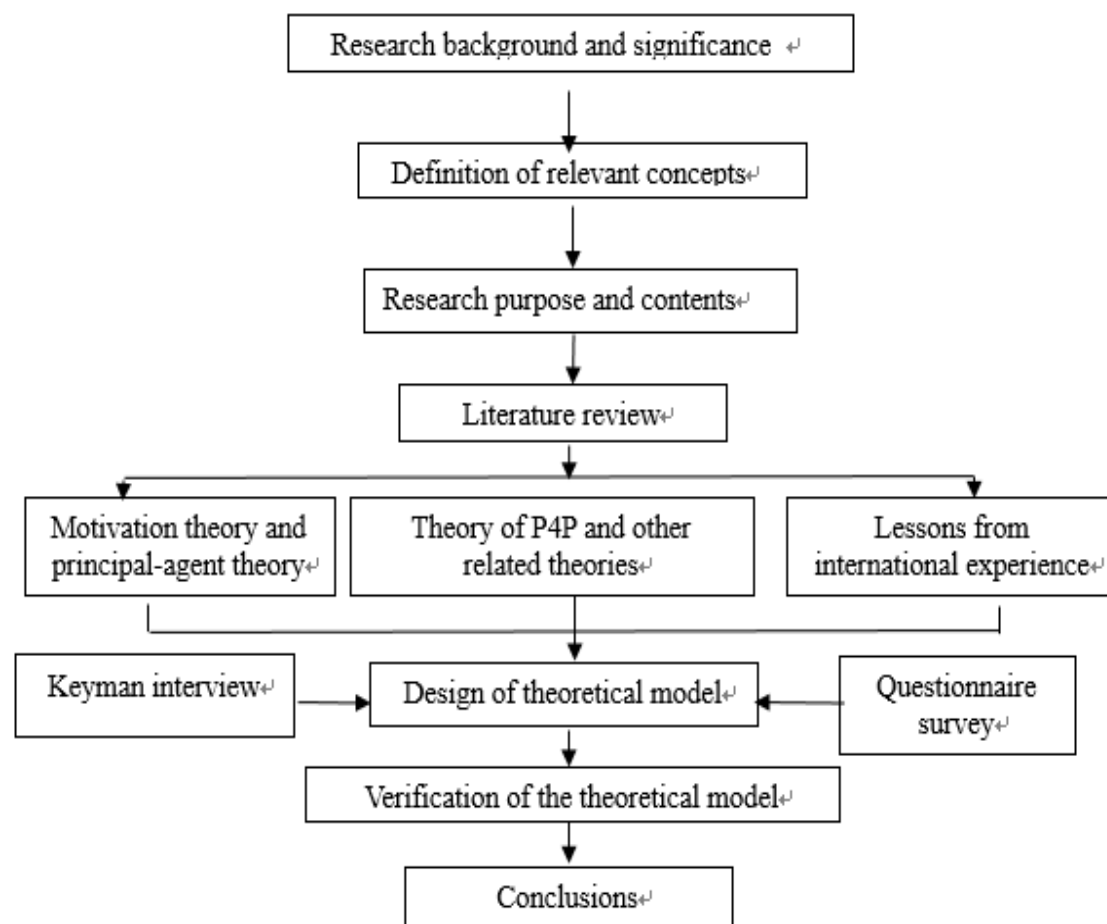
Figure 1.1 Technical roadmap

This thesis includes six chapters. In addition to the introduction of the reform background and significance in Chapter 1, the following chapters are literature review, theoretical framework and research method, establishment of index system and verification of the theoretical model, empirical case, and conclusions and suggestions. The specific contents are as following:

Chapter 1: Introduction. This chapter mainly discusses the reform background and significance, analyzes the current situation of theoretical research and practice of internal performance management in public hospitals in China, clarifies relevant concepts and research content, and constructs the research framework according to the research purpose and research method.

Chapter 2: Literature Review. This chapter makes an in-depth study of theories and international experience related to incentive management as well as some practical cases. First of all, the theoretical review includes Taylor's scientific management theory, incentive theory and principal-agent theory. Secondly, the international experience includes the relevant theories, concepts and framework of payment performance. Finally, this part reflects on the value of

management loss and balance.

Chapter 3: Theoretical Background and Research Design. This chapter synthesizes principal-agent theory and Donabedian's structural framework to construct the conceptual framework of this study and elaborates the procedure and principle of index establishment.

Chapter 4: Empirical Research. Based on the constructed model, the source of indicators is selected. Firstly, the index screening survey was conducted. Through two questionnaire surveys, frequency analysis and single factor analysis were used to screen and establish the prototype of the index system. After that, the key information was further obtained through KIS, and the primary index system of the theoretical model was verified through research and results analysis, so as to form the completed 3D equilibrium performance incentive model of public hospitals.

Chapter 5: Case Study. Taking the First People's Hospital of R City as a case, we selected researchers in the hospital to participate in the study, and further assigned the weight of indicators through the AHP to complete the weight assignment of the management index system of public hospitals proposed in this thesis. Besides, this part gives corresponding solutions to problems existing in the trial implementation of the system in the case hospital.

Chapter 6: Discussion and Research Limitations. This chapter reviews the research process, combs the process of theoretical research, empirical research, literature review and constructing conceptual model, summarizes the research results, and finally reflects on the limitations and deficiencies of the research.

Chapter 2: Literature Review

2.1 Research on motivation theory

Research on motivation theory has been a hot issue in multiple contemporary disciplines. Since the 1950s, the research results of motivation theory masters including Maslow, McClelland, Herzberg, Vroom, and Locke have constituted a bright starry sky of motivation theory, the stars in which are still shining today. In recent decades, motivation theory has been an important research domain of management science, and there has formed a series of branch disciplines such as organizational design theory and behavioral theory. In addition, with global economic integration and rapid development of information and Internet technology, especially with the development of multi-disciplinary and interdisciplinary mixed-sequence changes and enrichment of research methods and tools, the motivation theory is going through profound changes in the transformation from research on management science and psychology to multiple disciplines such as economics. Motivation theory has become a hot topic in economics, and game theory, economic mechanism design theory, and principal-agent theory have developed rapidly and yielded fruitful results.

2.1.1 Taylor's scientific management theory

Frederick Winslow Taylor (1856-1915), who proposed the scientific management theory, was the first efficiency expert, and was called "the father of scientific management". Taylor left us a world of tasks as accurate as a hundred times per minute. He was obsessed with time, order, productivity, and efficiency throughout his life (Mindell, 1999).

Scientific management theory has made great progress on the problem of how to motivate people's working enthusiasm, and has formed a relatively systematic motivation theory. Taylor noticed the game behavior between employers and employees in the design of the motivation system. He criticized Tang and Halsey's gain sharing plan, and pointed out that its shortcoming was that the workers' current output was used as the production standard, which led to systematic soldiering and lowered output standard. The core of Taylor's incentive plan is to scientifically determine production standards through motion and time, and set differential treatment wages based on individual performance (Locke, 1982). Apart from focusing on

motivation, Taylor's motivation plan focuses more on discovering the working potential of workers. On the one hand, the "first-class workers" are identified or stimulated and are given "reward ranging from 30% to 100% of the average salary in their level". On the other hand, it is also reflected in the knowledge training and task arrangements given by managers to the "optimal production standards" (determined through motion and time study) of the workers (Koumparoulis & Solomos, 2012).

Chen (2011)summarized four principles of scientific management: 1) find out scientific methods to avoid the inefficiency of empirical methods; 2) scientifically select workers and help them become talents through education; 3) try to collaborate closely with employees to ensure implementation of the scientific methods; 4) both managers and employees should take their own responsibilities. The core of scientific and standardized management is to conduct motion studies, establish rules and operating specifications, determine labor time quotas, establish scientific operating methods and procedures, including formulating scientific technological processes, so that all factors involved in operations, such as machinery, equipment, technology, tools, materials, and the working environment are standardized as much as possible; in addition, scientific methods are used to select suitable workers to receive training in standard methods and work processes, so that workers can work according to standards in their positions. Workers receive wages by the piece and excess work leads to excess returns (Metzgar, 2004). The efficiency brought by scientific management doubled in less than 40 years. In another 30 years till 1958, the efficiency doubled again (Zhou & Song, 2011).

Taylor's approach was not recognized by everyone, and even encountered radical criticism like "restarting the slave age" (Morgan, 2006). But Locke (1982) believes that two important factors have been ignored by the critics. First, the scientific management method formulated by Taylor completely breaks the traditionally subjective, empirical, rumored or precedent-following decision-making basis. Second, Taylor pays attention to the relationship between the labor and management and common interests. He uses scientific management by objectives to bypass "how to allocate the pie" to "how to make a bigger pie", so that the two parties can find the possibility of maximizing the interests of both parties from the original conflict of interests.

Harmonious management and labor-management relations exist throughout all of Taylor's scientific management principles, and are also important footholds of all principles and factors. The close and friendly cooperation between managers and workers is the guarantee or basic constraints to realize scientific management, and produce economic effects and social welfare (maximization). Under this constraint, two main issues become the basis of scientific management: (1) the scientific and rational arrangement of tasks; (2) the scientific management

of people. Taylor further pointed out that the two factors of task and bonus constitute the two most important factors of scientific management mechanism (Metzgar, 2004).

Taylor's scientific management announced that harmonious win-win between labor and management is not only a philosophical idea, but also a feasible scientific management goal (Wagner-Tsukamoto, 2007). This was regarded by economists as Taylor's pioneering contribution to institutional economics. In addition, Tsukamoto (2007) regards Taylor as the spokesperson of institutional economics. Institutional economics intervenes the conflict and interaction process between the capital contributions of organizational members, such as skills, working hours and financial assets and their capital distribution, such as wages, free time, additional benefits and goods. It is designed to establish an institutional structure that resolves conflicts and achieves a win-win situation, and is also conceptualized as an incentive structure. It is in this sense that Taylor has developed the institutional economic ideas and solutions of scientific management (Wagner-Tsukamoto, 2007).

Grachev and Rakitsky (2013) believe that Taylor's scientific management theory is determined by the economic growth of the unique work type and industrial economic environment. Russia's political environment changed the unique cycle of the scientific management, making it appear in the 1910s, quickly develop in the 1920s, decline in the 1930s, and re-emerge in the late 1950s with the emergence of technocrats. Before the October Revolution in Russia, Lenin criticized the "Taylor system" and insisted that the Taylor system was used as a tool by capitalists to squeeze workers, and excessive pursuit of efficiency has become obsessed with efficiency itself (Shao, 1984). Oliver (2002) believes that the obsession of efficiency carries risks of overemphasizing means while ignoring ends. If we do not first understand what we are going to accomplish, how do we know whether we are efficient? Scientific management was very popular in Japan in the 20th century. Japanese observers believe that the Taylor model introduced from the United States created miracles and was subtly reshaped as Japanese-specific management method that has driven Japan's rapid economic boom (Tsutsui, 1995).

Influenced by scientific management, Ieamoto et al. (1975) pointed out that it is necessary to analyze and improve the process of various production activities while studying the services of public health clinics, and it is important to lay stress on various standardized processes and standards in order to improve the service efficiency and quality of public health organizations. Wang (2015) discussed the impact of the introduction of scientific management theory on the disinfection rate of hospital supply room and the hospital infection rate. Wang compared how the scientific management affects the qualified rate of disinfection and performance of nursing

staff after the introduction of scientific management for one year and found that the disinfection qualified rate was improved from 90.2% to 100%; meanwhile, the performance of nursing staff in terms of operational norms and knowledge growth was also improved. Therefore, the scholar concluded that the introduction of the scientific management in the supply room can significantly improve the work quality and create a sterile environment for patients, and therefore reduce the hospital infection rate. When studying the application of the scientific management theory in hospital management. Focusing on China, Chen, and Wang (2016) pointed out that scientific management lays stress on the standardization and efficiency of management, and therefore the administrative departments of hospital should establish a first-class team or adopt first class management mode. A pilot test is first conducted on a small scale for a period of time then the experts are assembled together to discuss its implementation effects and make suggestions for improvement if needed. If the experimental management mode achieves better results, it will be generalized to other departments as the standard management mode to improve the work efficiency and service quality of all the departments. That is to say, whether it is the administrative departments or the clinical departments, it is necessary to establish a standardized operational mode, improve the management system and process and make the management process more standardized and scientific, so as to improve the business efficiency and service quality.

2.1.2 Motivation theory from the perspective of behaviorism: "Hawthorne effect"

Shortly after Taylor proposed scientific management, Elton Mayo, professor of industrial management, Harvard Business School, and his assistant conducted the famous Hawthorne experiment Western Electric's Hawthorne plant from 1924 to1933 (Kompier, 2010). The Hawthorne experiment marked the beginning of the school of human relations (Kompier, 2010). The experimental results negate the hypothesis of the "economic man", and it is a mistake to regard money as the sole motivation to stimulate enthusiasm. People are social people, and money or economic stimulus is only of secondary importance in motivation, while socio-psychological factors occupy the first place. Mayo proposed that the motivation should be focused on people and meeting their social needs. Mayo's Hawthorne experiment found the important role of human irrationality, which opened the path for the development of irrationality in management (Shang, 1992).

From 1924 to 1932, the Hawthorne experiment has undergone four phases "illumination experiment", "welfare experiment", "interview experiment", and "group experiment".

Phase 1: Plant illumination experiment-illumination experiment (November 1924-April 1927)

The purpose of the illumination experiment is to understand the influence of the illumination intensity on production efficiency. Three illumination experiments were carried out within two and a half years. The National Research Council (NRC) sponsored the study. However, the experiment was not successful. Researchers believe that illumination is the only factor that does not affect output of employees, and production efficiency does not change with the intensity or trend of illumination (Roethlisberger & Dickson, 1986). Researchers did not think it is necessary to continue the illumination experiment. The experiment failed, and many people withdrew from it. The illumination experiment was also not considered as part of the Hawthorne research and the final report of this program was not submitted to NRC (Kompier, 2010).

Phase 2: Relay assembly test room experiment-welfare experiment (April 1927-)

Stimulated by the failure of the illumination experiment, Mayo accepted the invitation in 1927 and organized a group of Harvard professors to set up a new research group to conduct further research on welfare, starting the second phase called "welfare experiment". Researchers selected six women workers from the workshop to enter the test room where their behaviors can be carefully and systematically studied (Roethlisberger & Dickson, 1986).

After two years, the researchers found that no matter how the benefits changed (including changes in payment methods, increase or decrease in preferential measures, increase or decrease in break times), there were no influence on the continuous increase in production. Later, it was discovered that the main reason for the increase in production efficiency was the glory of participating in the experiment. The workers felt novel and curious about being the research objects, and knowing that they were being followed, they felt that they were special and important, and changed their behaviors in turn, which led to an increase in productivity in the short term (within the experimental phase).This finding is also known as the Hawthorne effect (Fincham & Rhodes, 2003).

The purpose of the "welfare experiment" is to find factors that can more effectively control and affect employee enthusiasm. Mayo summed up the experimental results and ruled out four assumptions. (1) Improvement of material conditions and working methods in the experiment can lead to increased output; (2) Arrangement of coffee breaks and shortening of working days can relieve or reduce fatigue; (3) Coffee breaks can reduce the monotony of work; (4) Individual piecework wages can increase production. The final conclusion is that "changing the methods of supervision and control can improve interpersonal relationships, improve workers' working

attitudes, and increase production".

Phase 3: Mass interviewing program-interview experiment (September 1928-May 1930)

Research at the test room has fully proved that there is a close relationship between employees' morale and management and supervision. In order to further study views of workers on power, management and working conditions, Mayo and his team developed an interview plan for employee directives. In less than two years from September 1928 to May 1930, researchers interviewed about 20,000 employees in the plant. By understanding workers' views on work attitudes, management styles, authority, and social background, they decided to allow employees to fully express their dissatisfaction (Roethlisberger & Dickson, 1986).

In this experiment, the negative comments on supervision ranked fourth, and wage payment (including rate revision, piece rate) ranked first, followed by lockers and safety and health. Roethlisberger and Dickson did not reach the expected conclusion. They believe that Hawthorne employees considered the wage conditions to be particularly important (Roethlisberger & Dickson, 1986).

Through interviews, researchers found that in addition to formal Hawthorne organizations, several types of informal organizations existed, and the working groups controlled their output through social norms and corrective measures (Kompier, 2010).

In the interview, the researchers analyzed the complaints of workers in the conversation, and found that the facts that caused their dissatisfaction were not the same as the facts they complained about. Workers were not consistent in their dissatisfaction expressed and the deep-seated dissatisfaction. The interview program lasted for more than two years, which not only met the employees needs to be respected, but also provided employees with the opportunity to vent their dissatisfaction and propose reasonable suggestions. The mood of the workers became better and their morale was higher, which leads to a significant increase in production (Paradis & Sutkin, 2016).

Based on these analyses, researchers realized that workers' concerns about their personal issues could affect their productivity. Therefore, managers should be aware of these problems of the workers. To this end, managers, especially grass-roots managers, need to be trained so that they can become interviewers who can listen to and understand workers, put more emphasis on human factors and be more enthusiastic and caring about workers, which can help improve interpersonal relationships and enhance employee morale (McCambridge, Witton, & Elbourne, 2014).

Phase 4: Bank wiring observation room experiment-group experiment (1931-1932)

In order to further supplement the research and confirm the researchers' assumption that there exists an informal organization summarized in the mass interviewing program, and that this informal organization had a very important influence on workers' attitudes, the researchers went on to carry out group observation experiment (Roethlisberger & Dickson, 1986).

In order to systematically observe the mutual influence between workers in the experimental group, the experimenter selected 14 male workers in the workshop, of which nine were winders, three were welders, and two were inspectors. They were asked to perform winding, welding and inspection in a separate room, and a special piece-rate wage system was implemented for the team. Researchers thought that implementing this method would make employees work harder, but the results were unexpectedly disappointing (Fincham & Rhodes, 2003). In fact, the actual output produced by the workers were only maintained at a medium level, and the daily output of each worker was similar, and the workers did not report the output truthfully at all. According to the analysis of motion and time, each worker should complete the standard quota of 7,312 welding points, but the workers only completed 6,000 to 6,600 welding points per day before they stopped. Even if there was still ample time before work, they would stop working on their own account. Through observation, researchers found the reason for workers to automatically limit output. If they worked too hard, the company might punish other slow-moving employees or reduce employees, so that their peers might lose jobs, or the company might adjust the current reward policies to work out higher production quotas. A more in-depth investigation revealed that the team has set some hidden rules to protect the interests of the small group. For instance, no one can do too much and highlight themselves; no one can do too little to affect the output of the entire group; the group members are not allowed to report secretly to the management. If anyone violates the rules, they will be abused and scolded or even bashed and kicked. Therefore, Mayo put forward the concept of "informal group" and he believes that the spontaneously formed "informal groups" in an organization have their own special behavioral norms and play a regulating and controlling role on human behavior (Kompier, 2010).

The Hawthorne Effect signifies that the cognitive theory of motivation has begun an in-depth exploration of human nature, and began to ask "what do we use to motivate employees" rather than "what does people seek". With a view to identifying the individual factors that promote employees' hard work, a "content-based motivation theory" is formed, and with a view to identifying direction and channels of human behavior, a "process-based motivation theory" that provides a dynamic perspective on how to motivate employees is formed.

In recent years, scholars have further studied the Hawthorne effect and presented different

views. Chinese scholar Shang (1992) argues that Mayo's theory overemphasizes the importance of informal organizations and emotional factors in work, which caused many reasonable factors to be distorted by unreasonable interpersonal relationships in the enterprise. It fails to meet management needs and has great limitations. McCambridge, Witton, and Elbourne (2014) selected 19 cases from data related to thousands of Hawthorne effects, and concluded that there is no single Hawthorne effect. There are behavioral changes of experimental subjects in most cases, but it is difficult to determine under what operating conditions these behaviors are changed, and the influence degree and intensity of these operating conditions. They also found in research cases that some cases did not have the Hawthorne effect, while others had a significant Hawthorne effect. Paradis and Sutkin (2016)found that their experimental results did not present the Hawthorne effect. In their research on health professional education based on multiple and inconsistent use of Hawthorne effect, Paradis and Sutkin studied observer effect and found the participants' response to the observation is inconsistent and there is no significant change of behaviors in the response to observation. Long time and continuous contact with participants will help improve the quality of data collection.

Based on the study of hospital management practice in China, Huang (1989) argues that the informal organization is an invisible organization formed by medical employees who share common feelings, interests or needs. Sometimes, the invisible organization is more powerful than the formal organization. The informal organization of hospital generally exists independent of people's will, which can neither be created nor eliminated but can be perceived, guided and utilized. Under the proper guidance, the informal organization can serve the hospital's goal (Shao, 2007). Wang (2014) thinks that inspired by the informal organization found in Hawthorne experiment, many scholars started to study the "people-oriented" management mode, and the management practice of hospital shows that the special interpersonal relationship between people in the informal organization plays an important role in the decision-making of major issues, the appointment of key posts and the standard use of large funds. Fang (1995) believes that the core duties of management personnel are to manage and deal with all kinds of interpersonal relationships, but the invisible interpersonal relationships between supervisors and subordinates or same level peers in informal organization are unrestricted by executive power. Despite this, they can still affect the success or failure of hospital management.

2.1.3 Content-based motivation theory

There are many different theoretical approaches to the topic of motivation. For a group of authors, the motivation is strictly related to human needs, and the point of view of the other group by far more focused on the cognitive processes that influence human behavior. The differences between these theories resulted in the division into two categories: content and process theories. Process theory is characterized by a dynamic character. The main concern is not "what" motivates people, but how motivation occurs. Process theories attempt to explain how and why the behavior of the people associated with a particular election (Nicin & Vasiljevic, 2015).

In the content-based motivation theories, the four most popular ones include Maslow's hierarchy of needs, Alderfer's existence-relatedness-growth (ERG), Herzberg's motivation-hygiene two-factor theory and McClelland's achievement motivation theory (Wang, 2005).

2.1.3.1 Maslow's hierarchy of needs

One of the most popular motivation theories is the hierarchy of needs theory proposed by Abraham Maslow (American psychologist in the 1970s) (Pinder, 1984). Maslow believes that human needs are arranged in a hierarchical order and can be divided into two categories: basic needs and higher needs (Anderson, 2014).

(1) Basic needs are physiological, such as food, water, and sleep; and psychological, such as emotion, security, and self-esteem. These basic needs are also called "deficiency needs";

(2) Higher needs are the growth needs, which include justice, kindness, beauty, order, solidarity, and so on. Basic needs usually take precedence over these needs. For example, a person who lacks food or water usually does not notice the need for justice or beauty.

These needs are usually listed in a hierarchical order in the form of a pyramid to show that basic needs (minimum needs) must be met before higher-level needs.

Maslow assumes that individuals pay attention to needs in a certain order, and when lower needs are met, people will shift to higher level needs. From Maslow's point of view, no one can fully achieve self-actualization. To motivate a person, it is necessary to know his current level of needs so as to meet the needs of that level and higher level. The intuitiveness and simplicity of Maslow's theory have been recognized by practical managers, making it more attractive. Maslow's hierarchy of needs is known as the most famous theory of individual motivation (Su & Zhang, 2009). Maslow's theory is applied to motivation theory, and is called a revival of hierarchy of needs.

Although the theory has gained a good reputation, it has also been criticized and questioned by scholars who believe that hierarchy of needs is not universal. Alderfer (1969) argues that people can be motivated by more than one level of needs, and if the living environment changes, people may also shift to lower-level needs. France so believes that in the context of internationalization, the value of environmental factors in a specific culture will affect the importance of various types of needs and the order (Liang & Feng, 2004).

2.1.3.2 Alderfer's existence-relatedness-growth (ERG) theory

However, Maslow's hierarchy of needs is also supported by relevant scholars and is further expanded and improved. Among them, in the article *An Empirical Test of a New Theory of Human Needs* published in 1969, based on investigation and study of a large number of workers, Alderfer (1969) modified Maslow's hierarchy of needs theory and proposed the existence-relatedness-growth (ERG) theory. Alderfer's ERG theory attempted to construct a concept of human needs related to organizational scenarios. He divided the types of needs into three more general types concerning existence, relatedness and growth. The existence needs are similar to the needs of the first and second levels in Maslow's theory. The relatedness needs are needs for interpersonal communication and social communication, similar to the third and fourth level of needs in Maslow's theory. The growth needs refer to an inherent desire for self-development, similar to the needs of the fifth level in Maslow's theory (Schneider & Alderfer, 1974).

But Alderfer believes that the boundaries between these three levels are not very clear and should be regarded as a complete and continuous whole rather than a strict hierarchical level. Unlike Maslow's theory of needs, Alderfer does not believe that high-level needs can motivate behavior only when low-level needs are met, and that the generation of needs does not only come from deficiency (Alderfer, 1969). This point has been recognized by most scholars.

Unlike Maslow's theory, ERG proposes the "frustration-regression" principle. When an attempt to meet higher-level needs is frustrated, it will lead regression to easier-met and lower-level needs. This is the so-called "frustration-regression" principle (Alderfer, 1969).

2.1.3.3 Herzberg's two-factor theory

Both Alderfer and Maslow believe that when each type of needs is met, individual needs tend to shift from existence to relatedness and to growth. In Alderfer's DRG theory and Maslow's hierarchy of needs, there is an implicit assumption: the prerequisite for employees to produce high performance is to satisfy them. Herzberg's two-factor theory breaks this assumption.

Frederick Herzberg's motivation-hygiene theory, also known as the two-factor theory, was

developed in the 1950s and 1960s on the basis of Maslow's theory (Robbins, 2009). In comparison with Maslow's hierarchy of needs and Herzberg's two-factor theory, the motivation factors in the two-factor theory correspond to the higher-level needs in Maslow's hierarchy of needs and the hygiene fact or score respond to the lower-level needs (Yusoff, Kian, & Idris, 2013).

Herzberg's theory is based on satisfaction and dissatisfaction, but he believes that satisfaction and dissatisfaction are two factors completely different from each other, rather than two opposite points on the scale. Based on this view, Herzberg conducted surveys and interviews with some engineers and accountants in the United States, collecting feedback on their work environment and personal feelings that made them satisfied and dissatisfied (Yusoff, Kian, & Idris, 2013). According to Herzberg, the finally obtained two factors-motivation factors and hygiene factors play very different roles in motivation.

Herzberg (1968) believes that motivation factors are the internal factors improving the employees' enthusiasm for work, referring to job satisfaction in various aspects of the job itself (achievement, recognition, challenge, responsibility, progress, and growth).These factors can make employees feel satisfied and effectively motivate their behavior. The hygiene factors are also called the context factors which refer to the factors that affect employees apart from the job itself (company policy, management, supervision and relationship with colleagues, working conditions, salary, status, and security) and are external factors preventing employees from being dissatisfied. Herzberg further pointed out that even if the hygiene factors reach a high level, they will not satisfy employees, and in order to motivate employees' performance or productivity, motivation factors must be provided. The implication of this theory on organizations is that the external or hygiene factors will only prevent employees from becoming dissatisfied, rather than motivate them to make additional efforts for better performance. To motivate employees, organizations should focus on providing internal or motivation factors (Robbins, 2009).

Hertzberg's two-factor theory has been widely applied in motivation research in different industries and in different ages. The value of the theory is that it provides an integration of individual's internal and external motivation factors. Herzberg's two-factor theory was criticized by some scholars in the early days. Mckee (2007) summarized the criticisms in three aspects.

(1) There are flaws in the method of design. Herzberg asked the interviewees to review and describe those unhappy or painful experiences. Vroom believes that the differences of satisfaction and dissatisfaction obtained from these interviews may come from defense of the

interviewees. House and Wigdor agreed with Vroom's point of view and suggested that in addition to retrospective interviews, other methods needed to be added (Mckee, 2007);

(2) There is a defect in reasoning design. House and Wigdor believe that in the classification of data, there is no clear distinction between "satisfied factors" and "dissatisfied factors", and motivation factors and hygiene factors may be biased due to unclear data distinction (Mckee, 2007);

(3) Herzberg and his colleagues' findings are inconsistent with previous studies. According to Herzberg's theory, it is believed that there are ten positive correlations between job satisfaction and productivity, but this is not always the case. House and Wigdon concluded that the impact of satisfaction on employee motivation and productivity depended on context variables, which needs to be further clarified in future research. House and Wigdon also pointed out that if working conditions are unsatisfactory, then high-degree incentives cannot effectively affect production efficiency and may even exert a negative impact. House and Wigdon argue that unless environmental factors (hygiene factors) in the work environment are acceptable to employees, motivation factors generally do not work. However, Herzberg and his colleagues did not study the impact of environmental constraints and setbacks on motivation (Mckee, 2007).

Bassett-Jones and Lloyd (2005) concluded through a survey participated by more than 3,200 respondents that money and recognition do not seem to be the main source of motivation for employees to contribute ideas. Consistent with Herzberg's prediction, factors related to internal satisfaction play a more important role. This research shows that despite these criticisms, Herzberg's two-factor theory still has practical value nearly 50 years after it was first proposed.

Holmberg, Caro, and Sobis, (2018) applied Herzberg's two-factor theory to study the problem of staff shortage caused by low job satisfaction of nursing staff in Swedish mental health care institutions and found that Herzberg's two-factor theory proved to be effective from the perspective of job satisfaction. Interviewees emphasized that mental health nurses are different from other specialized nursing staff. Without a clear career growth trajectory, even if they obtain higher degrees, their clinical responsibilities or clinical authority will not be improved, resulting in limited career development. Interviewees also said that dealing with patients with acute mental illness is often described as demanding and emotionally stressful, and the work environment is challenging both physically and psychologically. According to Herzberg's two-factor theory, promotion opportunities are motivation factors and work status is considered a hygiene factor. These findings contradict the basic principles of the theory to

some extent.

2.1.3.4 McClelland's achievement motivation theory

American psychologist and professor of the Harvard University David McClelland proposed that need for achievement, need for power, and need for affiliation affect human behavior, and these needs are obtained through acquired learning, not survival instinct as proposed by Maslow. McClelland studied people's high-level needs and co-authored the Motivation Economic Achievement with D. G. Winter in 1969 to explain the achievement motivation theory (Pardee, 1990) McClelland's need for achievement is the foundation of Maslow's self-actualization. Similar to Herzberg's theory, high performance achievers tend to be interested in Herzberg's motivation factors, while low performance achievers are more concerned about hygiene factors.

However, McClelland's view that the need for achievement is obtained through acquired learning conflicts with the view in most literature that the motivation is generally obtained in childhood and is difficult to change in adulthood. In addition, scholars believe that the predictive validity of his main research tools is problematic. Besides, McClelland's interpretation of needs to be obtained is also questioned by some scholars, who believe that it is impossible to obtain needs permanently. McClelland's achievement motivation attracts attention of other organizational behavioral scientists and researchers on the one hand, and also receives considerable harsh criticism from other scholars (Su & Zhang, 2009).

The main point of McClelland's theory is that needs are obtained through contact with environment, learning and competition. Since needs are acquired, rewarded behaviors tend to recur more frequently.

Wallace, Goldstein, and Nathan (1987) argue that the need for achievement includes a desire for independent mastery of objects, thoughts, and others, as well as a desire to enhance self-esteem through the exercise of personal talent (Pardee, 1990). McClelland finds that people with high need for achievement tend to take responsibility for problems by themselves and can get satisfaction from completing tasks. The level of achievement motivation also affects individual choice of career. Those with low achievement motivation tend to choose occupations with less risk and less independent decision-making; those with high achievement motivation tend to engage in groundbreaking work and have the courage to make decisions at work (Eysenck, 1987).

In summary, the content-based motivation theories focus on the content of motivation, and limit the interpretation of motivation to the specific needs closely related to the motivation and their hierarchical structures so as to use these limiting factors for motivation. The content-based

motivation theory develops from Maslow's hierarchy of needs to Alderfer's ERG theory, Herzberg's two-factor theory, and then to McClelland's theory of acquired needs. "Needs" become a window for us to look into the theory of motivation and the key to analyze problems. However, "needs" have great instability and contradictions. For example, human psychological needs are internal variables and are difficult to observe, evaluate, and measure; in addition, psychological characteristics will inevitably vary for different people, times, and events, and are constantly in dynamic change. Also values in different cultures often differ, making it difficult to find a set of motivation needs hierarchy that applies to all human beings. The dynamic change and stability of "needs" has led to repeatability error in the implementation of various motivation methods, and thus it is difficult to grasp; it is also because of this, the research results of content-based motivation theories so far lack conclusive support.

2.1.4 Process theories of motivation

Vroom's Expectancy Theory, Skinner's Reinforcement Theory, Adams' Equity Theory, and Locke's Goal Setting Theory are the popular process theories of motivation (Nicin & Vasiljevic, 2015).

2.1.4.1 Vroom's expectancy theory

In 1964, the American psychologist Vroom published *Work and Motivation* and proposed the expectancy theory, also known as valence-instrumentality-expectancy theory. He believes that the motivation or incentive for people to take an action depends on the outcome assessment of the behavior and anticipation of the likelihood of outcomes to be achieved (Daniels & Harris, 2000). According to Stephan Robbins, what the expectancy theory expresses is that a person's mobility depends on the strength of his desire for achieving the goal and whether the rewards he obtains after working hard to succeed are attractive (Robbins & Judge, 2013).

Vroom divides the psychological process of a person determined to make efforts in his job into three links. Firstly, he considers whether attempts and efforts can bring good outcomes, and if he thinks that such an attempt or effort can bring success, he will make more efforts; secondly, he considers how likely it is to get rewards by good outcomes and judgment on rewards determines how many efforts are paid. The rewards are positively related to the performance results, finally, he considers or measures whether the value of the rewards is worthwhile for him to make efforts. Therefore, for an employee, there are four variables that influence his motivation: 1) personal effort; 2) personal performance; 3) organizational rewards or work outcomes; 4) personal goals (Denhardt, Denhardt, & Aristigueta, 2007)

Vroom's expectancy theory differs from the content theories of Maslow, Alderfer, Herzberg, and McClelland in that Vroom's expectancy theory does not provide specific suggestions on what motivates organization members. Instead, Vroom's theory provides a process of cognitive variables that reflects individual differences in work motivation. From a management standpoint, the expectancy theory has some important implications for motivating employees. It identifies several important things that can be done to motivate employees by altering the person's effort-to-performance expectancy, performance-to-reward expectancy, and reward valences (Lunenburg, 2011)

The expectancy theory explains three relationships to arouse people's enthusiasm.

(1) The relationship between effort and performance, which is also called expectancy (E). Expectancy explains the subjective probability of an effort producing an outcome (called the first-level outcome). The expectancy value will vary between 0 and 1. Expectancy of 0 means that even making best efforts will not lead to any change in performance. In other words, the probability of performance improvement is zero. Expectancy of 1 means that efforts will lead to great success or best performance. In other words, the probability of improvement is 1.

(2) The relationship between performance and rewards/work outcomes, which is also called instrumentality (I). Instrumentality is the employee's perception of the likelihood that performance will bring organizational rewards or outcomes, such as higher salaries, bonuses and promotion. The value of instrumentality also varies between 0 and 1. An employee will have a motive to get better outcomes or better performance because he is eager to get a higher bonus. Better outcomes or better performance or first-level outcomes will therefore help earn higher bonuses or second-level outcomes (Parijat & Bagga, 2014).

(3) The relationship between rewards/work outcomes and personal goals, which is known as valence (V). Valence measures attractiveness, preferences, value, or the degree to which employees like rewards or work outcomes. Its value varies from -1 to +1. For a person, the valence of one outcome is a monotonically increasing function of the algebraic sum of the products of the valences of all other outcomes, and the means to achieve these other outcomes. The outcome of work can be stress or fatigue, but it can also be a raise or promotion. Stress or fatigue can exert a negative impact to some extent, but pay raise or promotion can have a strong positive effect. But for motivation, it is important that the sum of all valences must be positive. The valence varies from person to person.

Therefore, according to the expectancy theory, **efforts or motivation = E*I*V** (Parijat & Bagga, 2014).

As a contingency model, it is realized in the expectancy theory that there is no universal

principle that can explain the individual behaviors of all people. At the same time, the theory provides a theoretical basis for rewarding practice and evaluating reward policies of organizations (Su & Zhang, 2009). Although expectancy theory is one of the most important motivation theories, its complexity makes it not only difficult to be tested but to be implemented. Employees do not have enough time, willingness, favorable environment or resources, or even sufficient ability to calculate motivations in this theoretically hypothesized way. In addition, managers also lack one or more of the above parameters to determine what motivates the specific employees.

The measurement of expectancy, means, and valence in the expectancy theory is sometimes impossible or difficult to be realized. Whether the formula of motivation can be calculated and applied to motivation in a realistic sense is also a controversial issue. In addition, experts have pointed out that a reliable approach of valence, expectancy and means needs to be developed (Sadri, 1999). Some critics have pointed out that it is more effective when individuals clearly understand the relationship between effort performance and performance rewards, because in reality few people can recognize this. Therefore, the ideal theoretical significance of this theory is higher than its practical value (Robbins & Judge, 2013).

2.1.4.2 Skinner's reinforcement theory

Closely related to the expectancy theory is the reinforcement theory proposed by Skinner in the 1970s. Skinner believes that human behavior is determined by the external environment, and external reinforcement factors can shape behavior. Human behavior is the result of learning about the consequences of their past. Reinforcement theory believes that human behavior is related to whether they are rewarded (positive reinforcement) or punished (negative reinforcement). This theory provides a powerful tool for analyzing control behavior. However, it ignores people's internal states, attitudes, expectations, and other known cognitive variables that affect people's behavior (Su & Zhang, 2009).

The reinforcement theory of motivation shifts the focus from employees' potential needs and thinking process to the relationship between behavior and results. This theory has two prerequisites. First, the environment is an important catalyst for determining or strengthening behavior. If the environment complements the established behavior, then that behavior will be actively reinforced. On the other hand, if the environment is hostile to employees' values and skills, negative reactions will occur. Second, human behavior is affected by causality, so consequences can be predicted based on identified causes, and behaviors can be changed by manipulating the consequences.

Reinforcement is a concept borrowed by Skinner from Pavlov, but the connotation has changed. In Pavlov's classic conditioned reflex, reinforcement refers to the presentation of unconditioned stimulation accompanied by conditioned stimulus. In Skinner's operational conditioned reflex, reinforcement refers to the events that accompany a behavior and contribute to the increased probability of the re-occurrence of the behavior. There are four types of reinforcement strategies: positive reinforcement, negative reinforcement, extinction, and punishment. The first two reinforcement conditions try to encourage desirable behaviors in different ways, while the other two try to prevent undesirable behaviors (Xie, 2003).

Both Skinner's reinforcement theory and Vroom's expectancy theory emphasize the importance of the relationship between behavior and its consequences. However, the expectancy theory emphasizes the psychological process analysis of subjective judgment, and the reinforcement theory focuses on the relationship between stimulus and behavior. Both theories ignore motivation of employees and the relationship between the intensity of motivation and other employees.

2.1.4.3 Adams' equity theory

In the 1960s, Adams proposed the famous equity theory. He found that individuals pay attention to not only the absolute amount of their rewards, but also their inputs and outputs. The inputs here refer to hard work, previous work experience, educational background, time and ability, while outputs refer to salary, rewards, recognition, promotion, training and working conditions. The equity theory, also called social comparison theory, reveals that the individual perception of equity is affected not only by absolute returns, but also relative returns, which offers new ideas for motivation issues.

The equity equation of Adams:

Self outputs/self inputs=Others outputs/others inputs

When the ratios of the two sides of the equation are equal, it is called equity, and it cannot generate motivation. When the ratios of the two sides are not equal, the individuals will have a feeling of anxiety, which will motivate them to take corresponding changes: (1) change one's input; (2) change one's output; (3) change one's self-cognition; (4) change one's perception of others' outputs; (5) choose another reference objects; (6) decide to leave.

From the equity theory, it is known that employees pay attention not only to their absolute amount of returns, but also to their relative amount. Of course, this does not mean that everyone is sensitive to the returns.

While equity theory is a significant step forward, the theory itself needs further

specification. The research supports equity predictions in the area of underpayment, but the overpayment effects have not been satisfactorily demonstrated. Elaborations of the theory are presented in the areas of (1) determinants of inequity, (2) dissatisfaction resulting from inequity, and (3) responses to dissatisfaction (Pritchard, 1969).

Notwithstanding the optimism generated by equity theory, there are lacunae that appear to deserve attention. In particular, theoretical and research effort might profitably be directed to the phenomenological experience of inequity, how inequity may be used instrumentally, the analysis of the interactive dynamics of inequity reduction, and the quantification of inequity (Adams & Freedman, 1976).

2.1.4.4 Locke's goal setting theory

At the end of the 1960s, Locke and Latham (1991a) proposed the concept of goal and they believe that there can be clear goals can be set by clarifying the tasks required to be completed and setting the time range and requirements for attaining the goals. In addition, it is believed that a work intention that points to a goal can effectively improve work efficiency, and clear goals can effectively improve performance. With performance-based incentive plan as the core of goal management, Locke and Latham focus on how to design goals so that they can really play the corresponding incentive role, thus forming the "Goal-Setting Theory". According to the goal setting theory, setting a difficult but achievable goal can achieve better performance than setting a simple goal. When encountering multiple goals, it is necessary to clarify each task required to attain the goal and the time range to complete task, and then explain how to measure the priority between the performance and the multiple goals. In this way, the clarity of goals can be further strengthened. In addition, the goal feedback is positively correlated with performance.

In management practice, although it can be seen that employees make various efforts to involve themselves in setting goals, there is no evidence proving that whether the goals are set by individuals or by others has a significant impact on the final performance. In addition, although goal setting can lead to better performance, there is no evidence proving that this goal is related to improvement of job satisfaction (Locke & Latham, 1991b).

Process theories of motivation attempt to find the general process to explain motivation behavior. Since these theories focus on process rather than specific content, they have better applicability.

2.1.5 The principal-agent theory

In recent decades, with the continuous economic globalization and the advancement of information technology, especially the multi-disciplinary perspectives and the diversification of research methods and tools, the research horizons of motivation issues have become broader. In the classical motivation theory, the research perspective and thought are focused on the psychological process of human beings, now the focus has been shifted to system and mechanism. Due to the ubiquity of the principal-agent relationship, the principal-agent theory is adopted to seek the influencing factors of motivation for enterprises and design the optimal motivation mechanism.

2.1.5.1 Review of principal-agent theory

Ross (1973) first proposed the concept of principal-agent. He believes that in both parties involved, if one party exercises some decision-making power on behalf of the principal's interests, an agency relationship will arise. Ross studied how a principal can design a compensation system to facilitate another person (agent) to serve the principal's interests (Ross, 1973). Jensen and Meckling (1976) argue that the principal-agent relationship is a contractual relationship that exists in any organization and cooperation involving two or more people. If both the principal and the agent pursue utility maximization, then the agent will not always act in the principal's best interests. Managers are considered to be agents for decision-making or control, while owners are considered risk bearers. The agency costs incurred include: 1) the cost of signing contracts; 2) the cost of monitoring and controlling agent behavior; 3) the cost to ensure that the agent will make optimal decisions, otherwise the principal will need to be compensated; 4) residual loss—residual loss caused by failure to effectively control the agent's behavior.

Arrow (1984) distinguishes the agent's behavior in agency theory against the principal's decision choice into moral hazard and adverse selection. Moral hazard refers to the behaviors unfavorable for the principals done by the agents by ex-post information asymmetry and uncertainty and imperfection of contract. Adverse selection refers to the decision choice unfavorable for principals made by agents by ex-ante information asymmetry. Adverse selection models and moral hazard models verify that transactions under asymmetric information will lead to bad money driving out good and bring about moral crisis (Arrow, 1984).

When applied in motivation theory, the principal-agent theory explores how to establish an incentive contract mechanism. Incentive contracts can enable agents to maximize the utility of

principals while pursuing their own utility maximization. Based on the factors of the principals and agents, this effective incentive contract must meet three conditions: incentive constraints; participation constraints; the utility obtained by the principal after paying the agent cannot be improved by adopting any other contract (Su & Zhang, 2009).

The earliest scholars studying the principal-agent dynamic model are Radner and Rubbinstein, They used a repeated game model to prove that if the principal and agent maintain a long-term relationship, then the principal will infer the agent's effort level based on the observed relevant data in the past, and design a contract to reward or punish the agent so as to avoid the agent using lazy methods to improve their welfare (Liang & Feng, 2004). The agent market reputation model and the ratchet effect model are two well-known models for studying "dynamic motivation" and "implicit incentive mechanism". In the 1980s, the yardstick competition theory with competitive yardstick and reward and punishment system was proposed. The performances of agents with similar conditions are compared according to similar conditions so as to measure the effort level of agents. In addition, the challenge of the initial performance and the incentive degree are also considered to play an incentive role.

2.1.5.2 Analytical framework of principal-agent problems

The agent's private information into several categories. From the perspective of agents, 1) the moral hazard (MH) problem or the hidden action (HA) problem, 2) the private information owned by the agents that the principals are unable to know, namely the adverse selection (AS) problem or hidden information (HI) problem. From the perspective of ex post result management, there are no third parties such as authoritative institutions who can observe this information other than the principal and agent, which are also known as ex post unverifiable information phenomena (Macho-Stadler & Pérez-Castrillo, 2012)

Zheng et al. systematically analyzed the hidden action and hidden information problems from the perspective of agents with information asymmetry as well as studied the timing problems of hidden action and hidden information asymmetry, and summarized the main analytical framework of principal-agent problems (Zheng et al., 2013).

The essence of the principal-agent theory is to establish an incentive and restraint mechanism, so that agents can maximize their own interests while maintaining the interests of the principal as much as possible. In this way, it is possible to ensure the consistency of the agent's goals and the principal's goals, while enabling the principal to have sufficient enthusiasm to supervise agents to maintain the normal operation of the principal-agent relationship. The key to the principal's defense of the agent lies in how to define the scope of

rights and liabilities of the agents. The incentive mechanism is designed from two ideas: one is based on monitoring the behavior of the agent; the other is effective control of the agents based on behavioral outcomes.

2.1.6 Summary of motivation theory

With the rapid development of economy and science and technology, the demand for motivation theory in management practice is constantly changing, thus promoting the development of motivation theory. From the "piece rate system" in Taylor's scientific management based on motivation to improve work efficiency to motivation research based on one or several links of human behavioral motivation model from psychology, the classical motivation theory including content theory and process theory has been formulated. The classical motivation theory developed from psychology is based on the psychological characteristics of people and the behavioral characteristics on this basis.

In recent years, with the rise of information economics and institutional economics, the research perspective and idea of incentive theory focus on studying problems from the perspective of system and mechanism. With the development of modern enterprise theory, principal-agent theory has made outstanding achievements in the application and practice of motivation theory. The research objective of the principal-agent theory is to provide an effective incentive principle to avoid information asymmetry in the principal-agent relationship, and solve the problem of balance of interests between the principal and the agent.

The research and development of motivation theory are becoming increasingly clear, the research fields and methods are becoming gradually diversified, and the theoretical system is gradually being improved. Based on the practice of hospital management, further research on motivation theory will effectively promote the modernization process of hospital management.

The systematic analysis of the incentive theory shows that the incentive theory developed from psychology cannot resolve complex problems regarding performance. The design of hospital performance incentive system should prioritize building a new framework of medical performance management with balanced interests over how to motivate doctors and employees, so as to avoid the negative effects caused by improper incentives.

2.2 Theoretical research on P4P

Hospital is an organization specially established to deal with various kinds of diseases. There are two types of pay for performance (P4P), namely external P4P and internal P4P. External payment (medical insurance department vs hospital) refers to a payment contract signed between insurance company/government and hospital, which is used to pay or reimbursement the expenses incurred by insured patients for diagnosis and treatment of diseases in hospitals. Internal payment (hospital vs doctor) refers to the payment paid by the hospital to its employees (Harris, 1977). Harris (1977) believes external PFP and internal PFP are two entirely different payment systems. External payment, internationally known as Pay for Performance (P4P), affects the benefits of the hospital.

2.2.1 Origin of P4P

The Organization for Economic Co-operation and Development published *Health System Priorities when Money is Tight* in response to the phenomenon that the growth rate of health expenditure exceeds economic growth in many countries (OECD, 2010). The report points out that Pay for Performance (P4P) is one of the methods adopted by the countries to obtain better economic benefits.

As a result, based on the development of information system and performance measurement, designing new payment mechanism for health professionals in order to align financial incentives with quality and efficiency goals has become a strategic mission. In fact, no traditional payment methods, whether it is fee-for-service, cost per sales or packaged payment, can clearly reward the achievement of quality goals.

The origin of P4P in healthcare can be traced back to the US private sector in the late 1990s. In 1999, the Institute of Medicine (IOM) published the well-known report to *Err is Human: Building a Safer Health System*. In 2001, IOM (2001) published Crossing the Quality Chasm: A New Health System for the 21st Century, suggesting that health care in the United States often deviates from clinical guidelines and best practices. An important recommendation of the report is that it is necessary to readjust payment incentives to providers to support quality improvement. These reports are consistent in opposition to the medical management efforts in cost control, and these efforts are considered to be consequences ignoring the management of medical quality. By 2002, many P4P programs had been launched in the US private sector, but these programs were mainly small in scale and were still in the experimental stage. The first large-scale private

sector P4P program was initiated by the California General Healthcare Association in 2003 and is still in operation (Cashin et al., 2014)

2.2.2 Definition of P4P

There is no internationally accepted definition of P4P, and the term P4P is often used interchangeably with other closely related terms, such as performance-based funding, payment by results, or results-based financing (RBF). OECD has sorted out some of the common definitions of performance pay used so far as follows. Agency for Healthcare Research and Quality (AHRQ) believes that the definition of P4P is to pay more for good performance on quality indicators; Centers for Medicare and Medicaid Services (CMS) argues that P4P is the high-value care that uses payment methods and other incentives to encourage quality improvement and takes patients as the center. RAND believes that P4P is a general strategy to promote quality improvement by rewarding providers (physicians, clinics, or hospitals) that achieve certain performance expectations in terms of quality or efficiency of health care. The definitions of AHRQ, CMS and RAND are from the perspective of the United States, reflecting the origin of the P4P movement in the United States. Although these definitions are different, they are focused on quality improvement. Among them, RAND also uses efficiency as a measurement (Cashin et al., 2014).

World Bank believes that P4P is a series of mechanisms aimed at improving health system performance through reward-based payment (2008), USAID believes that P4P introduces incentives (usually financial incentives) to reward the achievement of positive health outcomes. Center for Global Development believes that P4P is a transfer of funds or materials by adopting measurable actions or meeting predetermined performance goals. The definitions given by World Bank, USAID, and Center for Global Development are broader and more concerned with developing countries. They include both incentives for the supply side of providers and incentives for the demand side of patients, although demand-side incentives are beyond the scope of this study (Cheryl et al., 2014)

The researcher believes that the health system of any country pays providers through some kind of payment combination. By sorting out and discussing the incentive methods of various payment models, the researcher focuses on the mixture of basic payment system with specific incentive to promote quality and other performance. Thus the definition of P4P is adjustment of the payment methods of medical service providers and clarification of specific incentive measures and indicators to promote the pursuit of quality and other health system performance

goals.

2.2.3 Influences of different payment types on P4P

In 1883, German Bismarck formulated the world's first social health insurance system, *the Health Insurance Law,* which was a pioneer in the social medical insurance. A third-party insurance fund was established outside doctors and patients to pay for some or all the medical expenses. This payment method is still the core of medical service payment until now (Busse et al., 2017).

Third-party payments form a major plank in the pattern of many health insurance advocates. Because of the advent of third-party payment plans, and particularly medicare and medicaid, more people are getting various types of health services. Under most existing third-party payment plans the providers of health services are paid on a fee-for-service basis. Thus, there is an incentive to prescribe the maximum amount of services and the most costly ones (Oppenheim, 1977).

Over time, third-party payment entities are currently grouped into three categories: social mutual aid (German-style social health insurance), government budget (UK-style free medical care), and commercial insurance (tax-free commercial insurance for American employees). Third-party payments have been superimposed on the existing health-care system (Oppenheim, 1977).

After nearly 140 years of development, it can be summarized that medical insurance and third-party payment have undergone three important changes. In the first stage, it is mainly fee for service (FFS), and medical insurance has pricing power. In the second stage, it is mainly diagnosis-related group (DRG), and the median value of the medical records of doctors is the basis for ricing. In the third stage, it is mainly hospital value-based purchasing (VBP), and patients' medical treatment experience is valued.

At present, internationally accepted medical insurance payment systems are divided into the following categories:

Payment Methods：Capitation payment，Based on the number of people served, a flat fee will be paid；P4P Influence：Use of health services is discouraged；Cost and Quality Influence：Cost control is discouraged; Focusing on prevention and improving medical delivery, but it cannot directly stimulate quality improvement

Payment Methods: FFS, Pay the medical institutions by each service; P4P Influence: Give clear motivation to offer more medical services; Cost and Quality Influence: unable to

effectively control cost, over-treatment.

Payment Methods: Bundled payments, or case payments, A fixed price pays for a fixed disease; P4P Influence: Inspire the number of cases to increase; Cost and Quality Influence: Intra-case costs are controlled downward; The increase in the number of unnecessary services indirectly provides more medical opportunities

Payment Methods: DRG, Pay according to diagnosis related groups; P4P Influence: More accurately reflect the severity and complexity of diseases and encourage heavy weighting diseases; Cost and Quality Influence: In the groups, service intensity will be lowered, service items will be reduced to control cost. Select profitable diseases and may lead to selective diagnosis (Berki, 1985)

The work content, value core, and pricing mechanism of medical insurance at different stages are different, and the payment models for hospitals are also different, which has different effects on medical services and hospital performance policies.

In order to block or reverse the bad incentive transmission and establish a reasonable incentive pathway, the current medical insurance payment mode and the reform of the doctor compensation system in China must be effectively coordinated and incentive compatibility be achieved, so as to achieve the expected goal of medical reform (Sun, Gu, & Feng, 2018).

2.2.4 Core elements of P4P

The core elements of all performance management schemes should include: 1) the scope of performance and performance indicators; 2) effective reward and punishment system and dynamic indicators monitoring; 3) clearly defined nature of funds, including bonus or fines and punishment measures, including non-financial punishment; (4) the disclosure system for performance data, including data review and verification.

Wang (2017) believes that in order to construct the hospital performance management system, the hospital should pay a close eye on the trend of health policies, establish the evaluation index system regarding the amount of service, quality, efficiency and patient satisfaction, standardize the procedures, contents and standards of hospital performance management, so as to select the suitable and highly relevant hospital management indicators. Besides, the hospital should lay stress on the evaluation and feedback of performance management. Performance management is a continuous cycle of self-correction. The basic process includes: 1) set performance objectives; 2) build up work expectations; 3) objectives guidance; 4) performance process guidance; 5) sign performance contract; 6) performance

evaluation, 7) performance interview, 8) make performance improvement plan; 9) develop new performance objectives. Performance assessment can motivate employees to take initiatives to self-examine and thus take effective measures to constantly improve themselves, which is beneficial to the long-term strategic development of the hospital and the achievement of the performance management purpose (Chen & Cao, 2007).

2.2.4 Performance appraisal framework

The health systems of the United Kingdom, the United States and Australia have experienced a long history of development, and the construction of health performance appraisal framework is relatively mature. Sun, Zhang, and Wang (2018) conduct a systematic review of the experience of the UK, the US and Australia in the development process, appraisal framework, appraisal indicators, and evaluation data of performance appraisal.

After the rapid economic development of the United Kingdom after World War II, with the outbreak of the world oil crisis in the 1970s, the pressure on financial expenditure of medical services in the UK had increased dramatically. The British government had carried out a series of reforms in terms of controlling the size of medical fiscal expenditure, improving the efficiency of medical expenditures, reducing management costs, and optimizing management structure. The United States began to study the performance assessment framework of the health system as early as the 18th century, and achieved remarkable results in evaluation methods and reporting. Since then, the US government and forces from all walks of life had devoted themselves to research on health performance. Australia set up an interim committee on health care service standards in 1974, established a set of clinical indicators, intensified evaluation of medical service processes and results, and constantly made modifications and improvements. The Australian government has also established a performance assessment framework for multiple service areas, and the government is responsible for checking. The framework mainly includes the performance of public hospitals in the field of health care and the performance of health management systems in the areas of mental health and breast cancer (Sun, Zhang, & Wang, 2018).

From the development of the health care systems of the three countries, financial pressure has always been one of the thorny issues facing the UK government. The UK evaluation framework mainly includes two dimensions of finance and service quality. The focus on the finance dimension indicates that the financial burden is an important risk encountered by the government, and the service quality dimension reflects the government's goal of ensuring the

public as the core to achieve fairness. Due to the market-oriented nature of medical services in the United States, it is facing problems such as excessively rapid growth in medical expenses, inaccessibility to medical resources, and service quality assurance. Therefore, the US evaluation framework also emphasizes these aspects. The health evaluation framework of Australia reflects the "big health system". The health system is guided by "improving public health". Its performance assessment framework includes not only the evaluation of health system performance, but also the health influencing factors and the final health results.

In terms of evaluation indicator design, there are commonalities in the selection of dimensional indicators for the performance assessment indicators of the health systems in the United Kingdom, the United States and Australia. In terms of name and connotation, the commonalities include safety, effectiveness, responsiveness (or patient satisfaction orientation), and accessibility. First, safety is a key concern of the three countries because it provides the most basic guarantee for medical services in the health system. Evaluation of safety can help prevent the occurrence of adverse events, medical accidents and iatrogenic infections in the medical process. Second, in terms of effectiveness and efficiency, all three countries have adopted effectiveness indicators to measure whether the services they provide have met the expected goals. The United States and Australia have set efficiency indicators to evaluate the input and output of resources, mainly including resources such as funds, manpower, and equipment; while the United Kingdom reflects efficiency in financial indicators. Third, the quality of medical services is evaluated from the demand side of medical and health services. It includes both subjective indicators such as patients' attitudes towards medical staff, medical directives, and feedback on patient needs and measurable objective indicators such as waiting time for medical treatment and surgery. Fourth, in terms of fairness and accessibility, the United Kingdom does not directly set fairness indicators, and fairness is reflected through other indicators. The United States and Australia reflect the accessibility of medical services and medical insurance through other indicators to demonstrate that all people enjoy equal medical services (Sun, Zhang, & Wang, 2018).

2.2.5 P4P Review

Pay for performance (P4P) refers to the use of financial incentives to promote improvement of medical efficiency and quality. Performance-based health care financing or pay for performance (P4P) is increasingly being used as a mechanism to improve health system performance around the world. By using incentives related to the achievement of indicators or goals, it is hoped that

the offering, efficiency or outcome of health care or public health services will be improved. There is no definitive positive information on the effect of P4P implementation in different countries (Ogundeji, Bland, & Sheldon, 2016).

Kondo et al. (2016) took implementation of P4P in the U.S. Veterans Health Administration (VHA) as the background and strictly applied the CFIR framework for analysis through literature research, hoping to study the factors affecting P4P in the process of implementation and whether P4P can bring tangible influence on medical efficiency and quality.

Taking the Veterans Health Administration (VHA) making performance compensation as an example, health care personnel performance compensation is related to the volume of services per month and performance goals and processes, which may include measures in the care process (for example, glycated hemoglobin testing for diabetic patients), health status or job responsibilities performed (such as completing training activities in a timely manner), and there is also a performance pay plan for the management. The VHA performance pay plan allows medical centers and medical domain networks to autonomously make performance target management measures based on different types of services offered different service providers. In 2011, about 80% of veteran service providers received an average performance salary of $ 8049 (Kondo et al., 2016).

Researchers reviewed the procedures, interventions, and implementation process of VHA bonus incentives, including the indicator structure (such as service structure, cost/efficiency, clinical process, patient/intermediate results, patient experience) of incentive measure design, reward objects (such as service providers, service groups, managers, administration), the amount of bonuses, positive rewards (such as cost differences, bonuses) or negative penalties (such as withholding fines, repayment to payers), and frequency of rewards. More complicated situations include different types of institutions (such as hospitals, nursing homes), including the organizational culture and other factors in the institution, as well as the number of patients, which may constitute positive and negative factors affecting P4P projects (Kondo et al., 2016).

The conclusions drawn in their research is that the design of P4P should pay attention to the following aspects. 1) Incentive goals and organizational goals should be consistent, and incentive measures should be consistent with organizational priorities; the top-down management method is adopted. 2) Focus should be put on the design of incentive structure, amount and frequency. 3) Priorities of incentives should be on the clinical staff, focusing on evidence-based evidence such as clinical processes and treatment results; data collection should be simple and clear. 4) P4P projects should establish regular evaluation measures, and evaluation focus should be on the poorly-performed areas; feedback of objective information is

also important. 5) P4P project design should include patient elements, and stakeholder participation is very important. 6) The project should be flexible and allow the organization to meet the needs of the patients; researchers believe that paying attention to the clinic will have a more positive impact than paying attention to productivity and efficiency in the first place. The payers and service providers have the same expectations for medical quality (Kondo et al., 2016).

In addition, the research also warns of the risks in the implementation of P4P. 1) Incentives not only can bring positive factors, but may trigger gambling mentality. 2) There is no evidence proving that incentives can effectively improve the relationship between cost and efficiency. Instead, incentives may increase costs. 3) Whether there is a strong information base, whether reports can be made public, and organizational culture are important factors affecting the effectiveness of P4P implementation. 4) P4P processes should have the ability to change over time to respond to the data being constantly measured and input of providers (Kondo et al., 2016).

Ogundeji, Bland, and Sheldon (2016) also believe that the implementation effects of P4P programs may be related to differences in design features, background, implementation factors, and evaluation design among the programs; with different scopes and rules, and implementation in different countries and environments (ownership and funding),the complexity is also different. However, Ogundeji, Bland, and Sheldon believe that P4P has little influence on health outcomes. The money paid to individuals by P4P is more effective than the money paid to groups. Kondo et al. (2016) and Ogundeji, Bland, and Sheldon (2016) all believe that the overall performance of the UK Quality and Outcome Framework (QOF) is high. Kondo et al. found that in P4P projects under QOF and VHA, once a high performance level is reached, removing incentives from implementation measures has little impact on performance. Increasing the maximum threshold will lead to bigger growth of practice with better performance. Ogundeji, Bland, and Sheldon believes that under key incentive conditions, the higher the overall performance of QOF, the lower the mortality rate will be. If the effectiveness of intervention measures is evaluated by relatively poor design, such as an inadequate control group, the effects may be overestimated. Proper control is particularly important because incentive programs are usually compensated by other improvement activities and additional funding. These indicate that the implementation of P4P requires a more rigorous assessment and a longer-term follow-up to assess the sustainability of the effects. Despite the popularity of P4P in healthcare, its effectiveness in improving healthcare performance has proven to be unstable and limited, especially in terms of improving health outcomes, and even in terms of improvement of cost-

effectiveness, there is no significant supporting evidence (Petersen et al., 2006). Common problems with P4P are often poor design, lack of proper control, and overestimation of its impact. Decision makers should consider how these measures can improve efficiency when designing plans. These measures include paying sufficient bonuses and using performance measurement and payment systems to reduce the risk of not being paid when necessary performance improvements are made. P4P requires good control design, especially cost-effectiveness assessment (Ogundeji, Bland, & Sheldon, 2016).

According to Lindenauer et al. (2007) during the implementation of P4P, publicizing the P4P report is not a simple matter, it is complicated and full of political significance. Unless it is new funds that are injected into the payment system, any bonuses with determined proportion need to face the balance within the total size of incentive and make judgement about the system design. The management cost brought by it is likely to be higher than the value generated by the public report. In addition, can the benefits of P4P implementation outweigh the increased costs and management complexity brought by it.

2.3 Lessons learned from the doctors' incentive mechanism

External payment (medical insurance department vs hospital) and internal payment (hospital vs doctor) are two entirely different payment systems. These two kinds of incentives are separated in some health systems, and therefore cause potential conflicts between doctors and hospitals. In fact, as far as medical practice is concerned, the impact of the internal payment on doctors' medical behaviors is greater than that of the external payment to hospital (Qian & He, 2018). The P4P previously discussed mainly focuses on the payment of medical insurance department to hospital, and this part mainly discusses the impact of internal payment (hospital vs doctor) on medical behaviors. Singapore scholars Qian and He (2018) and Chinese scholars Sun, Gu, and Feng (2018) believe that the reform of hospital incentive mechanism should give equal consideration to the external payment (medical insurance department vs hospital) and internal payment (hospital vs doctor) (Qian & He, 2018).

2.3.1 Influencing factors of doctors' medical behaviors

Wennberg (1975) proposed the concept of medical behavior differences and analyzed the behavioral differences occurring in nine common surgical procedures in hospitals near Maine. He found that the medical behavior differences may result from the doctor's selection of treatment plan, including the treatment effectiveness or the doctor's understanding of patients' medical needs. In some cases, the suggestions may vary according to the speed of new

knowledge transmission in medical practice. Although the salary level of surgeons in hospitals near Maine is similar, yet whether there are economic factors needs to be considered.

Woodward and Warren-Boulton (1984) think whether the doctors can provide medically appropriate amount of care depends on the rest time of doctors. The longer the doctors get rest, the more effective the medical services for patients will be.

Jae-young (2004) holds that different payment methods of doctors' salary have different effects on doctors' medical behaviors.

Unlike other ordinary services and commodity services, medical service is a special service provided by doctors who play an irreplaceable and unique role in medical activities. What kind of services doctors provide and how they provide these services determine the service quality and efficiency, and also affect the treatment results of patients and the hospital performance and even the national total medical costs? The medical behaviors of doctors are affected by the individual goals and needs. Although the medical behaviors are restricted and regulated by industrial norms and policies, there is a complex body of impact mechanisms that play a part in guiding, motivating and restricting doctors' behaviors. Therefore, the intervention of doctors' behaviors is filled with uncertainty and complexity (Sun, Gu, & Feng, 2018).

2.3.1 Definition of doctors' bonus

The doctor's bonus is paid by hospital thus belongs to the internal payment (hospital vs doctor). Internal payment refers to various forms of payment paid by hospital to its employees for their labor or technical services in the forms of money, bonus and welfare (Hua et al., 2014).

Salary system includes fixed income, service-time based income and workload based income. Income based on "more pay for more work" can create incentives for doctors that they generally provide more services for patients than needed. In contrast, fixed income and time-based income can lead doctors to provide inappropriate amount of services (Hua et al., 2014).

The doctor salary system includes fixed salary system, salary system based on patient visits, service item-based salary system (Jae-Young, 2004), management personnel salary system, disease-based salary system and resource-based salary system (Cui, 2008). It is necessary to make it clear that the payment for doctors does not belong to external payment (medical insurance department vs hospital), but internal payment (hospital vs doctor).

If doctors are paid according to fixed salary and patient visits, patients' medical expenses will be lower than the expenses incurred by standard medical services; if doctors are rewarded

according to service items they may provide services beyond standard medical services (Jae-Young, 2004).

2.3.2 The influence of doctor's bonus on medical behavior

Based on motivation crowding theory and target income hypothesis, Qian and He (2018) studied the impact of the bonus on doctors' medical behaviors in Chinese public hospitals. The motivation crowding theory considers that human behavior is not only driven by internal motivation, such as altruism and emotion, but also external motivation, such as reward and punishment, and especially external incentive factors such as money incentives. External incentives often crowd out internal incentives such as altruism. In the field of health care, motivation crowding theory is often used to explain why doctors always violate the medical ethics under economic incentives; and the target income hypothesis holds that the aspiration of income maximization has given doctors strong incentives to increase their income as much as possible to achieve the expected income target. The target income hypothesis is often used to explain why most of the time patients are provided excessive services by doctors.

One of the most fundamental characteristics of medical services is that the treatment behaviors and treatment results are filled with uncertainties (Arrow, 1963). Although doctors have motivation and ability to induce demands and can even find good reasons for their excessive services, yet sometimes they have to pay the price for their demand-inducing behaviors. The amount of induced demands mainly depends on the pricing of treatment services, potential benefits and the difference of medical knowledge between doctors and patients. However, the cost resulting from the unethical behaviors has become the key deterring factor discouraging doctors to induce demands. For example, some doctors may get a bad reputation for "over treatment and over prescription". In order to preserve good reputation, doctors generally refrain from providing wildly excessive services. When the marginal benefit of induced demand equals to the marginal cost, the amount of induced demands is the most appropriate (Lv & Xue, 2008).

Although the salary system plays a direct and significant role in creating incentives for doctors, it is only a part of the overall incentive mechanism. The doctor salary system needs to be linked up with hospital total budget, and the service unit payment (hospitalization day income, disease type and disease diagnosis group). The performance of doctors should be evaluated according to ability of costs control, level of technical services, service quality, cost surplus and treatment results. Doctors with better performance will be rewarded. The doctors

should provide medically appropriate services for patients with a view to constantly improving treat results and slashing costs. On this basis, doctors' medical behaviors will be aligned with hospital's goal (Sun, Gu, & Feng, 2018).

In China's public hospitals, the common goal of hospital and doctors is to maximize the hospital's revenue. To that end, the hospital managers can establish incentive mechanism to align doctors' individual goals with hospital's objective. Qian and He (2018) found that in China's public hospitals, the incentive mechanism based on base salary plus bonus produces better incentive effect than the base salary alone. In order to get more bonuses, doctors try hard to receive more patients as possible as they can, prescribe more medicine and examinations. Besides, the bonus level is also affected by education background of doctors and the hospital's level. In this way, increasing number of patients has brought a lot of incomes for the cash-strapped public hospitals. However, the quantity-oriented incentive mechanism has led to shortened time of outpatient treatment and reduced frequency of doctors' smile and patient-doctor communications. Aoki et al (2008) observe that the lack of effective communication or correct communication is the main reason causing faultless medical disputes and the probability of faultless medical disputes is often higher than malpractice-induced medical disputes.

Although the bonus-based external incentives have greatly boosted staff's morale, the services pursuing quantity over quality seriously erodes the doctor's internal motivation for medical professionalism. As we have seen in recent years, the declining service quality has seriously worsened the doctor-patient relationship and caused the rising number of medical disputes. Therefore, the bonus incentive in public hospitals is not only morally inappropriate, but also causes a series of social problems (Qian & He, 2018).

Hua et al. (2014) studied the influence of bonus on medical behavior in a Grade 3 first class hospital in Beijing and concluded that: 1) the bonus plays a decisive role in medical behavior. The reason is that the base salary is relatively fixed with little space to rise; meanwhile, the base salary does not widely vary according to education background and professional title. However, the bonus can be very big depending on the workload or labor intensity; 2) the bonus incentive has increased the treatment efficiency, for example, the average length of stay (ALOS) has been reduced from 7 days to 3 days under the premise of ensuring quality. If the hospitalization time of severe patients is too long, the doctors will balance the income by hospitalizing more mild patients. However it is unknown whether the doctors will encourage the patients with mild diseases to be hospitalized for physical examination by means of inducing demand; 3) with the national control policy on drugs, hospitals generally do not link up bonuses with the income of

drugs prescribed by doctors, and even strictly control doctors' over-prescription behaviors; 4) the phenomenon of accelerating patient turnover is common; speeding up the patient turnover does not mean discharging patients still in need of hospitalization treatment and instead doctors use the method of manual discharge to turn one patient into two; 5)The evaluation index of patient satisfaction has limited impact on doctors' bonus. The evaluation of patient satisfaction is just a mere formality and has no substantial impact on the doctor's bonus and thus doctors care little about the evaluation results of patient satisfaction. Considering the influence of bonus on medical behavior, the stronger the economic incentive effect on doctors, the more unnecessary services the doctors are likely to provide. The doctors' improved work efficiency driven by bonus incentives is likely to be at the cost of service quality. South Korea scholar Jae-Young (2004) believes that the bonus incentives not only affect doctors' medical behavior but more importantly cause the sharp rise of national medical expenses. Although the government has taken multiple measures to eliminate the unnecessary medical services so as to curb the rising medical expenses, yet if the economic incentives continue to exist, these measures do not help the situation. Jae young also pointed out that the patients' comments or satisfaction score written on the notebook for comments and criticisms do not reflect the actual situation.

Cui (2008) believes that aside from the salary and bonus, the doctors in public hospitals also have gray income, such as rebate, red envelopes from patients, and income from excessive treatment by means of inducing demand. In some cases, some doctors are even in collusion with patients to defraud the insurance money.

The economic incentives for doctors without considering the interests of patients will inevitably lead to the unrestricted unethical medical behaviors and other consequent problems.

2.4Management myths and the value of balancing

In the study of management itself, Mintzberg (1999) quoted from *What is Management, What Do Managers Do* published in Fortune in 1976 by Albert Shapiro, a scholar with Ohio State University to dismantle management activities.

First of all, management activities can be separated from management power; for example, each department within a company can autonomously separate itself, and each department has a clear task. If the goal is achieved, its departmental organizational behavior will not be interfered too much;

Second, department performance can be reasonably and objectively evaluated. The

achievement of the goals of each activity can be expressed by quantitative indicators: for instance, both costs and benefits can be measured; but this system cannot meet scattered and vague needs;

Third, business activities can be entrusted to "managers to manage", and performance is used to evaluate them. "Let them take responsibility, and they will be rewarded if the evaluation results are excellent, otherwise they will be replaced."

However, Henry Mintzberg argues that these assumptions are not valid in the work contents and methods of the governmental agencies. According to the above description of management, the government's activities need to be separated from the direct bureaucratic control, and a implementation policy with clear rights and responsibilities must be formed in the political field. The facts show that few politicians are willing to give up their political power. Similarly, policies are gradually formed in the iterative process of governance and management, and policy formulation and administration can be completely separated, just as company planning and execution are separated, However, it is just an unrealizable dream (Mintzberg, 1996).

The excessive mania of "performance assessment or appraisal" in management activities will bring some omissions and distortions. He gave an example in the British NHS. A liver transplant doctor performed surgeries for 10 patients, of which two died and eight survived. Among the eight survivors, one had cancer recurrence in the early years, one had liver failure and needed a second transplant. Only three of the remaining six regained working ability. We can take this case to discuss the perspective of evaluation from different angles. As for the doctor, he would think that he has successfully performed eight or nine surgeries (calculating the two transplants), and the doctor counts the number of surgeries, not people; immunology experts believe there are only seven successful cases because cancer patients may not necessarily need transplantation; hospital managers who are considering cost management will reduce the amount of surgeries to six; if considering the postoperative rehabilitation and quality of life of patients, the amount of surgeries can also be reduced to three. This case indicates that some things are difficult to handle in management evaluation, and management methods cannot solve all the problems. Hard evaluation in management conceals many facts outside of management. If hard management methods are coercively used to solve problems or achieve goals, it will be the "patients or consumers" who suffer substantially.

In addition, Mintzberg believes that the idea that managers can effectively solve all management problems is actually too absurd; the obsession with management itself will only complicate the management and management issues, conceal the problems behind management, and bring severe chaos in the name of management.

Mintzberg not only pointed out the management problems of enterprises due to "obsession with management", but further sorted out several government operation modes, and pointed out that these problems also exist in government governance, each of which is characterized with the way of government control and agency activities. These five government models are used to reflect on the "management myths".

For example, the "mechanical government model" with control as its core idea is characterized by treating the government as a machine controlled by rules, regulations, and standards; the government presents the characteristics of a hologram, and each subsection of the government is very similar to the government itself; this model guarantees consistency of policy and reliability of implementation, but lacks flexibility and responsiveness to individual autonomy. This model was particularly popular in the 1930s and is still used by some governments even today.

The second model is "network government model" with liquidity replacing controllability. "Correlation, communication, and cooperation are the core ideas of this model." This model is completely different from the mechanical model as looseness replaces tightness. Governments are seen as complex systems of interaction, where short-term relationships are formed with the goal of solving problems. From a micro level, work is carried out around the project. But ironically, the network government model is also holographic, with a similar part and whole relationship.

The core idea of the "performance control mode" that brings full value to "management" is isolation, distribution, and evaluation. This model emulates business management and divides the entire organization into different organizational departments. The goals are assigned to each department, and then the upper-level designs plan and control, thereby promoting the completion of goals through assessment. The performance mode achieves the purpose of centralized power through decentralization. Therefore, the new model of public management operates in almost the same way as the old model of mechanical management.

The fourth is the "virtual government model" with no real government. In the perfect world of virtual government, micro-activities will no longer be controlled by the government, and all activities are organized and provided by private sectors. Privatization, contracting, and negotiation are at the core of this model. However, this is just a bold experiment by economists with no management experience.

The fifth is the "normative control model" rooted in values and beliefs. Its core ideas are choice, socialization and judgment. In all the above models, the social power cannot be fully structured effectively so as to establish a definition different from the world. The normative

control model is not an operating system, but it is about the soul. The normative control model includes five key factors: "the talent view featuring the same value choices, ensuring the socialization of members in the society as a whole, the guidance guided by values, the responsibility consciousness of shared responsibility among all employees; the judgmental performance assessment by experienced persons". In this model, it is not the numbers that make sense, but the attitude. The service and dedication of the normative control model softens the negative effects of bureaucracy.

The key to the normative control model lies in the proposal of bidirectional dedication. Both service providers and service recipients are dedication targets and sources. The microstructure in this model is essentially different from the past models, as it is more enthusiastic, more equal and dynamic, with less mechanical and hierarchical nature.

Although Mintzberg also believes that there is no best model, he also highly values the "normative control model". In particular, he believes that the Japanese experience can show that "the spiritual role of human beings is irreplaceable." "Organizations without dedication are like people without souls. Bones, muscles, and blood may be sufficient to maintain body metabolism, but they have no vitality."

Mintzberg especially emphasizes that this conclusion is especially applicable to customer-oriented professional services such as health care and education, because human factors are the most critical in these industries. He argues that professional services need to be released from the direct control of government agencies and the narrow pressure of market competition. The value of balance is emphasized and promoted by Mintzberg. The influence brought by interests of different institutions and the political system, the interrelationship between institutional and individual interests, affirmation of individual needs, treasuring of personal wealth, establishment of balance between personal interests and institutional and social interests, and establishment of balance of interests between different stakeholders are those need continuous attention (Mintzberg, 1996).

2.5 Summary of literature research

The hospital is an organization playing dual roles as provider of treatment services and guardian for people's health. The study of hospital performance focuses on not only the government's complex payment system designed for hospitals but also the important role of doctors. The government implements supervision on hospital according to regulatory policy. Doctors, as the legal producers and providers of medical services, perform the medical service provision agreement signed between the government and hospitals (Harris, 1977).

After reviewing the literature on scientific management theory and incentive theory, principal-agent theory and P4P theory, the study found that:

2.5.1 The incentive mechanism purely in favor of doctors while ignoring potential damages on interests of patients will pose risks.

Unlike other commercial services, the customers' expectation for medical suppliers is entirely different because they cannot test products and establish trust before consumption. Therefore, the moral requirements for doctors are higher than that for hairdresser. Unlike other businesses, 1) There are basically no advertisements on medical services and medical services are not sold at expressly marked price; 2) Doctors' treatment suggestions to patients are generally considered to be correct and irrefutable; 3) Doctors should select the treatment plan according to the patient's disease conditions instead of economic factors; doctors are expected to make correct diagnosis responsibly rather than just please customers (Arrow, 1963).

The standardization system and efficiency optimization advocated by scientific management theory are very important to medical services filled with complexity and uncertainty. But there is reason to be cautious about the efficiency optimization because the doctor incentives based on quantity-oriented services may be at the cost of full communication between doctor and patients and humanistic quality, thus causing potential medical disputes (Jae-Young, 2004; Hua et al., 2014).

Besides, without considering the patients' interests, it is impossible for any incentive measure, whether it is based on the Hawthorne effect or the process incentive theory, to eliminate the doctors' motivation to induce demand by taking advantage of the highly asymmetric medical information between doctors and patients and it is also impossible to improve the medical service and promote the hospital reform.

Furthermore, consumers actually care little about the doctors' performance monitoring because even if all the monitoring data are made public, there is no way for customers to effectively use and explain the information (Cashin et al., 2014).

2.5.2 The performance management mechanism based on the external payment cannot effectively exert influence on the internal payment.

On basis of external payment, the P4P essentially makes health insurance departments bear more responsibilities for service purchasers and service recipients. P4P scheme has its own internal responsibility mechanism aiming to guarantee the interests of service purchasers, providers and patients in the whole process of service provision (Cashin et al., 2014), However, in China, the entity responsible for monitoring external payment is not doctors, but hospitals. With the profit-seeking nature and residual claim rights unchanged, the hospital has high motivation to establish a profit-oriented incentive system encouraging doctors to pursue more profits. The health administrative departments are always absent from the supervision on medical service quality. A hospital obsessed with pursuing excessive profits can do everything possible to evade the external supervision (Harris, 1977).

When hospital revenue is directly linked to medical insurance reimbursement and the external payment is based on fee for service, the hospital will link up the doctors' income with business income or service items. Driven by the economic interests, the hospital is highly motivated to forge medical records, prescribe false medical orders, and provide excessive medical services and even register unprovided services for hospitalized patients with medical insurance, so as to increase the economic income (Qiu & Wang, 2009). With the change of medical insurance policy and when the external payment is based on DRGs, hospitals are inclined to shift the blame on patients, repeatedly hospitalize them, or adjust the diagnosis results according to DRG weight (Zhang, Wang, & Zhang, 2018), leading to the inconsistency of medical record data and clinical medical behavior (Leng & Chen, 2018).

2.5.3 Rampant induced demand by doctors in the principal-agent relationship

In the process of medical service, doctors play dual roles as the providers of medical services and the agents of patients. Due to the lack of medical knowledge, patients lose their consumer sovereignty to doctors who help choose the treatment plan for patients, and thus the principal-agent relationship between doctors and patients is established (Lv & Xue, 2008). With doctors playing dominant role in medical services, their inducing-demand behaviors driven by economic incentives can lead to moral hazard.

Doctors' moral hazards are triggered by three preconditions: 1) whether the interests of doctors and patients are consistent; 2) whether the information between patients and doctors is

symmetrical; 3) whether the treatment result has positive or negative consequences for doctors; when the interests of doctors and patients are not entirely aligned, the doctors are likely to induce demand to increase their incomes. Only when the interests of doctors and patients are consistent, can the perfect principal-agent relationship is formed. The doctors' ability to induce demand is fully based on the unsymmetrical information between doctors and patients. If the information of both sides is symmetrical, doctors will lose the ability to induce demand even if they have motivation. Unlike other products, medical service is a special product whose quality is influenced by many unpredictable factors such as doctor's professional ability, patients' individual differences, treatment plans, hospital level and medication use. For the same disease, different hospitals and different doctors may select different treatment plans that lead to different treatment results; similarly, for the same patient, different treatment plans in the same hospital may produce different treatment results. Therefore, the uncertain nature of medical services has served as "safe haven" for doctors to cover their ethics violations. For safety's sake, doctors may induce demand to prescribe more expensive drugs, excessive examinations, and require longer hospital stay, so as to 1) reduce the risk of medical accidents or disputes; 2) increase personal incomes. The personalized treatment plans and treatment results are largely decided by the doctors' professional ability and therefore it is difficult for the outsiders to identify or evaluate whether there is induced demand in the process of treatment (Xu, 2014).

Although the medical services are highly uncertain, doctors obviously know more information about the treatment results than patients (Arrow, 1963). The financial incentives may become the hotbed breeding doctors' ethics violations. Some people think economic incentives can help improve service quality, but there is no empirical evidence to support this view (Christianson, Leatherman, & Sutherland, 2008). The incentive mechanism should be established based on the aligned interests and symmetrical information of patients and doctors.

2.5.4 Coordinated development of payment performance and internal payment in public hospitals

Ideally, the reform of the internal payment system should be carried out following the reform of the external payment system and external payment method so that the profit mechanism of hospitals can be changed. The change of the profit motivation of the hospitals will directly promote the reform of the doctor's incentive method (internal payment). Only when the reforms of external payment and internal payment are conducted in a coordinated way, can the new "incentive compatibility" be achieved, thus directing the reform of internal payment

towards the anticipated performance goals of medical reform (Sun, Gu, & Feng, 2018).

Although the negative impact of doctors' financial incentives on medical behavior is widely criticized, the public can hardly endure to allow the doctors' unethical medical behaviors to go unchecked (Arrow, 1963).

The internal payment paid by hospitals to doctors and the external payment paid by medical insurance departments to hospitals should be highly coordinated. The doctor salary system needs to be linked up with hospital total budget, and the service unit payment (hospitalization day income, disease type and disease diagnosis group). The performance of doctors should be evaluated according to ability of costs control, level of technical services, service quality, cost surplus and service results. Doctors with better performance should be rewarded. The doctors should provide medically appropriate services for patients with a view to constantly improving treat results and slashing costs. On this basis, doctors' medical behaviors will be aligned with hospital's goal. Only when the external payment is highly coordinated with the internal payment, can the harmful incentives be eliminated or reversed and healthy incentive mechanism be established (Sun, Gu, & Feng, 2018).

2.5.5 Establish a hospital internal performance management system balancing the interests of patients and doctors

The doctor-patient relationship is decidedly ambivalent and often confused. On the one hand, the doctor-patient relationship has impact on medical quality. The effect of pure spiritual interactions between doctors and patients cannot be distinguished from the effect of drugs. The effect of patients' strong dependence on and trust in doctors is far more than that of some drugs. On the other hand, the public consensus is that in order to protect the interests of patients, a series of payment methods and management systems should be established to monitor doctors' behaviors (Arrow, 1963).

As the provider of medical services, the hospitals, together with doctors and patients, should form a community with shared interests. The hospitals are responsible for balancing the interests of patients and doctors, establishing good hospital reputation, building long-term mutual trust between doctors and patients, giving doctors a sense of belonging, mission and security, and providing high quality service and humanistic care for patients.

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Chapter 3: Theoretical Background and Research Design

3.1 Implications of theoretical framework and theoretical model construction

After learning the P4P experience of various countries, it can be found that the performance incentive of doctors is closely related to the payment of insurance. In particular, relevant DRG practice provides a scientific and reliable management tool with strong operability for designing hospital management performance model. In the field of inpatient payment especially, which is now extended to many aspects such as medical quality management, hospital evaluation, and doctor ability evaluation, doctor elements of the doctor performance incentive model can refer to common evaluation indicators such as DRGs, CMI (Case-Mix Index), RW (relative weight) and cost consumption index. However, it is necessary to balance the interests of the hospital (organization) and the patients (results) when considering doctors' performance incentive.

When facing the need to systematically construct a theoretical framework for hospital performance management research, we should realize the balance relationship between benefit and quality from the perspective of organization, and establish the management framework prudently by combining the whole process of quality management and administrative relationships, so as to protect various stakeholders and realize healthy and benign development of the hospital.

3.1.1 Donabedian's "structure-process-outcome" model

Donabedian, known as the father of medical quality management in the United States and Mr. "structure-process-outcome", was awarded the Sevik Medal, the highest honor in public health in the United States, by the American Public Health Association in 1999. In the 1960s, Donabedian began to focus on the medical quality research, and in 1966 he put forward the three-dimensional connotation of medical quality, namely structure-process-outcome, in which structure was defined as the relationship and efficiency of static allocation of all kinds of resources in medical institutions, including the number of beds, personnel allocation, items, scope and quantity of medical services; process was summarized as the quality and efficiency of the dynamic operation of the medical institution, such as paths of clinical treatment and

management, the detection and evaluation of various activities, staff training and education; and outcome was the final quality measure of medical institutions' structure and operation, including patient satisfaction, morbidity, readmission rate, mortality rate, cesarean section rate, and patient waiting time. Donabedian constructed the theoretical framework of the medical quality system based on the unified model of medical quality, and incorporated the medical cost, patient benefit and related risks of service provision into the scope of unified medical quality (Li, 2003). Berwick and Fox (2016) argued that to this day, Donabedian's model covers the entire field of quality measurement as understood by people. It's worth pointing out that Donabedian himself believed that the system only has the enabling mechanism, that personal morality is critical to the success of a system, and that the secret of quality control lies love. "You must love your patients, love your career, and love the God", and that's the core of quality.

Jiang and Hu (2004) and Su (2011) respectively constructed a performance assessment framework in the public health system based on Donabedian's theory. The public health evaluation framework proposed by Jiang and Hu is divided into two levels, national and regional. They built an evaluation framework by linking five parts of structure, process, output, outcome and external environment to measure the performance of specific institutions and projects in the public health system (Jiang & Hu, 2004). Su, on the other hand, referred to the conceptual framework of WHO health system performance assessment and Donabedian's three-dimensional assessment framework of structure-process-outcome to construct a three-level index system, including three first-level indicators, 12 second-level indicators and 25 third-level indicators. He expected to establish an instructive health assessment system (Su, 2011). Jia and Fang (2017) adopted Donabedian's structure-process-outcome model to design the evaluation index system for the operation effect of hospital health alliance.

Donabedian (1989) believed that system design and effective supervision are the guarantee of the optimization and improvement of quality, while supervision may occur naturally in the cooperation of various departments, rather than in some formalized and dogmatic forms. Supervision includes 1) systematic and complete collection of information in medical care process and outcome, 2) identifiable practice models, 3) interpretation of these models, 4) actions taken to correct deficiencies in time, and (5) verifiable effects of remedial actions. In supervision process, professional accountability is adopted and sound management is realized by documenting the quality of service. The effectiveness of supervision will depend on specific elements: 1) leadership, 2) organizational characteristics, 3) healthcare professionals, (4) monitoring methods, and 5) factors that influence the behavior of practitioners.

3.1.2 Application of principal-agent theoretical framework

When discussing the motivation of doctors, first of all, it is impossible to avoid in-depth analysis and research on the principal-agent relationship between hospitals and doctors. The central task of the principal-agent theory is to study how can the principal design optimal contract to stimulate the agent in the context of conflicting interests and asymmetric information. In the principal-agent relationship, the principal pursues maximization of his own interests, and the agent pursues maximization of his own income and luxury consumption and leisure time, which will inevitably lead to conflicts of interest between the two. Without effective institutional arrangements, the agent's actions are likely to ultimately harm the client's interests.

In the principal-agent relationship of medical service, the hospital acts as the principal and the doctors act as the hospital's agents in performing the medical service. The practice of the doctors is directly related to the hospital's entrusted tasks. Therefore, the principal-agent theory is considered as the first entry point to understand the principal-agent relationship between doctors and the hospital. Based on the organizational goals and values, the principal goals of the hospital, the principal, can be clearly expressed. In addition, based on the principal goal, a quantifiable agent task goal can be established with the doctors, the agent, and based on the multidimensional countermeasures, the two parties reach a highly agreed balanced contract so that the hospital's principal target and the doctors' agent task can reach goal uniformity. The balanced contract in which principal goals and agent tasks reach uniformity is as per the following Figure 3.1:
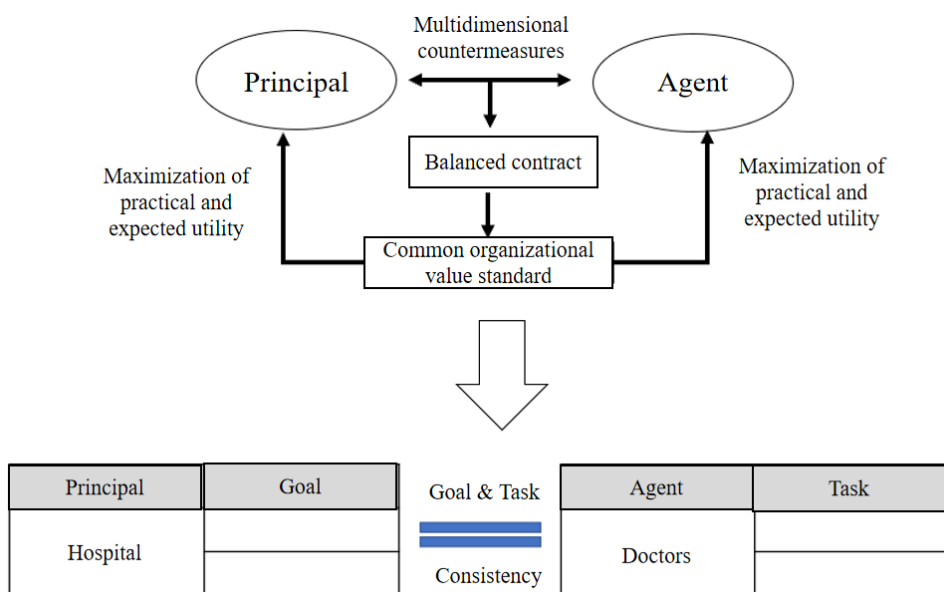

Figure 3.1 Principal-agent relationship-balanced contract

In addition, based on the information asymmetry problem in the principal-agent problem, corresponding to the exante and ex post management control nodes, combined with the Donabedian theoretical model, in the three links of organization-process-outcome three, a linked quantifiable management indicator is established. Donabedian theory is actually a dynamic process, in which one link directly or indirectly affects the other (Jiang & Hu, 2004). Besides, the key point of the principal-agent problem caused by information asymmetry is whether the information of the agent's behavior is hidden will directly affect the interests of the beneficiaries and ultimately affect the interests of the principals. The entire process is dynamic and continuous. The "structure-process" link establishes an ex-ante control node, the "structure-outcome" link establishes an ex-post feedback node, and the "process-outcome" link establishes anin-process control node to form a complete incentive supervision mechanism, as shown in the following Figure 3.2:

Timing / Hidden Content	Hidden Action	Hidden Action
Ex ante		Adverse selection model, signal transmission model, signal screening model
Ex post	Moral hazard model of hidden action	Moral hazard model of hidden information
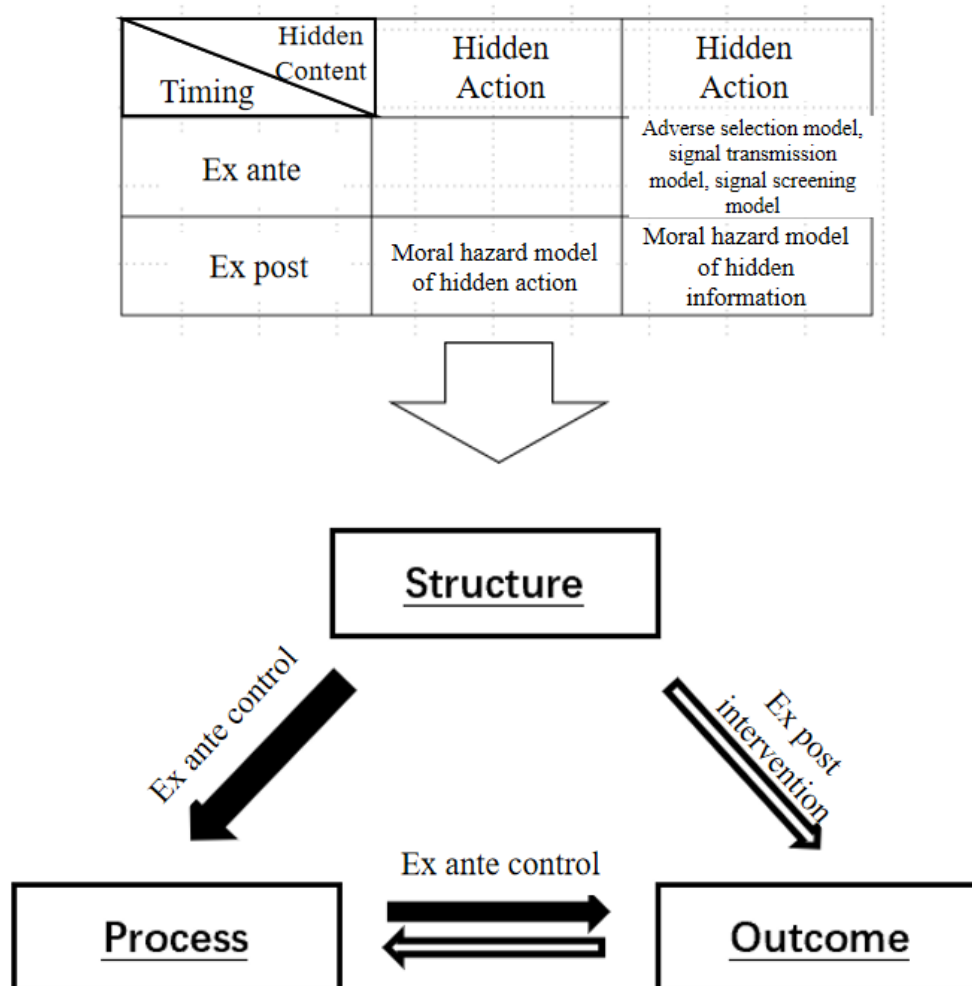
Figure 3.2 Application of Donabedian in information asymmetry control mechanism

3.1.3 Doctor performance motivation theoretical model

Based on previous research, the researcher integrates the principal-agent relationship, information asymmetry, and the Donabedian theoretical model in the motivation theory from a systematic perspective to form a theoretical model of doctor performance motivation in this research. The purpose is to explore how to avoid a single income-based incentive for doctors' bonuses, reasonably increase their income level, balance the relationship between hospital development, patient safety, and individual development of doctors, and offer good ideas and solutions to achieve high-quality medical services and realize optimal input-output path using the development method which suits the hospital development. From establishing a commissioning task suitable with hospital development to setting agency goals suitable with doctor technical skills and level, to achieving good clinical safety quality of patients and satisfaction quality output, then to realizing the benign development of the hospital, and finally to achieving the ideal state of the well-guaranteed principal effect, the theoretical model of performance incentive model for public hospital doctors is deduced as per Figure 3.3:
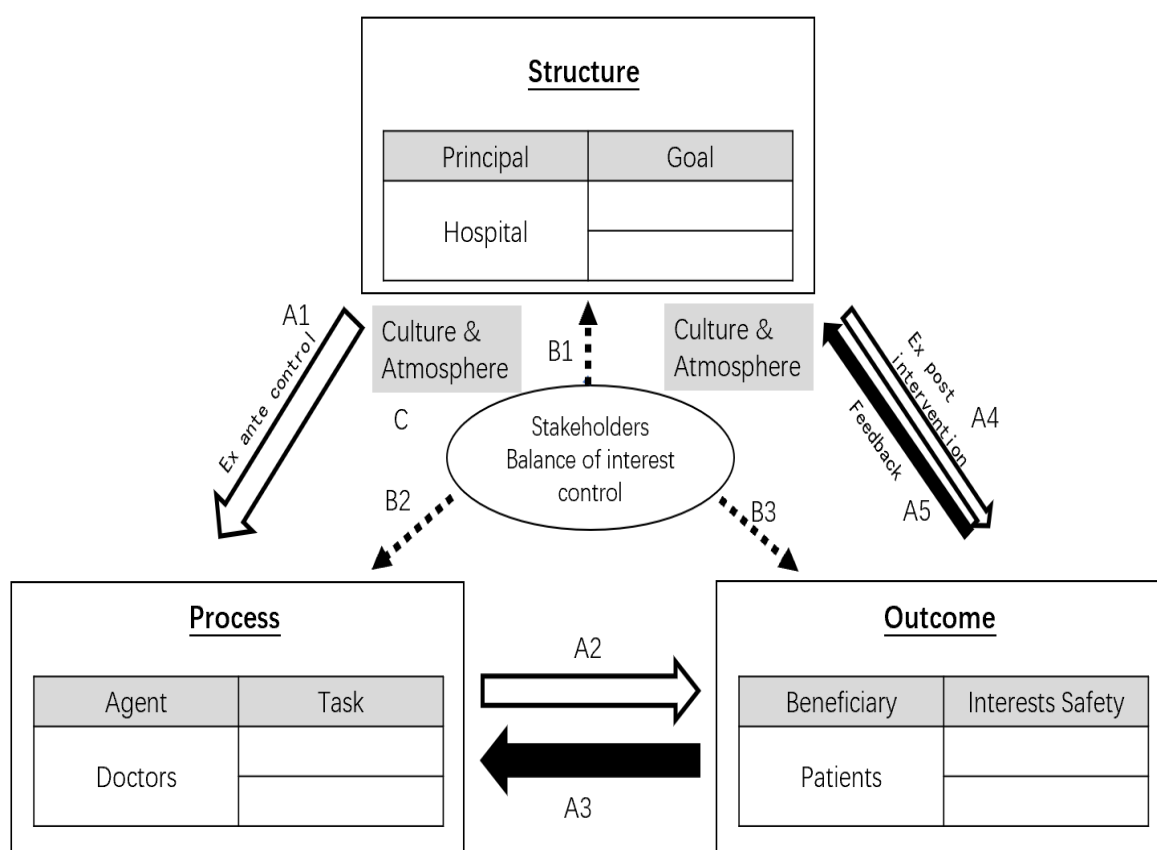
Figure 3.3 Theoretical model of performance motivation for doctors

In constructing this theoretical model with "balance of interest control" as its core, the important implication is to always be alert to the warning of "loss of management" put forward

by Mintzberg. In the management of hospitals, the incentive subjects and service targets are all living people. Through balanced values, they tend to embrace more enthusiastic, more equal and dynamic organizational and service processes. The deep-rooted belief and values in their heart will eventually play a more important role apart from management, because "organizations without dedication are like people without souls, and although bone, muscle, and blood may be sufficient to maintain body metabolism but they have no vitality at all". As a result, in hospital management, providers of medical services are stimulated to be freed from the limitations of management and the narrow market competition (Mintzberg, 1996).

3.1.4 Research analysis

The design based on the doctors' incentive theory model is mainly derived from the perfect combination of principal-agent theory and "organization-process-outcome" model.

The principal-agent theory is used to establish an incentive and restraint mechanism. The key to the principal's defense of the agent is how to define the scope of powers, responsibilities and interests of the agent. The incentive mechanism is designed based on two ideas: one is based on the monitoring of agent behavior; the other is based on effective control of agents by behavioral results.

The "organization-process-outcome" theory of Donabedian is a dynamic model. Organization represents the attributes of the medical service organization, including goals and resources; process indicates what is actually done in the medical service, including patients' activities of seeking medical service and treatment as well as doctors' activities of making diagnoses and recommendations or performing treatment; outcome indicates the impact of treatment on the health status of patients and the population and patient satisfaction.

In medical services, doctors are the agent in the principal-agent relationship, and there is a huge information asymmetry between them and the service objects and the principal. Motivation of the doctors' behavior occurs right in the whole process when doctors make diagnosis or perform treatment.

The "hospital-doctor-patient" relationship form a perfect contrast with the "organization-process-outcome", so that the design of the "doctor incentive model" can be realized, but in order to prove the effectiveness of the model and to promote the model in the future, we need to further disassemble and analyze the relevant relationships in the model, and discuss and sort out the following issues by interviewing key persons and stakeholders.

A1: The hospital-doctor relationship, which is the starting point of the principal-agent

relationship. It is also the beginning of establishing organizational goals and process. This set of relationship expresses the consensus between the goals of the hospital (organization) and the tasks of the doctors, that is, a balanced contract. At the same time, it is necessary to clearly define the management measures based on the achievement of the goals in order to achieve the effect of pre-intervention; the prerequisite for the consensus between the hospital and the doctor is that they have common values.

Therefore, in A1 what needs to be clearly expressed is the specific goals of the principal hospital (organization) and the specific tasks of the agent doctors, and the two sides reach a consensus to form a balanced relationship.

If there is a long-term relationship between the principal and the agent, the principal will infer the agent's level of effort based on the relevant data observed in the past so as to design a contract to reward or punish the agent and avoid the agent using lazy methods to improve their own welfare (Liang & Feng, 2004).

So, at this level, the questions that need to be figured out are:

1) What aspects demonstrate the maximization of benefits of hospitals as the principal? What keywords or indicators can indicate it?

2) What keywords can express doctors as the agent: shirking behavior?

3) What can reflect the doctors' demand for maximization of welfare? What keywords can be used to express?

A2: The doctor-patient relationship expresses the direct impact of the doctors' medical behavior on patients during the medical process. Assume that in the hospital-doctor equilibrium contract, the doctors' tasks will be in the interests of the hospital. Then, are they in line with the patients' interests? How will the hospital be able to monitor the behavior of doctors as the agent?

Therefore, at this level, the A2 relationship needs to clearly express the following questions:

1) What keywords can be used to express what the doctor has done to the patient? Or what keywords can reflect the workload and quality of the doctor?

2) What keywords can be used to express the linkage between the interests of doctors and patients?

A3: The patient-doctor relationship expresses the patients' feedback on the doctors' medical behavior or medical results during the medical process. Assume that in the A2 doctor-patient relationship, doctors bring a sense of insecurity to patients because of asymmetric information of patients, and thus it is necessary to establish an indicator to form feedback channels or feedback on clinical feelings.

In fact, it is widely recognized in the academia that the doctor-patient relationship is also a

set of principal-agent relationship. The principal is the patient and the agent is the doctor. There is a huge information asymmetry between the principal and the agent, and their interests are inconsistent.

Therefore, at this level, the A3 relationship needs to clearly express the following question:

1) What keywords or indicators can be used by patients as beneficiaries or medical result bearers to express their demands for maximizing benefits?

A4: The hospital-patient relationship expresses the relationship between the principal hospital (organization) and the patient (bearer of medical results). In the principal-agent theory, the principal has the initiative to supervise the agent to maintain the smooth operation of principal-agent relationship, and one of the effective ways to supervise the agents is to effectively supervise them based on the behavioral results.

Therefore, the A4 relationship needs to clearly express the following questions:

1) What keywords that reflect results does the hospital use to supervise the results so as to control the doctors?

2) Do these keywords need to establish a relationship with the equilibrium contract between the hospital and the doctor?

A5: The patient-hospital relationship expresses the patient feedback mechanism to the hospital. During the treatment in the hospital, if the patient is satisfied or dissatisfied (especially dissatisfied) with the medical process, the patient needs to find an organization to give feedback so as to improve sense of security. In fact, the establishment of this feedback mechanism also helps the principal (hospital) to effectively control the agent (doctor).

Therefore, the A5 relationship needs to clearly express the following questions:

1) When a patient gives feedback to the hospital in his own interest, what is the usual behavior?

2) Can we find the keywords that align the interests of patients and hospitals, what are they?

B is the core, the point of interest balance. C refers to the cultural and atmospheric factors. The enlightenment obtained from the management myth is that when we demonstrate the management theory and management model in a meticulously logical way, we will eventually find management imbalance in practice. Apart from management, what can affect the interests, and can the non-quantifiable concepts of culture, atmosphere and spirit actually fill the gap of management?

So, what are the balanced value factors we need to find in this incentive model?

3.2 Research design

With the official launch of public hospital performance appraisal (2019), the performance appraisal indicators of public hospitals have become the vane and baton for the management of public hospitals (Liu, 2020), and have also laid a foundation for public hospitals to study their internal performance management system.

The following research is based on the "conceptual model of performance incentives for doctors in public hospital" to analyze the important relationships established by the combination of "principal-agent theory" and "organization-process-outcome" theory, to further construct and identify in principal-agent relationship how the balance of interests between the hospital and doctors as well as doctors and patients can be embodied in "organization-process-outcome" model, and to establish a relevant mechanism of action. By doing so, the conceptual models constructed previously can be continuously standardized and the operability can also be ensured.

3.2.1 Indicators establishment and research procedures

First of all, the key points of the survey in this research were formulated based on the *55 Key Performance Indicators of National Public Tertiary Hospitals* (2019) and Donabedian's "organization-process-outcome" model. After that, the survey questionnaire was designed and handed out to hospital administrators. The aim of the questionnaire is to obtain the understanding of the *55 Key Performance Indicators* among hospital administrators and furthermore, select the relevant indicators in terms of hospitals, doctors and patients.

Secondly, key informant interview was adopted in this research. The research chose key persons in the related area, including experienced hospital performance management experts, performance managers of health management administrative department, public hospital directors, heads of hospital performance department, clinicians and patient representatives, to conduct interviews about particular questions based on the relation analysis.

Thirdly, experienced hospital performance management experts and hospital directors were selected to accept further questionnaire survey about the selected indicators based on the 5-point Likert scale.

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Chapter 4: Indicator System Construction

On the basis of previous literature analysis, this study systematically sorted out the relevant experience of incentive theory, principal-agent theory, and P4P, and built up the theoretical model of performance incentive. This chapter will further study the model, so as to improve its operability.

4.1 Principle of establishing indicators

4.1.1 Principle of systematization

The particularity of medical service is that it is tied to the performance benefits of doctors at one end, and the life safety of patients at the other end. The good design of performance indicators can strike a balance among the organizational objectives, the service value of clinicians, and the safety of medical outcomes. Therefore, all indicators should conform to the logic of "organization – process – outcome", so that the selection of performance indicators can reflect the characteristics of medical services on the operational level.

4.1.2 Principle of scientificity

The relevant indicators in the performance model should avoid overlapping and remain relevant at the meantime. Also, the authenticity and scienticity of indicators should be reflected without conflicting different indicators.

4.1.3 Principle of operability

Selected indicators should have clear definitions and boundaries. The indicator data should be objective and quantitative as far as possible, and easy to obtain with clear sources as well as accurate and normative calculative rules, which is easy to understand, use, and operate.

4.1.4 Principle of value orientation

The process of medical service is complex with obvious externalities. On the one hand, the constructed performance calculation is likely to fall into a situation with too many indicators,

which will lead to tedious management and complicated results. On the other hand, improper design of indicators may easily result in the problem of overtreatment due to performance incentive. This research does not simply judge or motivate doctor's ability and performance as well as hospitals' performance, but is dedicated to constructing the key point of performance incentive with positive value orientation under the guidance of the core values of medical service, so as to achieve the balanced goal of benefiting hospitals, staff, and patients.

4.2 Research on the performance indicators of China's public tertiary hospitals

The directives on Strengthening the Evaluation of Public Tertiary Hospitals (hereinafter referred to as the directives) promulgated by the State Council on January 16th, 2020, clearly stipulates the performance assessment indicator system for public tertiary hospitals, including four first-class indicators, 14 second-class indicators, and 55 third-class indicators. The public hospital performance assessment has started across China in 2019, with a view to basically establishing an improved public hospital evaluation system in 2020 (General Office of the State Council of the People's Republic of China, 2019).*The Directives* which is authoritative, has contributed to the refinement of medical reforms, and has posed a huge challenge to hospital management. This research survey starts with 55 indicators and aims to improve the adaptability of this research to policies, solve the subjective and unquantifiable problems in medical management in this research, and build consensus in the principal-agent relationship in management relationship and the cognition of management in the organizational management process.

4.2.1 Questionnaire design

The content design of the questionnaire is based on 55 indicators, each of which is given four options: "organizational goals, process indicator, outcome indicator and difficult to identify". The purpose of conducting a sample questionnaire survey on the target hospital managers is to 1) understand medical managers' cognition of the 55 indicators; 2) on the basis of the reality of the hospital management, know whether the current national performance indicators are integrated to the management process of organizational goals—process management—outcome control; 3) try to form the basic indicator system of "Conceptual model of performance incentives for doctors in public hospital" based on the 55 indicators.

4.2.2 Questionnaire distribution and data analysis

4.2.2.1 Selection of questionnaire recipients

This questionnaire survey was distributed to participants in the excellent medical management courses of public hospitals developed by Board Hospital Management. Since 2009, open hospital management courses designed by Board Hospital Management have covered more than 40,000 managerial cadres from 7,830 public hospitals above the county-level in China. Open classes are held in different second-tier cities every month for two to four times, including Public Hospital Performance Management, Financial Management, Strategic Management, Clinical Quality Management and others. There are 120-150 trainees in each course, mainly composed of middle and senior managers in public hospitals, including the head of hospital supervisory unit, director or section chief of health bureau, hospital director, secretary, head of functional department, head of finance department, and director of clinical department. The audience of Board's public courses was the research object of our performance management system study, who were all managers in public hospitals so that questionnaires were issued and collected with certain quality assurance and the number of discarded and invalid ones would be reduced as much as possible. Therefore, questionnaires were distributed through nine public courses from the second half of 2019 to the first half of 2020 respectively in Guangzhou, Zhengzhou, Hangzhou, Lanzhou, Hefei, Nanchang, Changsha, Shijiazhuang and Chengdu.

Before the formal survey, we conducted a preliminary investigation on 55 third-level indicators involved in the questionnaire, focusing on the intelligibility of relevant items, timely finding out ambiguity and other problems that may occur in formal investigation, and revising the expression of relevant items to form the "Organization-Structure-Outcome Survey Questionnaire for the Performance Assessment Indicators of Public Tertiary Hospitals" (Annex C).

4.2.2.2 Sample composition analysis

This is a research survey that combines "55 performance indicators of China's public tertiary hospitals" with hospital performance. A total of 991 valid samples were collected as Table 4.1

Table 4.1 Basic information of samples

		Frequency	Percentage	Effective percentage	Cumulative percentage
Gender	Male	559	56.4	56.4	56.4
	Female	432	43.6	43.6	100.0
Age	Under 30	9	0.9	0.9	0.9
	30-40	190	19.2	19.2	20.1
	41-50	576	58.1	58.1	78.2

	Above 50	216	21.8	21.8	100.0
Working position	Hospital management	252	25.4	25.4	25.4
	Hospital administrative management	234	23.6	23.6	49.0
	Hospital department management	379	38.2	38.2	87.3
	Administrative department	9	0.9	0.9	88.2
	Business-related agencies	117	11.8	11.8	100.0
Years of working	1	18	1.8	1.8	1.8
	2	9	0.9	0.9	30.1
	3	18	1.8	1.8	71.8
	5	27	2.7	2.7	93.6
	7	18	1.8	1.8	95.5
	8	27	2.7	2.7	98.2
	9	18	1.8	1.8	100.0
	10	53	5.3	5.3	7.2
	11	27	2.7	2.7	9.9
	13	36	3.6	3.6	13.5
	14	20	2.0	2.0	15.5
	15	45	4.5	4.5	20.1
	16	9	0.9	0.9	21.0
	17	18	1.8	1.8	22.8
	18	45	4.5	4.5	27.3
	19	18	1.8	1.8	29.2
	20	63	6.4	6.4	36.4
	21	45	4.5	4.5	41.0
	22	54	5.4	5.4	46.4
	23	36	3.6	3.6	50.1
	24	45	4.5	4.5	54.6
	25	36	3.6	3.6	58.2
	26	36	3.6	3.6	61.9
	27	27	2.7	2.7	64.6
	28	27	2.7	2.7	67.3
	29	27	2.7	2.7	70.0
	30	81	8.2	8.2	80.0
	31	9	0.9	0.9	80.9
	32	36	3.6	3.6	84.6
	35	27	2.7	2.7	87.3
	37	9	0.9	0.9	88.2
	40	27	2.7	2.7	90.9
The highest academic qualification	PhD degree	27	2.7	2.7	2.7
	Master degree	198	20.0	20.0	22.7
	Bachelor degree	748	75.5	75.5	98.2
	Post-secondary education	9	0.9	0.9	99.1
	Others	9	0.9	0.9	100.0
	Total	991	100.0	100.0	

Among 991 respondents of the questionnaire, 56.4% were male and 43.6% were female, with 12.8% more males than females. In terms of age, less than 1% (0.9%) were under 30 years old. 41-50 years old was the main age group, accounting for more than half (58.1%), followed by the group over 50 years old accounting for 21.8% of the total samples and that of 31-40 years old accounting for 19.2%. As for the position, 87.3% of the respondents held management positions in the hospital, and 25.4% of them were at hospital-level. The sample size of administrative positions was rarely different with that of the management positions, accounting for 23.6%, and the department administrative positions accounted for 38.2% with a comparative advantage. This survey also collected a small number of samples from administrative departments (accounting for 0.9%) and some business-related units (accounting for 11.8%), indicating that the survey was not limited to positions in public hospitals. According to the survey, only 13.5% had worked in current department for less than 10 years, while the majority (86.5%) had worked for more than 10 years, and 19% for 30 to 40 years, which reflected that the respondents had rich working experience in this industry. In terms of educational background, the highest degree was Ph.D., accounting for 2.7%. Those with junior college degree or below were the least (0.9%), those with undergraduate education were the majority, accounting for 75.5%, and those with master degree also took up a considerable proportion (20%) of the total.

It can be drawn from the sample structure the overall portrait of the research subject: more males than females, middle-aged group (41-50 years old, 58.1%) with rich working experience (working for over 10 years, 86.5%) and good education (bachelor degree or above, 98.2%).

4.2.2.3 Results of indicator screening

In the data analysis, based on the feedback on the 55 indicators in the questionnaire, the frequency analysis method was used to screen the survey results, and a total of 27 indicators were selected. The detailed results are as Table 4.2:

Table 4.2 Indicator screening results

	Indicators	Frequency	Percentage
Organizational goals	2-42. Comprehensive budget management	747	70.9
	2-43. Standard of chief accountant	738	70.1
	3-44. Title structure of health technicians	738	70.1
	3-46. Ratio of nurses to physicians	720	68.4
	3-45. Proportion of anesthesiologists, pediatricians, intensive physicians, pathologists, and TCM physicians	711	67.5
	1-20. Proportion of types of basic drugs purchased	684	65
	1-21. Proportion of drugs used in the national procurement of centralized drug procurement	684	65
	2-33. Proportion of staff expenditure in business expenditure	656	62.3
	2-26. Number of pharmacists per 100 beds	630	59.8
	1-18. Proportion of basic drug prescriptions for outpatients	585	55.6
	1-24. Classification of functions of electronic medical record	576	54.7
	1-16. Proportion of prescriptions with comment in total prescriptions	570	54.1
	1-19. Rate of basic drug use in hospitalized patients	567	53.8
	3-50. Funding for scientific research projects per 100 health technicians	558	53
	3-47. Proportion of staffs receiving training in other hospitals (especially partner assistance hospitals and hospitals in integrated healthcare system) and returning to work independently in the original hospital	531	50.4
Process indicators	1-10. Single disease quality control	723	68.7
	1-17. Antibacterial use intensity (DDDs)	718	68.2
	1-15. Coverage of ward with high quality nursing service	587	55.7
	1-9. Infection rate of type I incision surgery	573	54.4
	2-25. Daily hospitalization workload for each certified physician	553	52.5
	1-8. Incidence of complications in surgical patients	552	52.4
Outcome Indicators	4-54. Inpatient satisfaction	670	63.6
	1-6. Proportion of discharged patients receiving grade 4 surgery	666	63.2
	4-55. Medical staff satisfaction	599	56.9
	4-53. Outpatient satisfaction	550	52.2
	1-14. Mortality of low-risk group case	541	51.4
	1-4. Proportion of surgery received by discharged patients	540	51.3

4.2.3 Second survey design

By employing frequency analysis method to screen results of the first round of questionnaires, 27 indicators were obtained, including 15 indicators signifying organizational goals, six process indicators, and six result indicators. In order to further refine the indicators, five-point Likert scale was used to screen indicators for further analysis.

Likert scale gives five alternative answers for attitude rating for each question (e.g., 1- Strongly disagree, 2- Disagree, 3- General, 4- Agree, 5- Strongly agree), and these five answers are scored on from 1 to 5 points. The total score of attitudes can be obtained by summing up the scores of each question in a scale. It can reflect the comprehensive attitude of respondents towards the object or topic and the higher the total score of the scale is, the more positive the respondents' attitude towards the object or topic will be (Qi, 2006).

In this round of questionnaire design, a total of 22 indicators selected from the results of the first round of questions were given five levels of attitudes one by one to collect the respondents' comprehensive attitudes towards all these indicators, so as to further refine the number of indicators and form **a performance incentive index system in public hospitals**.

Focusing on the application of internal performance incentive index system of public hospitals established in this study in the case hospital, the First People's Hospital of R City, a grass-root tertiary hospital, was selected as the object of questionnaire distribution and case study in this round of questionnaire (specific information about the First People's Hospital of R City will be elaborated in Chapter 5).

4.2.4 Preparatory work before the survey

4.2.4.1 Training and publicity to build consensus

This study aims to establish an internal performance index system of public hospitals. In order to better achieve management consensus and reduce information asymmetry, the interpretation of relevant indicators in the questionnaire and knowledge about the "goal-process-outcome" model is necessary to reduce cognitive ambiguity.

4.2.4.2 Pre-survey and questionnaire adjustment

We selected 10 employees in the hospital to conduct a pre-survey, which aimed to know whether employees at different levels understand relevant items in the questionnaire and the Likert five-point method, as well as their incomprehension or cognitive ambiguity of the indicators, so as to timely find out other problems that may occur in formal survey. Finally, the "Secondary

Investigation of the Performance System in Public Hospitals - Likert Five-subscale Questionnaire" was formulated (Annex D).

4.2.5 Questionnaire distribution and data collection

The second round of questionnaire survey is based on the preliminary screening of indicators in the first round. Based on the 27 indicators obtained from the screening results of the frequency analysis, we further refined and explored the application of the internal performance index system of public hospitals. Therefore, for the second questionnaire survey, we selected public hospitals that are qualified to apply the internal performance index system of public hospitals in the later period as the sample hospitals. The sample hospitals were selected in representative grass-root tertiary public hospitals to carry out the survey.

4.2.5.1 Sample composition

This survey is the second questionnaire survey conducted on the basis of the indicators screened in the first questionnaire survey on the "55 performance indicators of national public tertiary hospital". A total of 770 valid samples were collected this time. The basic information of the samples includes gender, age, Position and Position level. As Table 4.3

Table 4.3 Sample composition

		Frequency	Percentage	Effective percentage	Cumulative percentage
Gender	Male	214	27.79%	27.79%	27.79%
	Female	556	72.21%	72.21%	100.00%
Age	18~25	100	12.99%	12.99%	12.99%
	26~30	239	31.04%	31.04%	44.03%
	31~40	234	30.39%	30.39%	74.42%
	41~50	140	18.18%	18.18%	92.60%
	51~60	56	7.27%	7.27%	99.87%
	Above 60	1	0.13%	0.13%	100.00%
Working position	Hospital management	11	1.43%	1.43%	1.43%
	Administration or logistics	114	14.81%	14.81%	16.23%
	Clinical medical care	503	65.32%	65.32%	81.56%
	Medical assistance or medical technology	141	18.31%	18.31%	99.87%
	Superior department	1	0.13%	0.13%	100.00%
Level of position	Leadership	1	0.13%	0.13%	0.13%

Middle-level cadres	86	11.17%	11.17%	11.30%
General staff	683	88.70%	88.70%	100.00%
Total	770	100%	100%	100%

Among the 770 questionnaires collected in this survey, 27.79% of the respondents were male and 72.21% were female, with 44.42% more females than males. In terms of age distribution, 26-40 years old was the main age group, accounting for more than half (61.43%), followed by the group of 41-50 years old, accounting for 18.18%, and then was that of 18-25 years old, accounting for 12.99% of the total sample size. As for the position, clinical medical care was the majority, with a sample size of 65.32%, which had an absolute advantage. The second was medical technology & medical auxiliary and administrative & logistics positions, accounting for 18.31% and 14.81% of the total respectively. The sample size of positions in hospital management and superior department was relatively small, accounting for 1.43% and 0.13% respectively. The survey also divided the sample data according to different position levels, among which general staff were the main body accounting for 88.7% of the total, followed by middle-level cadres, accounting for 11.17%, while the proportion of main hospital leaders was only 0.13%.The sample shows that the subjects involved in this survey are young (26-40 years old, 61.43%) front-line clinical medical staff (65.32%) and medical technical and medical auxiliary staff (18.31%) with a small proportion in middle management (11.3%) or above positions. It is consistent with the proportion of personnel in the organizational structure of the hospital, laying a good personnel foundation for later practice as well.

4.2.5.2 Results of exploratory factor analysis

Exploratory factor analysis (EFA) is an analysis method used to uncover the underlying structure of multivariate measured variables and reduce dimensionality. Before conducting factor analysis, a moderateness test was conducted to check whether the questionnaire data is suitable for factor analysis.

The moderateness test shows that the Kaiser-Meyer-Olkin (KMO) value is 0.967, and the corresponding significance value of the Bartlett's test of sphericity is 0.000, less than 0.001, as Table 4.4, so it is suitable for factor analysis.

Table 4.4 KMO test and Bartlett's test of sphericity

KMO measure of sampling adequacy		.967
Bartlett's test of sphericity	Chi-square approximation	572.584
	Degrees of freedom	351
	Significance	.000

Four common factors with initial eigenvalues greater than 1 were extracted by performing principal components factor analysis. The results Table 4.5 Total variance explained show that the percent variance of the four common factor is 29.659%, 25.382%, 20.277%, and 4.113% respectively. The cumulative variance explanation rate reaches 79.431%, more than 50%, indicating that the extracted common factors can explain most of the questions, and the validity of the questionnaire is generally good.

Table 4.5 Total variance explained

Component	Initial eigenvalue			Extraction sum of squared loading			Rotation sum of square loading		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	17.475	64.721	64.721	17.475	64.721	64.721	8.008	29.659	29.659
2	1.521	5.633	70.354	1.521	5.633	70.354	6.853	25.382	55.041
3	1.377	5.099	75.454	1.377	5.099	75.454	5.475	20.277	75.318
4	1.074	3.977	79.431	1.074	3.977	79.431	1.111	4.113	79.431
5	.684	2.535	81.966						
6	.588	2.177	84.143						
7	.461	1.709	85.851						
8	.425	1.574	87.426						
9	.358	1.325	88.751						
10	.336	1.246	89.997						
11	.320	1.185	91.181						
12	.294	1.090	92.272						
13	.251	.929	93.201						
14	.224	.829	94.030						
15	.214	.791	94.821						
16	.196	.726	95.547						
17	.175	.649	96.196						
18	.162	.600	96.796						
19	.153	.565	97.361						
20	.131	.487	97.847						
21	.121	.447	98.295						
22	.113	.417	98.711						
23	.101	.375	99.086						
24	.088	.326	99.412						
25	.082	.303	99.715						
26	.050	.184	99.899						
27	.027	.101	100.000						

Extraction method: principal component analysis.

Table 4.6 Rotated component matrix [a]

	Component			
	1	2	3	4
OB4 Ratio of nurses to physicians	.766			
OB1 Comprehensive budget management	.760			
OB2 Standard of chief accountant	.755			
OB3 Title structure of health technicians	.750			
OB5 Proportion of anesthesiologists, pediatricians, intensive physicians, pathologists, and TCM physicians	.744			
OB6 Proportion of types of basic drugs purchased	.743			
OB7 Proportion of drugs used in the national procurement of centralized drug procurement	.736			
OB10 Proportion of basic drug prescriptions for outpatients	.657			
OB12 Proportion of prescriptions with comment in total prescriptions	.656			
OB14 Funding for scientific research projects per 100 health technicians	.642			
OB13 Rate of basic drug use in hospitalized patients	.642			
OB15 Proportion of staffs receiving training in other hospitals and returning to work independently in the original hospital	.605			
RE4 Outpatient satisfaction		.853		
RE1 Inpatient satisfaction		.849		
RE5 Mortality of low-risk group case		.844		
RE6 Proportion of surgery received by discharged patients		.841		
RE3 Medical staff satisfaction		.831		
PR2 Antibacterial use intensity (DDDs)		**.691**		
RE2 Proportion of discharged patients receiving grade 4 surgery		.658		
PR1 Single disease quality control			.833	
PR6 Incidence of complications in surgical patients			.774	
PR5 Daily hospitalization workload for each certified physician			.768	
OB9 Number of pharmacists per 100 beds			**.750**	
PR4 Infection rate of type I incision surgery		**.528**	**.629**	

PR3 Coverage of ward with high quality nursing service	.537	.618	
OB8 Proportion of staff expenditure in business expenditure			.751
OB11 Classification of functions of electronic medical record			-.624

Extraction method: principal component analysis

Rotation method: Caesar's normalized maximum variance method

a. The rotation has converged after 6 iterations

The rotated component matrix is shown in the Table 4.6 (OB means the goal management indicator; PR is the process management indicator; RE represents the result management indicator). As can be seen from the Table 4.4, the first common factor is organizational goal management. It contains 12 items, and all these items have a factor loading higher than 0.50. The second common factor is result management, which includes 6 items (the second item of OB is deleted as error common factor). The third common factor is the process management indicator, which comprises 3 items (the ninth item of OB is deleted as error common factor, and the third and fourth items are dropped because of cross-loading). The remaining items have relatively high factor loading. The fourth common factor is composed of the eighth and eleventh items of OB, which are dropped because they do not meet the theoretical dimension of the study. In summary, 12 items of OB, 3 items of PR and 6 items of RE are finalized.

4.2.5.3 One-way Analysis of Variance (ANOVA)

1) Variance analysis of demographic variables in goal management indicators

In order to compare the difference among people of different genders and different ages in the goal management indicators (see Table 4.7), we performed ANOVA. The results of gender analysis showed that male was significantly higher than female in goal management by objective indicators ($M = 4.0510$ vs $M = 3.9122$, $F = 8.440$, $p < 0.05$); the results of age analysis showed that there were significant differences in goal management indicators among people of different ages ($F = 6.417$, $p < 0.05$).

At the same time, we used single factor analysis to analyze whether there was a significant difference in goal management indicators among people in different positions and at position levels. The analysis results of different positions showed that people in different positions had significant differences in goal management indicators ($F = 2.696$, $p < 0.05$), while the analysis of position levels showed that there were significant differences in goal management indicators among people at different position levels ($F = 8.373$, $p < 0.05$).

Table 4.7 Goal management indicators

		Mean	Std. Deviation	F	Sig.
Gender	Male	4.051	0.58534	8.440	0.004
	Female	3.9122	0.5974		
Age	18~25	3.9536	.06176	6.417	.000
	26~30	4.0710	.03755		
	31~40	3.8629	.04205		
	41~50	3.9915	.03908		
	51~60	3.7583	.08200		
	Above 60	3.0417	.07217		

Position	Hospital management	3.5606	.95894	2.696	.030
	Administration & logistics	4.0175	.54284		
	Clinical medical care	3.9664	.59013		
	Medical auxiliary & medical technology	3.8830	.61140		
	Superior department	3.4167	.79495		
Position level	Main leaders	4.8667	.29814	8.373	.000
	Middle-level cadres	4.0738	.57151		
	General staff	3.9282	.59507		

[Age] Further posterior comparison showed Table 4.7that there were significant differences in goal management indicators among people aged 18~25 and those aged 26~30, 51~60 and above 60 ($p < 0.05$). There was a significant difference in goal management indicators between people aged 26~30 and 31~40 ($p < 0.05$). There was a significant difference in goal management indicators between people aged 31~40 and those above 60 ($p < 0.05$). There was a significant difference among people aged 41~50, 51~60 and those above 60 years old in goal management indicators ($p < 0.05$).

[Position] Further inter-group comparison showed Table4.7 that there were significant differences among hospital management, administrative & logistics, clinical medical care and medical technology & medical auxiliary in terms of goal management indicators ($p < 0.05$). There were significant differences between administrative & logistics and medical technology & medical auxiliary ($p < 0.05$).

[Position level] Further inter-group comparison showed Table 4.7that there were significant differences among main leaders, middle-level cadres and the general staff in goal management indicators ($p < 0.05$). There was a significant difference between middle-level cadres and general staff in goal management indicators ($p < 0.05$).

2) Variance analysis of demographic variables in process management indicators

In order to compare the differences in process management indicators among people of different genders and ages, we conducted ANOVA. The results of gender analysis showed that there was no significant difference between male and female in process management indicators ($p > 0.05$). The results of age analysis showed that there were significant differences in process management indicators among people of different ages ($F = 6.500$, $p < 0.05$).

At the same time, we performed ANOVA to explore whether there was a difference in management process indicators among people in different positions and at different position levels. The analysis results showed Table 4.8 that there was no significant difference in process management indicators among people in different positions ($F = 1.839$, $p > 0.05$), and that there

was no significant difference in process management indicators among people at different position levels, either (F = 0.576, p > 0.05).

Table 4.8 Process management indicators

		Mean	Std. Deviation	F	Sig.
Gender	Male	3.7648	0.74935	0.647	0.422
	Female	3.7158	0.75984		
Age	18~25	3.7766	.84673	6.500	.000
	26~30	3.8962	.74943		
	31~40	3.6140	.76650		
	41~50	3.7445	.68512		
	51~60	3.4333	.57995		
	Above 60	2.9167	.16667		
Position	Hospital management	3.3636	.92442	1.839	.120
	Administration & logistics	3.7310	.76022		
	Clinical medical care	3.7605	.74137		
	Medical auxiliary & medical technology	3.6619	.78779		
	Superior department	3.0000	.57735		
Position level	Main leaders	4.0667	.43461	.576	.563
	Middle-level cadres	3.6973	.79344		
	General staff	3.7311	.75397		

[Age] Further inter-group comparison showed Table 4.8 that there were significant differences in the process management indicators among the age groups of 18~25 and 51~60 as well as 18~25 and above 60 (p < 0.05). There were significant differences between 26~30 and 31~40, 41~50, 51~60 and above 60 (p < 0.05). There were significant differences in process management indicators between age groups of 31~40 and 51~60 as well as above 60 (p < 0.05).

3) Variance analysis of demographic variables in outcome management indicators

In order to explore whether there was a difference in outcome management indicators among people of different genders and ages, we conducted ANOVA. The results of gender analysis showed Table 4.9 that there was significant difference in outcome management indicators among different genders (F = 6.373, p < 0.05), and the analysis results of age groups showed that there was also significant difference in outcome management indicators of people in different age groups (F = 5.088, p < 0.05).

At the same time, in order to test whether people in different positions or at different levels had significant differences in outcome management indicators, we performed ANOVA. The

analysis results showed that people in different positions had significant differences in the outcome management indicators (F = 2.370, p < 0.10) and that there was a significant difference in outcome management indicators among people at different position levels (F = 5.666, p < 0.05).

Table 4.9 Outcome management indicators

		Mean	Std. Deviation	F	Sig.
Gender	Male	4.0249	0.63677	6.373	0.012
	Female	3.8915	0.66465		
Age	18~25	3.9708	.62082	5.088	.000
	26~30	4.0478	.64646		
	31~40	3.8063	.70650		
	41~50	3.9866	.53362		
	51~60	3.7444	.72776		
	Above 60	3.3750	.75000		
Position	Hospital management	3.5455	1.02223	2.370	.051
	Administration & logistics	4.0629	.58176		
	Clinical medical care	3.9215	.65933		
	Medical auxiliary & medical technology	3.8759	.65961		
	Superior department	3.8889	1.27294		
Position level	Main leaders	4.6667	.74536	5.666	.004
	Middle-level cadres	4.0709	.61874		
	General staff	3.9049	.65931		

[Age] Further inter-group comparison showed Table 4.9 that there were significant differences in outcome management indicators among people aged 18~25 and those aged 31~40, 51~60 and above 60 (p < 0.05).

[Position] Further inter-group comparison showed Table 4.9 that there were significant differences in outcome management indicators between administration & logistics and hospital management, clinical medical care, as well as medical auxiliary & medical technology in outcome management indicators (p < 0.05).

[Position level] Further inter-group comparison showed Table 4.9 that there were significant differences among main leaders and middle-level cadres as well as the general staff in outcome management indicators (p < 0.05), and that middle-level cadres and general staff had a significant difference in outcome management indicators (p < 0.05).

4.2.6 Theoretical model rudiment based on indicators

This research sets the evaluation indicators of national public tertiary hospitals as a pool from which indicators are selected for this theoretical model of performance. After screening and refinement of relevant indicators with the "organization – process – outcome" three-dimensional measurement in two rounds of questionnaire, here are 12 organizational objective indicators, 3 process indicators, and 6 outcome-controlling indicators, all of which are arranged to form the rudiment of performance incentive model Figure 4.1.
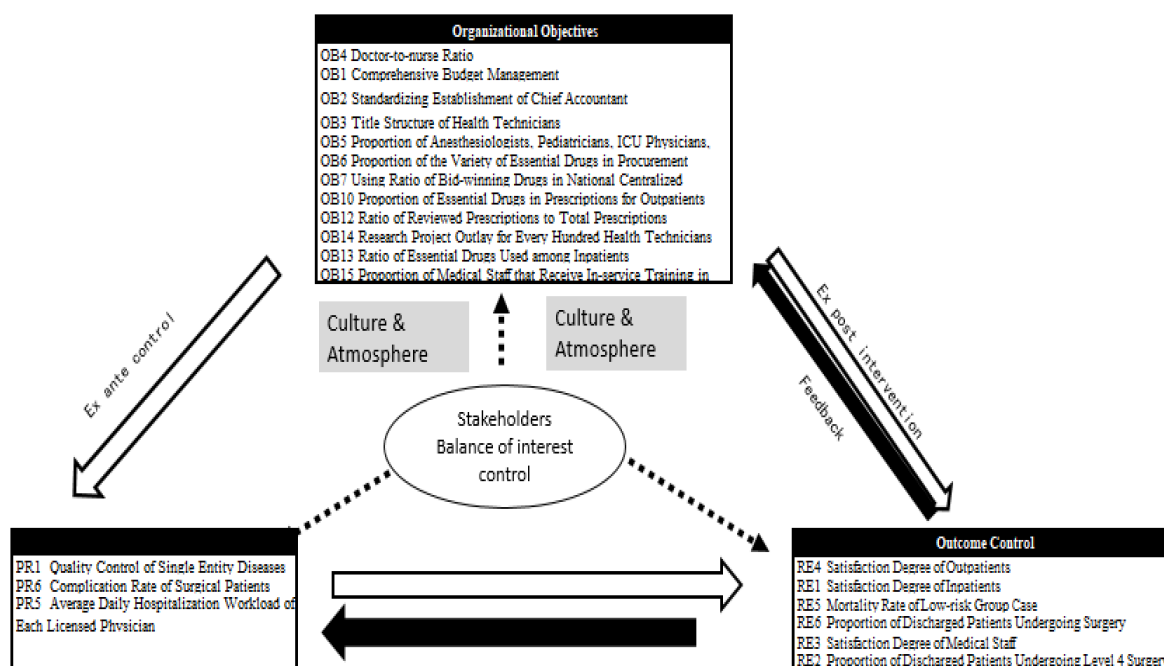
Figure 4.1 Performance incentive model

4.3 Calibration of indicator-based model

4.3.1 Keyman interview

Based on the performance incentive model rudiment constructed above, 20 respondents are chosen, including experts in hospital performance management, heads of administrative department of public health performance, presidents of public hospitals, executives of hospital performance department, clinicians, and patient representatives, to conduct interviews on the constitution and function of theoretical model indicators. From the interviews, it is expected to comprehend managers' perception and directives on the model indicators in the "organizational objectives – process indicators – outcome control" dimension, and further verify and amend the performance incentive model.

4.3.2 Design and basic situation of interview

The interviewees are middle and senior managers in public hospitals, who are aged from 42 to 58 with an undergraduate diploma or above, including 3 hospital top managers (like secretaries or vice presidents), 2 clinical managers (clinical directors), 2 business managers (in Medical Administration Division and Nursing Department), and 3 administrative managers (like presidents and managers in Human Resources Department and Social Services Department). All of them have been working in hospitals for over 15 years and are familiar with hospital management.

This research took the indicator dimensions of the theoretical model finished above as the starting point of interview design. The interview outline was designed in different dimensions, taking into account whether the indicators of objectives, organization, and outcome dimensions can meet with corresponding interests, and the related effect or influence that is to come. Amongthe11questionsintheinterview, four of them are in the objectives dimension, where directives are solicited from the following perspectives: the relevance of indicator selecting and organizational objectives and interests; whether the indicators can represent the organizational objectives; whether the indicators can play a role in beforehand control; and whether the indicators can give consideration to the interests of both hospitals and doctors. There are three questions in the process dimension, mainly focusing on whether the selecting of indicators can reflect the quality of process, the definition of workload and work value of doctors, and the relevance to patients' safety in the outcome dimension. Four questions are designed in the outcome dimension, including whether the indicators can reflect medical outcomes, the relationship between the indicators and doctors' interests, whether the indicators can reflect the patients' rights, and the relevance of outcome indicators and organizational objectives indicators.

The application process contained three steps – interview, interview notes compilation, and qualitative research. Qualitative research emphasizes the post positivist and empirical analysis and investigation of objects, and the explanatory comprehension towards them from a critical perspective. This research conducted qualitative research by applying Nvivo, a software launched by the Australian company QSR.

1. Automatic coding results of Nvivo Table 4.10

Table 4.10 Automatic coding results

Title	Files	Reference Points
Indicators	10	74
Subjective Indicators	1	1
Indicators of Subjective Kind	1	1
Quality Indicators	1	1
Quality Assessment Indicators	1	1
Hospital Objectives Benchmark	1	1
Reduction and Refinement of Indicators	1	1
Indicator Setting	4	4
Indicator Design	5	5
Setting of Indicators	2	2
Design of Indicators	2	2
Indicators – Indicators of Satisfaction	2	2
Indicators – Outcome Indicators	1	1
Drugs Indicators	1	1
Indicators of Operations	1	1
Assessment Indicators	2	2
Objectives Indicators	2	2
Indicators of Objectives	8	8
Indicators of Satisfaction	1	1
Objective Indicators	1	1
Comparable Indicators	1	1
Evaluation Indicators	1	1
Indicators of Integration Process	1	1
Outcome Indicators	4	4
Indicators of Outcomes	7	7
Performance Indicators	1	1
Indicators of Process	1	1
National Indicators	1	1
Workload Indicators	1	1
Corresponding Indicators	1	1
Indicators of Process	3	3
Hospitals	9	21
Hospital Objectives Benchmark	1	1
Hospital Operation	1	1
Hospital Humanism	1	1
Doctors in Hospitals	1	1
Attributes of Hospitals	1	1

Capabilities of Hospitals	1	1
Objectives of Hospitals	2	3
Interests of Hospitals	1	1
Scale of Hospitals	1	1
Management of Hospitals	1	1
Public Welfare Attribute of Hospitals	1	1
Hospital – Social Services Department	1	1
Hospital – Human Resources Department	1	1
Hospital – Administrative Management Department	1	1
Hospital – Vice President – Male	1	1
Rural Hospital Training	1	1
Primary Hospitals	1	1
Public Hospitals	1	1
Outcomes	10	18
Questions of Outcomes	1	1
Indicators of Operations	1	1
Relations of Outcomes	1	1
Of Scientific Research Outlay	1	1
Outcome Indicators	4	4
Indicators of Outcomes	7	7
Quality of Outcomes	1	1
Coherence of Outcomes	1	1
Management	8	23
Quality Management	1	1
Budget Management	1	1
Management of Hospitals	1	1
Implementation of Advance Studies Management	1	1
Performance Management	1	1
Standardized Management	1	1
Management Requirements	1	1
Management Demands	1	1
Management Problems	6	6
Management Personnel	1	1
Management Objectives	3	3
Management Work	1	1
Management Influences	1	1
Management of Risk Groups	1	1
Management of Definitions	1	1
Capability of Financial Management	1	1

2. Open coding

The interview records were read, analyzed, and numbered line by line, and those with similar attributes were conceptualized and categorized. Through careful and objective open coding, 574 original concepts were obtained in Arabic numerals. Then we further summarized and classified those concepts that were of a large number and that were overlapped. Finally, we sorted out 49 concepts and 13 categories, which are shown in Table 4.11.

Table 4.11 Concepts and categories sorted out by open coding

Original Materials	Conceptualization	Categorization
① **Although hospital objectives benchmarks like the doctor-to-nurse ratio, comprehensive budget management, and standardized setting of chief accountant are national objectives, they should be adjusted according to different situations of hospitals before adoption.** ② **The implementation of indicators concerning personnel allocation is not very standardized, some of which are too formalistic to play an effective guiding and motivating role.** ③ **Indicators of essential drugs reflect the public welfare attribute as well as the interests of hospitals.** ④ **The quality control of prescription review is conducive to drug use, realizing the full supervision on the selection, purchasing, and using of drugs.** ⑤ **Projects concerning scientific research outlay are difficult to implement in primary tertiary hospitals at present. More emphasis should be put on research on rural hospital training.**	Personnel allocation proportions; Indicators related to drugs; Indicators of scientific research project outlay; Indicators of advance studies; Rural hospital training	Constitution of Objectives Indicators
① **If set based on related national standards, objectives indicators can work well in guiding the management of hospitals.** ② **The setting of these indicators can fully reflect that the objectives of hospitals are scientific, reasonable, and comprehensive, with the basic human resources, technology resources, scientific research capabilities, talent training modes, and financial management capabilities of hospitals taken into account.** ③ **Indicators of essential drugs reflect the public welfare attribute of public hospitals.**	Guiding role; Manifesting hospital resources and capabilities; Public welfare attribute	Roles of Objectives Indicators
① **Although hospital objectives benchmarks like the doctor-to-nurse**	Enforcement at national level; Hospital scale	Deficiencies of Objectives

ratio, comprehensive budget management, and standardized setting of chief accountant are national objectives, they should be adjusted according to different situations of hospitals before adoption. ② In setting indicators in the objectives dimension, the scale of hospitals should be considered. ③ What fails to be manifested in indicators are personnel allocation proportions like the doctor-to-nurse ratio, the inconsistency of the number of registered staff and the number of fully employed staff, and the fact that a large number of front-line personnel have outflown to administrative logistics.	should be considered; Inconsistency with reality	Indicators
① Quality control method for single entity diseases can be an indicator of medical insurance cost control but is hard to implement. ②Indicators of the actual workload of doctors in hospitals are insufficient to reflect the actual clinical situation. Registered doctors far outnumber the fully employed ones that are overloaded. ③The three indicators of process, after reduction and refinement, are satisfying, and can be improved if indicators related to DRG are added.	Quality control method for single entity diseases; Workload; DRG indicators	Constitution of Process Indicators
① Process indicators can partly provide feedback on clinical interests and quality. ②The setting of process indicators can reflect medical quality. Process indicators can manifest the work value and workload of doctors, and build necessary relations with the quality of patients. ④ Manifest the coherence with indicators of objectives.	Feedback on interests and quality; Reflecting work value and workload; Building relations; Coherence with objectives	Roles of Process Indicators
① Quality control method for single entity diseases can be an indicator of medical insurance cost control, but is hard to implement. ② Indicators of quality and workload are both considered in process indicators. The sum and the intensity value of hospital labor can be well manifested, while the difficulty value cannot be fully expressed.	Hard to implement; Insufficient reflection of technology value	Deficiencies of Process Indicators
① The indicator of mortality of low-risk groups is effective, as well as the indicator of quality management of patients undergoing operations, which are the basic bottom line of hospital management. Risks can be avoided if these indicators are well grasped. ②The indicators of satisfaction, although are of	Indicators concerning operations; Mortality of low-risk groups; Satisfaction indicators	Constitution of Outcome Indicators

subjective kind, are fairly important. They explain a lot if well integrated with others.

① Indicators of satisfaction, especially the satisfaction degree of medical personnel, are sorted into outcome indicators, which can well provide feedback on the objectives and processes of management. ② Outcome indicators take the satisfaction of both doctors and patients into account, reflecting the consideration on balancing the interests of both sides.	Management objectives; Feedback on processes; Balancing doctor-patient interests	Roles of Outcome Indicators
① However, the indicators cannot sufficiently manifest information concerning internal medicine patients. ② Will indicators like the proportion of patients discharged after operations, and the proportion of fourth class operation, bring about overtreatment? ③ Indicators of satisfaction are subjective ones currently, of which the reference value is hard to say. ④ Satisfaction degree cannot be an outcome indicator manifesting effective services. ⑤ Indicators of low-risk groups management and operations can partly reflect clinical quality, but cannot assess operative risks.	Insufficient reflection of internal medicine; Overtreatment; Low reference value of subjective indicators; Absence of effective services reflection; Failure to assess risks	Deficiencies of Outcome Indicators
① The insufficiency of medical insurance funds cannot be solved by indicator design. ② Nor can human thinking and ideas be changed by indicator design. ③ Humanism, medical ethics, and humanitarian spirits are far more important than indicators, thus cannot be fully expressed in the design of indicators.	Medical insurance funds; Humanitarian care	Failure of Indicator Measurement
With modern standardized management, these indicators work well.	Modern standardized management	Management Philosophy
① Indicator setting should be refined. Only when the requirement of management is precisely grasped can the management indicators be accurately defined. ② Indicator setting is an important part of management. ③ In terms of indicator design, the consistency of indicators and the actual situation of hospitals should be considered. Apart from indicator setting, the corresponding target values are also guiding and motivating. ④ The emphasis is not the number of indicators, but the related	Precise grasp of requirements; Important part of management; Guiding and motivating role; Helping solve management problems; Satisfying management requirements; Considering hospital interests	Positive Role of the System

major issue to settle in a certain period. ⑤It is helpful in solving management problems to some degree. ⑥Indicator setting can sufficiently satisfy the management requirements. In the management process, objectives can only be achieved by setting indicators and improving assessment. ⑦The setting of the indicators above cannot fully indicate the objectives of hospitals, but considerate the hospital interests.		
① However, as for some phenomena that cannot be measured by indicators, the setting of indicators cannot solve all the management problems. ②There are certain gaps between national standards and the actual situation of hospitals. ③ The built systems are often not implemented. ④ In the design of indicators, objective indicators are too rigid, which are likely to trigger new management problems instead of solving existed ones.	Management work cannot be measured totally by indicators; Impossibility to solve all problems; Linking with reality; Poor execution; Rigid objective indicators trigger new problems	Negative Role of the System

3. Axial coding

Axial coding is the further development of main categories based on open coding, and to build relations between different categories through cluster analysis. There are certain logical reasoning relations between categories shown in Table 4-16, and 6 main categories are thus summarized. Each main category, as well as its corresponding open coding, is shown in Table 4-16. Each main category contains the already set organizational objectives, process, and outcome indicators, as well as the constitution, roles, and deficiencies of each kind. Phenomena that cannot be measured by indicators are included in the main category of undesignable indicators, but they are also important in management. The whole system, which plays both positive and negative roles, should be constructed under the guidance of management philosophy. The outcomes are shown in Table 4.12.

Table 4.12 Axial coding

Number	Main Categories		Corresponding Categories
1	Organizational Indicators	Objectives	Constitution of Objectives Indicators
			Roles of Objectives Indicators
			Deficiencies of Objectives Indicators
2	Process Indicators		Constitution of Process Indicators

		Roles of Process Indicators
		Deficiencies of Process Indicators
3	Outcome Indicators	Constitution of Outcome Indicators
		Roles of Outcome Indicators
		Deficiencies of Outcome Indicators
4	Undesignable Indicators	Failure of Indicator Measurement
5	Guiding Theories	Management Ideology
6	System Influence	Positive Role of the System
		Negative Role of the System

4. Selective coding

Selective coding, based on the previous two periods, explores the relations between core categories and other categories, and further abstracts them. By analyzing and teasing out original materials, original concepts, and category systems, the research categorizes the core issue as the indicator structural dimensions and influence model of hospital performance management. The outcomes are shown in Figure 4.2. Under the guidance of management theories, indicators covering three dimensions are set, including organizational objectives indicators, process indicators, and outcome indicators. Organizational objectives indicators can guide process indicators and provide orientation for outcome indicators; process indicators can provide feedback for organizational objectives indicators and control outcome indicators; outcome indicators are coherent with organizational objectives indicators and provide feedback for process indicators. Meanwhile, the influence of indicators that cannot be quantified in the system is equally important to performance, such as humanitarian care and medical insurance costs. The system is orienting to some degree, which can provide guidance and adjustment for practice. But problems such as poor execution and inconsistency with reality will also occur in practice, urging researchers to continue optimizing the system.
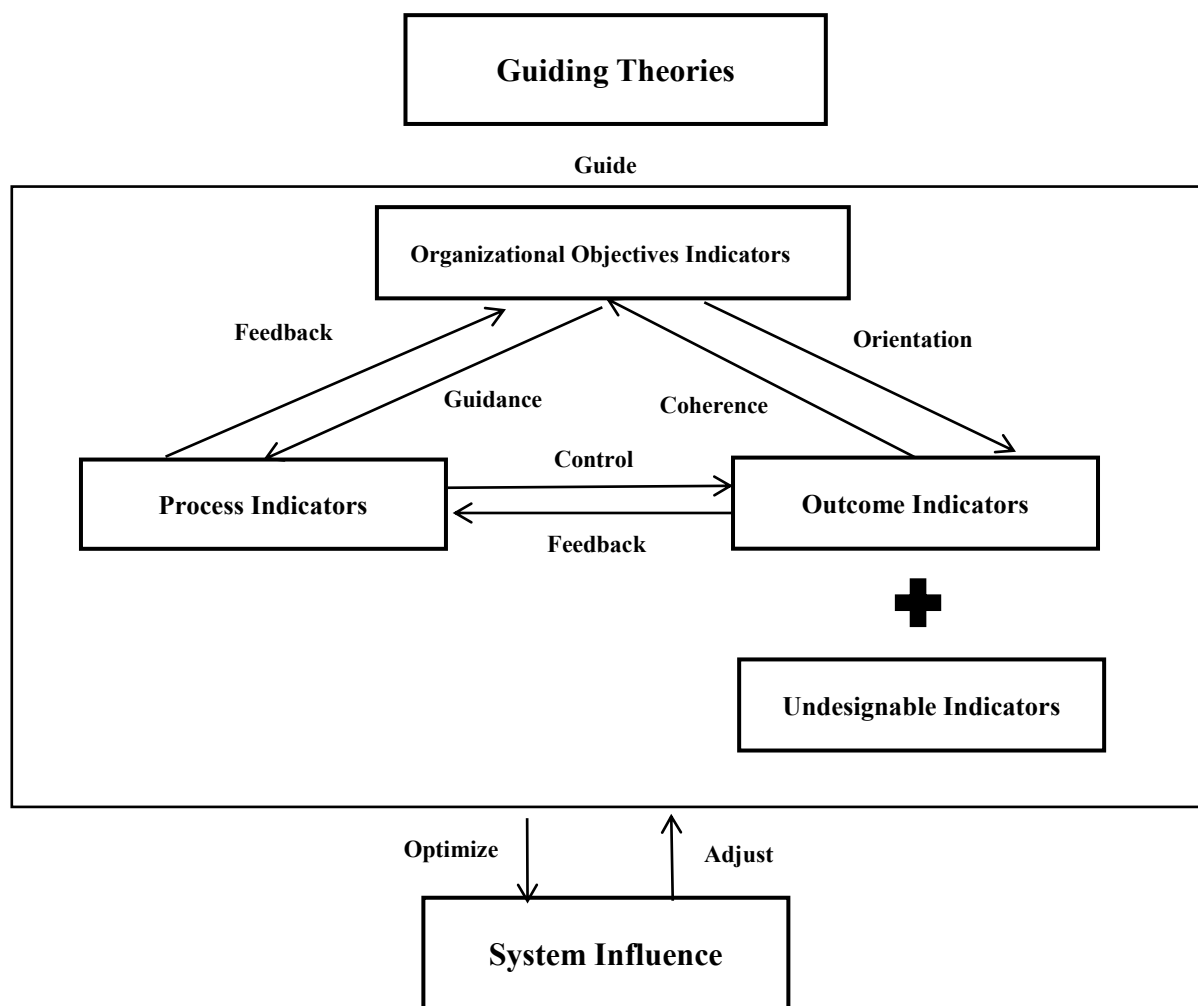
Figure 4.2 Indicator structural dimensions and influence model of hospital performance management

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Chapter 5: Case Study

In this study, the first round of the questionnaire survey (indicator screening) obtained the attention of the managers from dozens of public hospitals, among which those from The First People's Hospital of R City were highly active. Besides, the managers of this hospital believe that this study has a very strong connection with the development of the hospital which serves as a typical sample of grassroots tertiary hospitals. Therefore, the second round of the survey, namely the Likert questionnaire, was conducted on The First People's Hospital of R City with its enthusiastic cooperation. The hospital also actively participated in the further research on the weight of the index system.

5.1 Basic information of the hospital

The First People's Hospital of R City, founded in 1952, is the first tertiary general hospital in R City with the largest scale and the strongest comprehensive strength, which integrates the functions of medical treatment, teaching, scientific research, first aid and prevention. It is the cooperative hospital of The First Affiliated Hospital of ZZ University, The Second Affiliated Hospital of ZZ University and The First Affiliated Hospital of HN University of Science & Technology. The hospital also performs as the clinical teaching and practice base of H University of Science & Technology, Sanquan Medical College and ZZ Shuqing Medical College. Besides, The First People's Hospital of R City is also the only training base for the "3+2" assistant general practitioners in R city, the only designated hospital for the poor to receive centralized treatment of 25 kinds of serious diseases in R city, the unit in the first batch of HN province and the only hospital in R city to construct the "county-level medical center", as well as the only designated medical institution for the treatment of COVID-19 in R city.

The First People's Hospital of R City has been awarded the following honorary titles: National Health Commission Advanced Unit for Improving Medical Service, National Demonstration Award for Medical Community Construction, Advanced Primary Party Organization of HN Province, Advanced Collective Fighting against COVID-19 of HN Province, Advanced Medical Unit of HN Province, Most Satisfactory Hospital for People in HN Province, and Ping'an Hospital of HN Province. In addition, it has also won the following prizes: County Hospital's Discipline Capacity Building Award, Innovation Award for

Discipline Capacity Building of Chinese County Hospital, and Innovation Award for the Construction of Chinese County Internet Hospital in the Fifth China Forum on the Development of County Health, as well as the second prizes of the Fifth, Sixth, and Seventh National Hospital Quality Control Circle Competition.

The basic situation of the construction of The First People's Hospital of R City: located on Guangyu Road, R City, the hospital covers an area of 56,100 square meters and a construction area of more than 40,000 square meters. It has Outpatient Building, Inpatient Building, and Comprehensive Medical Technology Building, as well as 486 parking spaces and 1,000 beds.

The departments of The First People's Hospital of R City are as the followings. In the Outpatient Building, there are various outpatient clinics, Physical Examination Center, Ultrasound Department, Endoscopy Department, Electrocardiogram Room, Electroencephalogram Room, Rehabilitation Department (acupuncture, physiotherapy and massage), Psychological Counseling Center, Beauty Center, Stomatology Department, Dermatology Department, and Telemedicine Center of Medical Alliance. In the Comprehensive Medical Technology Building, there are more than 10 departments, including the Medical Imaging Center, Remote Imaging Diagnosis Center, Intervention Center, Radiotherapy Center, Emergency Department (120 Emergency Center), Center Blood Bank of R City, Sterilization and Supply Center, Laboratory Department, Neonatal Intensive Care Unit (NICU), Children Rehabilitation Department, Nephrology and Rheumatism Dialysis Department, Medical Intensive Care Unit (MICU), the first and the second wards of the Heart Center, Pediatrics Department, the first and the second wards of the Medical Oncology Department. As for the Inpatient Building, there are over 20 departments, which include the Gynecology Department, Obstetrics Department, Operating Room (Anesthesiology Department), Intensive Care Unit (ICU), Pathology Department, Spine and Joint Surgery, Trauma Microsurgery, Thyroid and Breast Surgery, Hepatobiliary Hernia Surgery, Neurosurgery, Burns Department, Departments of Ophthalmology, Stomatology and Otorhinolaryngology, Urology Surgery, Thoracic and Cardiovascular Surgery, Endocrine and Metabolic Department, Gastrointestinal and An orectal Surgery, Digestive and Blood Medicine, Rehabilitation Medicine, the first and the second wards of Encephalopathy Center, Infection Medicine, and the Department of Infectious Diseases.

The medical equipment of The First People's Hospital of R City: the hospital is equipped with many large medical equipment, including the advanced dual source CT, 1.5T magnetic resonance imaging, angiography interventional therapy system (large C-arm), high-end color ultrasonic scanner, laparoscopy, thoracoscopy, hemodialysis machine, linear accelerator, and automatic biochemical analyzer, among which more than 500 sets of the diagnosis and

treatment equipment are worth over 10,000 yuan, and more than 30 sets are worth over one million yuan.

The primary medical services of The First People's Hospital of R City: the hospital now has more than 1,400 staff, including 1,040 professional and technical personnel, and 105 employees with senior professional titles, 15 chief physicians, 61 medical masters, 4 top talents of the city of PDS, 1 young expert in science and technology, and 15 top talents of R city. With 1,000 beds, over 30 clinical departments, 6 medical and technical departments, and 1 provincial key specialty, the hospital receives more than 600,000 outpatient visits per year, delivers more than 40,000 discharged patients per year, and takes more than 8,000 operations of various kinds every year. With a strong technical force, the well-equipped hospital is able to carry out all kinds of large- and medium-sized operations at the third and the fourth levels, as well as the minimally invasive surgeries. Besides, it also takes the lead in the region in the diagnosis and treatment of complex and difficult diseases and the rescue of the patients with acute and serious diseases.

The basic business indicators of The First People's Hospital of R City: in 2019, the hospital's total economic revenue was 329.65 million yuan, an increase of 1.17% over that of last year. The outpatient income reached 109.72 million yuan, an increase of 41.76% over that of last year, while the inpatient income was 215.01 million yuan, a decrease of 11.6% from that of last year. The number of outpatients reached 669,200, an increase of 86.35% over that of last year, while the number of discharged patients was 39,500, a decrease of 9.62% from that of last year. The number of health check-ups were 24,764, an increase of 11% over that of last year, and the drugs income reduced 0.97% from the last year, accounting for 31.66% of the total revenue.

The hospital now has 1,497 staff, including 316 medical staff, 528 nursing staff, 122 medical technicians, and 368 management staff. There are 313 permanent staff in the hospital, accounting for 20.9% of the total, and 1,185 staff employed with contracts, accounting for 79.1%. Among the medical staff, 125 are permanent and 191 are employed; among the nurses, 23 are permanent and 505 are employed; among medical technicians, 16 are permanent and 76 are employed; among management staff, 133 are permanent and 266 are employed. In addition, according to the statistics of the academic qualifications of the physicians and nurses, who account for the majority of the whole staff, there are none doctors, 42 masters, 96 undergraduates and 7 junior college graduates among the physicians, and there are none masters, 241 undergraduates and 36 junior college graduates among the nurses.

Besides, the statistics also shows that among the physicians, the masters account for 29.0%,

the undergraduates 66.2%, and the junior college graduates 4.8%, while among the nurses, 87.0% are undergraduates and 13.0% are junior college graduates.

5.2 Management status of The First People's Hospital of R City

The First People's Hospital of R City implements the president responsibility system under the leadership of the Party Secretary. The leading group of the hospital comprises two Vice Presidents, the Party Secretary and the President. Less than one year after its establishment, the leading group has put forward new requirements for the development of the hospital, and at the same time, it has deliberated over the management of the hospital through many symposiums and departments visits.

First of all, during the rapid development of the hospital, the personality charm and strong working ability of the former President have laid a good foundation for the development of the hospital, which has been recognized by most employees. But at the same time, some management problems are brought about by the neglect of the organization's management and the undue emphasis on the meritocracy, such as other cadres' weak sense of responsibility, poor execution, low work efficiency, low staff momentum and reduced cohesion.

Second, the problem about talents is prominent in the hospital, mainly manifested in the relatively aged middle-level staff, the arrogant work style, lack of talent team construction, the outflow of high-level talents, complicated and tense interpersonal relations, lack of systematic talent training plan, the continuous outflow of newly introduced talents due to the lack of attention and respect from the hospital and the poor environment for personal development.

Third, the deep-seated problem behind the talent problem is the staff's lack of recognition of the hospital's values and strategic development goals, which makes the employees have no confidence in the future development of the hospital.

Fourth, among the management-related problems collected by the leading group, these problems were repeatedly mentioned by the staff: the low quality of the personnel, the difficulty of introducing talents, the backward management methods, the improper system and the lack of internal communication.

Fifth, the hospital lacks a clear strategic plan and development goals; its ability of discipline development is declining; the quality of clinical development is not high; at the same time, the problem of patient loss is quite prominent, and the influence of the hospital has dropped obviously in this city.

5.3 Research methods and goals

The indicator weight research was conducted with the previously verified performance model as the basis, and the nine managers chosen from The First People's Hospital of R City as the subjects. These nine management cadres from the hospital's performance management committee are the main leaders of the departments that participate in the performance management of the hospital.

The weight research was made via the analytic hierarchy process (AHP). Before the research, the AHP method and the structure of the scale were examined to ensure the quality of the research.

5.4 Process of determining indicator weight by AHP

5.4.1 Construction of the judgement matrix

AHP refers to the process of the pairwise comparison of the importance of factors at each level and rating them according to their importance. The Table 5.1 lists the nine importance levels and their assignments given by T. L. Satty, the founder of AHP.

Table 5.1 The nine importance levels and their assignments

Level	Explanation
1	C_i and C_j have the same influence.
3	C_i is slightly more influential than C_j.
5	C_i is more influential than C_j.
7	C_i is clearly more influential than C_j.
9	C_i is strongly more influential than C_j.
2,4,6,8	The ratio of the influence of C_i and C_j is between the two adjacent levels mentioned above.
1,1/2, …,1/9	The ratio of the influence of C_i and C_j is the reciprocal number of the above C_{ij}.

The *RI* of the judgment matrix of level 1-10 is shown in Table 5.2:

Table 5.2 RI values of the judgment matrix of level 1-10

Level	1	2	3	4	5	6	7	8	9	10
RI	0.00	0.00	0.52	0.89	1.12	1.26	1.36	1.41	1.46	1.49

5.4.2 The construction of judgment matrix and the solution of weight

According to the indicator system, the methods of expert consultation and questionnaire survey were taken. Nine medical experts were selected to score the importance of the indicators, and then the scoring results were discussed and summarized internally, through which the pairwise judgment matrix was obtained as Table 5.3:

Table 5.3 The pairwise judgment matrix

	Objective	**Process**	**Outcome**
Objective	1.0000	3.0593	2.4667
Process	0.3269	1.0000	0.9481
Outcome	0.4054	1.0547	1.0000

The maximum eigenvalue of the judgment matrix S was calculated by the software MATLAB, and $\lambda_{\max} = 3.0029$. In order to check the consistency of the judgment matrix, the consistency indicator was also calculated:

$$CI = \frac{\lambda_{\max}-n}{n-1} = \frac{3.0029-3}{3-1} = 0.0015 \dots\dots\dots\dots\dots\dots\dots\dots(5.1)$$

The average random consistency indicator $RI = 0.52$. The random consistency ratio:

$$CR = \frac{CI}{RI} = \frac{0.0015}{0.52} = 0.0028 < 0.10 \dots\dots\dots\dots\dots\dots\dots\dots(5.2)$$

Therefore, it is considered that the results of AHP have satisfactory consistency, that is, the distribution of weight coefficients is very reasonable. The weights of the indicators were calculated by the software MATLAB as Table 5.4

Table 5.4 The weights of the indicators-1

Indicators	**Weights**
Objective	0.5783
Process	0.1995
Outcome	0.2221

The weight of each indicator was calculated by the method of AHP. The judgment matrix $S = \left(u_{ij}\right)_{p\times p}$ was constructed as Table 5.5:

Table 5.5 Judgment matrix-1

	u1	u2	u3	u4	u5	u6	u7	u8	u9	u10	u11	u12
u1	1.0000	1.8198	3.1270	3.5926	3.4444	1.9630	1.7259	1.7111	2.3037	2.8899	1.3852	2.8963
u2	0.5495	1.0000	4.1111	2.9852	3.3556	4.2444	3.2963	2.7778	2.5407	4.9111	2.2593	3.8593
u3	0.3198	0.2432	1.0000	1.5630	0.8667	1.1926	1.4825	1.1566	1.0296	1.3407	1.3661	1.3132
u4	0.2784	0.3350	0.6398	1.0000	2.8370	3.1481	3.0381	2.5259	3.4825	3.8148	2.3185	4.4667
u5	0.2903	0.2980	1.1538	0.3525	1.0000	3.1481	2.8519	2.0222	2.6148	3.3704	2.9704	2.3926
u6	0.5094	0.2356	0.8385	0.3176	0.3176	1.0000	2.1111	1.9481	2.0688	1.3407	1.8741	2.0074

u7	0.5794	0.3034	0.6745	0.3292	0.3506	0.4737	1.0000	1.7852	1.2603	1.4741	1.0444	1.3852
u8	0.5844	0.3600	0.8646	0.3959	0.4945	0.5133	0.5602	1.0000	1.3492	2.1556	1.2963	1.7852
u9	0.4341	0.3936	0.9712	0.2871	0.3824	0.4834	0.7935	0.7412	1.0000	2.8519	2.5556	3.5926
u10	0.3460	0.2036	0.7459	0.2621	0.2967	0.7459	0.6784	0.4639	0.3506	1.0000	1.1926	1.4825
u11	0.7219	0.4426	0.7320	0.4313	0.3367	0.5336	0.9574	0.7714	0.3913	0.8385	1.0000	2.8159
u12	0.3453	0.2591	0.7615	0.2239	0.4180	0.4982	0.7219	0.5602	0.2784	0.6745	0.3551	1.0000

The maximum eigenvalue of the judgment matrix S was calculated by the software MATLAB, and $\lambda_{max} = 13.2044$. In order to check the consistency of the judgment matrix, the consistency indicator was also calculated:

$$CI = \frac{\lambda_{max}-n}{n-1} = \frac{13.2044-12}{12-1} = 0.1095 \dots\dots\dots\dots\dots\dots\dots\dots(5.3)$$

The average random consistency indicator $RI = 1.54$. The random consistency ratio:

$$CR = \frac{CI}{RI} = \frac{0.1095}{1.54} = 0.0711 < 0.10 \dots\dots\dots\dots\dots\dots\dots\dots (5.4)$$

Therefore, it is considered that the results of AHP have satisfactory consistency, that is, the distribution of weight coefficients is very reasonable. The weights of the indicators were calculated by the software MATLAB as Table 5.6.

Table 5.6 Weights of the indicators-2

Indicators	Weights
u1	0.1692
u2	0.1849
u3	0.0676
u4	0.1269
u5	0.0986
u6	0.0662
u7	0.0519
u8	0.0549
u9	0.0612
u10	0.0367
u11	0.0502
u12	0.0318

The weights of the indicators were calculated by the method of AHP. The judgment matrix $S = \left(u_{ij} \right)_{p \times p}$ was constructed as Table 5.7:

Table 5.7 The judgment matrix-2

	u13	u14	u15
u13	1.0000	4.6889	3.8000
u14	0.2133	1.0000	0.3704
u15	0.2632	2.7000	1.0000

The maximum eigenvalue of the judgment matrix S was calculated by the software MATLAB, and $\lambda_{max} = 3.0686$. In order to examine the consistency of the judgment matrix, the consistency indicator was also calculated:

$$CI = \frac{\lambda_{max}\text{-}n}{n\text{-}1} = \frac{3.0686\text{-}3}{3\text{-}1} = 0.0343 \dots\dots\dots\dots\dots\dots\dots\dots \quad (5.5)$$

The average random consistency indicator $RI = 0.52$. The random consistency ratio:

$$CR = \frac{CI}{RI} = \frac{0.0343}{0.52} = 0.0660 < 0.10 \dotso\dotso\dotso\dotso\dotso\dotso\dotso\dotso\dotso \quad (5.6)$$

Hence, it is believed that the results of AHP have satisfactory consistency, that is, the distribution of weight coefficients is very reasonable. The weights of the indicators were calculated by the software MATLAB as Table 5.8.

Table 5.8 Weights of the indicators-3

Indicators	Weights
u13	0.6640
u14	0.1091
u15	0.2269

The weights of the indicators were calculated by the method of AHP. The judgment matrix $S = \left(u_{ij}\right)_{p \times p}$ was constructed as Table 5.9:

Table 5.9 The judgment matrix-3

	u16	u17	u18	u19	u20	u21
u16	9.0000	16.3333	29.6667	27.5333	28.3333	29.3429
u17	0.0612	9.0000	36.3333	39.0000	24.3333	29.4000
u18	0.0337	0.0275	9.0000	42.1111	33.0000	38.2000
u19	0.0363	0.0256	0.0237	9.0000	12.6444	16.1429
u20	0.0353	0.0411	0.0303	0.0791	9.0000	32.3333
u21	0.0341	0.0340	0.0262	0.0619	0.0309	9.0000

The maximum eigenvalue of the judgment matrix S was calculated by the software MATLAB, and $\lambda_{max} = 6.0906$. In order to examine the consistency of the judgment matrix, the consistency indicator was also calculated:

$$CI = \frac{\lambda_{max}\text{-}n}{n\text{-}1} = \frac{6.0906\text{-}6}{6\text{-}1} = 0.0181 \dots\dots\dots\dots\dots\dots\dots\dots \quad (5.7)$$

The average random consistency indicator $RI = 1.26$. The random consistency ratio:

$$CR = \frac{CI}{RI} = \frac{0.0181}{1.26} = 0.0146 < 0.10 \dots\dots\dots\dots\dots\dots\dots\dots(5.8)$$

Hence, it is believed that the results of AHP have satisfactory consistency, that is, the distribution of weight coefficients is very reasonable. The weights of the indicators were calculated by the software MATLAB as Table 5.10.

Table 5.10 The weights of the indicators-4

Indicators	Weights
u16	0.4581
u17	0.2282
u18	0.1176
u19	0.0765
u20	0.0651
U21	0.0545

5.5 The result of indicator weight assignment:

The comprehensive weights were calculated through multiplying the weights of the first-level indicators by the weight of the second-level indicators as Table 5.11.

Table 5.11 The comprehensive weights

First-level indicators	Weights		Second-level indicators	Weights	Comprehensive weights
Objective	0.5783	u1	Doctor-to-nurse ratio	0.1692	0.0978
		u2	Comprehensive budget management	0.1849	0.1069
		u3	Set up the post of chief accountant according to relevant standards	0.0676	0.0391
		u4	Structure of professional titles of the medical technicians	0.1269	0.0734
		u5	Proportion of doctors in the departments of anesthesia, pediatrics, severe diseases, pathology and traditional Chinese medicine	0.0986	0.057
		u6	Proportion of purchased essential drugs	0.0662	0.0383
		u7	Proportion of drug use in the centralized drug procurement organized by the state	0.0519	0.03
		u8	Proportion of the essential drugs in the prescriptions for outpatients	0.0549	0.0317
		u9	Proportion of comment prescriptions in the total prescriptions	0.0612	0.0354
		u10	Funding for scientific research projects per 100 medical technicians	0.0367	0.0212
		u11	Utilization rate of essential drugs among inpatients	0.0502	0.029
		u12	The proportion of the staff from other hospitals who accepted further studies in the hospital and then returned to the original hospital to work independently	0.0318	0.0184

Process	0.1995	u13	Quality control of single disease	0.664	0.1325
		u14	Incidence of complications in patients receiving surgeries	0.1091	0.0218
		u15	Average daily workload of each medical practitioner	0.2269	0.0453
Outcome	0.2221	u16	Outpatient satisfaction	0.4581	0.1017
		u17	Inpatient satisfaction	0.2282	0.0507
		u18	Mortality rate of patients in low risks	0.1176	0.0261
		u19	Proportion of discharged patients after surgeries	0.0765	0.017
		u20	Medical staff satisfaction	0.0651	0.0145
		u21	Proportion of discharged patients after fourth-level operation	0.0545	0.0121

5.6 Case summary

During its participation in this study, The First People's Hospital of R City obtained a comprehensive understanding of the process and outcomes of the construction of hospital performance management system. In line with the management standardization, the hospital has established a clear hospital management framework, including the indicators of management objectives, process and outcomes, to achieve the goal of managing daily work by objectives.

In order to facilitate the implementation and improve the management efficiency, the hospital has established a three-dimensional balanced performance incentive system for public hospital, which is defined as *Three-dimensional Performance Management Indicator System of the First People's Hospital of R City*. It has worked out the details for further implementation as follows and the performance management committee is responsible for the implementation of performance management.

First of all, the objective indicators are defined as the indicators at the hospital level, and the hospital's leading group and the functional departments assume the corresponding management responsibility. The indicators are further subdivided: 1) the indicator of personnel ratio is defined as the annual monitoring indicator to monitor the annual personnel changes with the relevant national standards as the lowest line: the doctor-nurse ratio; the proportion of doctors in the departments of anesthesia, pediatrics, severe diseases, pathology and traditional Chinese medicine; structure of professional titles of medical technicians; the proportion of the

staff who accepted further studies in the hospital and then returned to the original hospital to work independently. Paying attention to the mobility of key technical personnel could ensure the establishment of a healthy hospital talent team; 2) the two indicators, namely comprehensive budget management and setting up the post of chief accountant according to relevant standard, are regarded as the core indicators of the hospital's financial management and internal control management. The situation of the hospital's comprehensive budget management is taken as the evidence of evaluation, and a training and supervision system is established for the chief accountant; 3) in accordance with national requirements, the data is monitored, and the core quality indicators are established for the relevant management regulations and processes: the proportion of purchased essential drugs, the proportion of drug use in the centralized drug procurement organized by the state, and the proportion of the essential drugs in the prescriptions for outpatients, the proportion of comment prescriptions in the total prescriptions, and the utilization rate of essential drugs among inpatients; 4) the defined monitoring indicators: funding for scientific research projects per 100 medical technicians; it is required to strive to break zero and achieve stable rise in each year. At the same time, the usage norms are to be established for the projects' funds.

Secondly, the process and outcome indicators are concluded as the indicators of clinical departments: 1) the indicators related to the clinical core quality and not supported by objective data should work out in accordance with national standards to monitor quality. A standardized periodic examination system shall be established, and it is required that the relevant examination traces should be left as the evidence: quality control of single disease and mortality rate of patients in low risks; 2) the indicators of the first page of the medical record, which are supported by objective data and need to be calculated twice, should be calculated strictly according to the formula in the national standard documents, and the indicator monitoring should be established: the incidence of complications in patients receiving surgeries, the proportion of discharged patients after surgeries, and the proportion of discharged patients after fourth-level operation; 3) in terms of purely subjective indicators, the research scale and process, and the number of samples shall be standardized, and the system should be built with 85 points as the upper limit of satisfaction; the patient complaint mailbox and the employee complaint mailbox should be added as an auxiliary tool: outpatient satisfaction, inpatient satisfaction, medical staff satisfaction.

Thirdly, in the system of periodic report and report disclosure, the Three-dimensional Performance Management Indicator System of the First People's Hospital of R City determines the quarterly assessment indicators. The completion progress of the indicators in every quarter

is made public by the middle-level cadres of the hospital. The hospital-level indicators are reported by the major managers to the whole hospital, and the implementation progress and the responsibility and accountability are also made public. The indicators at the clinical department level are monitored and the quarterly ranking are made among them. According to the forced distribution method, the ranking results are graded as five levels of A, B, C, D, and E, and the corresponding reward and punishment system is also formulated.

Finally, the cultural events that are beyond the assessment indicators and demonstrate the humanistic spirit, humanitarian care, good people and good deeds and values are carried out in the form of weekly report and quarterly theme activities.

The First People's Hospital of R City has creatively separated performance management from financial cash incentives, and at the same time, it has also pioneered the combination of performance management with thematic activities that are beyond indicators and are concerned with humanistic spirit and the shaping of values. In the future, separating performance management from financial cash incentive is likely to lead to the problem that motivation cannot be well stimulated, and the hospital's business may also decline. However, from an optimistic perspective, it may help hospitals to obtain management skills, gradually improve the standardization of management and the objectification of various indicators, and more importantly, offer effective guidance for the hospital to set development goals. Yet the related thematic activities beyond the indicators including the good people and good deeds, are faced with the possibility of becoming a mere formality, which is a test of overall implementation ability for the hospital's management team.

Chapter 6: Discussion and Research Limitations

6.1 Research review

With Chinese public hospitals as the background, this study combed the policy background of China's medical reform and the research status of performance management. Considering the core issues on performance management, a comprehensive summary of the Motivation Theory and Principal-agent Theory was made. At the same time, an in-depth study was carried out on the research experience of P4P in countries all over the world. Then the research framework was formed for the conceptual model of hospital performance management in China. This section laid the foundation for the completion of this research. The following is a review of the research:

6.1.1 Review of theoretical research

(1) The outstanding problem in the performance reform of Chinese public hospitals is that most hospitals still take the bonus distribution mode based on project or income. Taylor's scientific management shows that action research should be conducted; rules and operating norms should be established; working time quota should be determined, and scientific operation methods and processes should be established, including formulating scientific technological processes, so as to make all elements involved in the operation become as standardized as possible, such as the machines, equipment, technology, tools, materials, and even the working environment. Thus, the workers can work according to the standards in their posts, and get salaries according to the workload, and extra work is paid by extra money. The prerequisite for project-based or income-based remuneration is a scientific and standardized process, without which the personal financial incentives can bring more problems. Chinese scholars Gu and Guo (2015) and Wang (2013) have studied the problems caused by the above situation, such as the excessive medical treatment, medical quality, and moral hazard of doctors.

(2) It is proved to be wrong by Elton Mayo that when the individual is regarded as the incentive subject, money is the only driving force to stimulate enthusiasm. It took Mayo eight years to prove the irrational factors of human beings with the Hawthorne experiment. Through the in-depth study of Hawthorne experiment, we found the theoretical support for the common

motivation issues of doctors in Chinese public hospitals. Among them, it was found that what bother doctors in most of China's public hospitals are the long-term overwork and the work with high pressure and high frequency; in the study of doctors' incentive model, if it still stays at the incentive level of money and quantity, it will definitely not be able to get the expected results. Moreover, it is very common in the management of public hospitals that informal organizations and the emotional factors influence work efficiency and quality, and reasonable factors may be distorted by unreasonable interpersonal relationships.

(3) Through the systematic analysis of the Hierarchy of Needs Theory, ERG Theory, Two-factor Theory and the Theory of Acquired Needs, it was found that individual motivation focuses on the concept of "needs". The "needs" itself has great uncertainty. People at different levels have needs at different levels. Although in the hospital performance incentive system, the incentive for individuals is very important, viewed from the current situation of the development of public hospitals in China and the problems existing in the performance management, the priority should be given to the solution of the problem of how to establish a hospital organizational performance management system, rather than the problem of individual motivation. However, the development of the Theory of Individual Needs provides a good theoretical support while choosing the research subjects and carrying out the management research.

(4) The in-depth study of Expectation Theory, Fairness Theory and Goal Setting Theory helped the author to establish the relationship between the individual incentive and the organizational goals. The goal of performance management is to stimulate individual enthusiasm for work, so as to achieve the organizational goals. The Reinforcement Theory verifies how to transfer from employees' potential needs and thinking processes to the relationship between behavior and outcomes.

(5) The in-depth study of Principal-agent Theory was also made. The previous Theory of Individual Motivation and the related problems caused by individual motivation were studied under the information asymmetry in the framework of Principal-agent Theory. The Principal-agent Theory holds that the party with advantageous information is likely to make a profit by hiding information or making use of the information barriers. Not only in China, there is a risk in medical services that the interests of patients cannot be guaranteed due to the information asymmetry. In the US, the main reason for the extremely high medical costs and the exorbitant profits of medical institutions is that hospitals set up more service items in order to obtain more benefits. At the same time, it is very difficult for the regulators to achieve timely and meticulous supervision. The American scholars have even suggested the upper limit of the hospitals' profit

margins and the mandatory disclosure of medical service prices, and the control of the costs, so as to alleviate the rapid rise in medical costs (Bai & Anderson, 2015). The "principal-agent-beneficiary" tripartite interest balance model of Principal-agent Theory contributes to the construction of a complete management model of organizational performance operation. Inspired by this model, the main theoretical framework of this study comprises the issues of how to construct the principal goal, the agent's performance, the quality of the outcomes and the beneficiary's satisfaction.

6.1.2 Review of empirical literature

After a comprehensive and systematic review of the Scientific Management Theory, Motivation Theory and Principal-agent Theory, the relationship between individual motivation and organizational motivation was clarified, and then, based on the "principal-agent-beneficiary" framework in the Principal-agent Theory, the outline of hospital performance model was constructed. On this basis, further study was made on the origin and basic definition of P4P payment performance, the relevant experience of the performance evaluation framework of the Britain, the US and Australia, as well as the design and application of relevant indicators in the performance evaluation system of these three countries.

It is worth noting that in the further literature research, it was found that (Ogundeji, Bland, & Sheldon, 2016) believes that the use of financial incentives to improve the efficiency and quality of health care does not bring much positive effects. Taking the implementation process of the US Veterans Health Administration (VHA) as the basis, (Kondo et al., 2016) studied the factors affecting the implementation of P4P and whether P4P could have a substantial impact on medical efficiency and quality. For the design of P4P, study was carried out on the relevant goal design, stakeholder participation, clinical attention, and regular evaluation. What is more valuable in this study is the risk warning in the implementation of P4P: 1) incentive may result in gambling mentality; 2) there is no evidence to prove that incentive can effectively reduce cost and improve efficiency, but it may increase the cost; 3) organizational cultural factors such as information support and disclosure of performance data are important factors affecting P4P, and these are not professional and technical problems like the indicator design. Lindenauer et al. (2007) also pointed out that the implementation of P4P is more like a political intention. If there is no newly injected capital, the bonus with a fixed amount or proportion is only a game of internal balance and internal game, that is to say, it is not clear whether the benefits of P4P can offset the increase in management costs and management complexity, and it needs to be carefully evaluated.

In Mintzberg's research, the particularly preferred "normative control model" rooted in values and beliefs gives similar explanation in terms of the influence of immeasurable factors such as organizational culture: the normative control model includes five key elements: "the talent view chosen by the same values, ensuring socialization (the social members' participation in the whole society), the guidance guided by values, the sense of responsibility shared by all members, and judging performance evaluation conducted by experienced people". According to this model, what makes sense is not the measurable numbers, but attitudes. Mintzberg believes that an organization without dedication is like a person without a soul. Bones, muscles and blood may be sufficient to maintain metabolism, but they have no vitality. Therefore, the balance is the most valuable. Sustained attention should be paid to the influence of the interests of various institutions and political systems, the mutual impact between institutional interests and personal interests, the affirmation of individual needs, the cherish of personal wealth, the establishment of a good balance between personal interests and institutional and social interests, and the building of a balance of interests among different stakeholders (Mintzberg, 1996).

6.1.3 Review of the construction of conceptual model and the literature

This study is based on the in-depth learning after literature review, and the key point of establishing the hospital performance management system is how to set up a performance management system based on organizational motivation and management, rather than a set of incentive methods for doctors or individuals. For the organization, the balanced value should be taken as the direction; measurement should be done on the measurable and at the same time, more attention should be paid to the immeasurable; attention should also be paid to the interest balance of stakeholders, and the "organizational goal-implementation process-outcome benefits" should also be taken into account. Hence, this study creatively combined the "principal-agent-beneficiary" of the Principal-agent Theory with Donabedian's "objective-process-outcome" theory to form the conceptual model.

6.2 Review of the investigation

(1) According to the data of the sample in the first round of questionnaire survey, men outnumber women in the management of public hospitals. Staff with rich practical experience (more than 10 years) account for 86.5%, middle-aged staff (41-50 years old) 58.1%, and well-educated staff (with bachelor degree and above) 98.2%.

(2) In the second round of the investigation, we used the method of single factor analysis

to analyze the sample data. a) The results of gender analysis showed that men have significantly higher target management indicators than women, and the cognitive conflicts caused by gender differences are centered on target management indicators. b) The results of age analysis showed that there are significant differences in management indicators among groups with different ages, and it is common that different ages may result in different management cognition. c) There are significant differences in target management indicators and outcome management indicators among people with different positions and professional titles, but there are no significant differences in the process indicators.

(3) Some of the views obtained from the interview with key figures are highly consistent with those in the literature: a) the setting of such indicators as the proportion of fourth-level surgery may lead to concerns of excessive medical treatment; b) people's thoughts and ideas, humanism and humanitarian spirit cannot be reflected in the indicators; c) setting indicators cannot solve all the problems of management, and it may lead to new management problems; d) the target value set after the indicator setting can play the role of incentive; e) setting indicators is a necessary method to introduce the standardized management, and the premise of performance management is the strict implementation. In addition, some problems were exposed: a) the distortion of data, for example, the serious discrepancy between on-duty doctors and nurses and the registered doctors and nurses; the lack of information support; b) the heavy burden of doctors on post. Incentives may lead to the phenomenon of harming the most diligent staff; c) it is not possible to control medical insurance expenses through indicators. Different payment modes have different effects on hospitals. Now the most prominent problem is the overspending of medical insurance.

6.3 Research conclusions

China's medical care is based on public hospitals, and the medical and health care industry is a complex and special service industry. On the basis of comprehensive application of the management theory, international experience and analysis methods, this study constructs a conceptual model of performance motivation in public hospitals, and the conceptual model is concretized and standardized through questionnaire, investigation and interview analysis. Thus, a basic indicator system is formed, that is the Three-dimensional theoretical model of performance motivation in public hospitals.

6.3.1 The performance model is established with scientific and reasonable methods

Combining the incentive and control mechanism for principal, agent and beneficiary of the principal-agent theory with the Donabedian's three-dimensional evaluation framework of goal-process-outcome that is maturely applied by the health system of WHO, this study constructs a three-dimensional conceptual model of "principal (organizational goal)-agent (process execution)-beneficiary (quality outcome)" for the performance management in the public hospitals. At the same time, on the basis of *55 Key Performance Indicators of National Public Tertiary Hospitals*, this study divides each indicator into four options: organizational goals, process indicators, outcome indicators and difficult to identify by the method of questionnaire. A sampling questionnaire survey is conducted among the managers of the target hospitals, the purpose of which are: 1) to find out the cognition degree of the hospital managers to the 55 national indicators; 2) to know from the practice of hospital management whether the current performance evaluation indicators in the country are decomposed into the management process of "organizational goals-process management-outcome control"; 3) finally, on the basis of the 55 indicators, to try to form a basic indicator system of Three-dimensional theoretical model of performance motivation for public hospitals.

According to the results of the first round of questionnaire and the results of frequency analysis, 27 indicators are obtained, including 15 indicators for organizational goals, 6 process indicators and 6 outcome indicators. A 5-point Likert scale is used to screen and refine the indicators for further analysis. Through two rounds of questionnaire, 21 indicators are obtained, including 12 indicators for organizational goals, 3 process indicators and 6 indicators for outcome control. Furthermore, the refined result is installed in the three-dimensional conceptual model of performance motivation for public hospitals to form a three-dimensional public hospital performance motivation system.

Finally, this study uses the method of keyman interview to verify the indicator construction of the three-dimensional public hospital performance motivation system. The interview selects 10 subjects from clinical front-line directors, leaders of hospital administrative management and business management, and hospital directors. These interview subjects have received high level education, and they not only have rich experience in the first-line clinical management, but also master some management theories. Keyman interview can further support the construction of the indicator system with rich practical experience and solid theoretical basis, so that the performance system could have ideal reliability and practical value.

6.3.2 The performance system is designed with stable structure, lightweight indicators and strong operability

The performance system has three dimensions: principal (organizational goal)-agent (process execution)-beneficiary (quality outcome). The organizational goal can impact on the process indicator and guide the outcome indicator; at the same time, the process indicator feeds back to the organizational goal indicator and controls the outcome indicator; the outcome indicator echoes the organizational goal indicator and feeds back to the process indicator. The interaction among the three dimensions maintains the stability of the overall structure. Besides, consistent with the literature research, there are some unquantifiable indicators in the performance system, such as culture and humanitarian spirit, also having impact on performance. The organizational performance system does not only include quantifiable indicators.

The whole performance system consists of three dimensions and 21 indicators. The lightweight indicators can reflect the whole process of goal-process-outcome of organizational management, and they also take into account the interests of the three parties, namely the principal, agent and beneficiary, which reduces the operational difficulty of having too many indicators in the execution.

6.4 Limitations and deficiencies of the research

Although this research has established a three-dimensional public hospital performance motivation system on the basis of comprehensive application of multidisciplinary theories, it still has some imperfections and defects:

1) Theoretical choice and the model construction: the key to model construction is to identify the key elements that affect the performance of public hospitals and establish checks and balances of mutual interests. This study has synthesized the principal-agent-beneficiary of principal-agent theory and Donabedian's goal-process-outcome theory, taken *the 55 Key Performance Indicators of National Public Tertiary Hospitals* as the basis, conducted the questionnaire with the 55 indicators on the nature of goal-process-outcome in the management activities. Although the preliminary indicators are formed, it cannot be denied that there are some vague boundaries in the process of selecting indicators, which needs to be further improved.

2) The coverage of research subjects is not enough. In the course of this study, the questionnaire has been conducted twice and the interview once. The first two questionnaires

have screened the indicators that can be installed in the model, and the final interview has verified the selection results. However, through the review of the research process, we could find that although we have selected our research subjects considering the number and the hospital levels, they cannot represent the national level in the face of such huge base group of more than 3000 public tertiary hospitals in China. We still need to expand the research subjects as much as possible in the follow-up management research, and provide academic support for the development of the performance system of public hospitals in our country through more scientific methods.

3) Application of the indicator system: this study has verified the interaction and feedback relationship among the organizational goal indicators, process indicators and outcome indicators constructed under the management theory, but the system still cannot cover some indicators that cannot be quantified, such as humanitarian relations. Although the system provides certain guidance, it is also prone to unrealistic problems in practice. These defects will promote the follow-up research for further improvement of the system.

4) In terms of indicator weight, although this study took The First People's Hospital of R City as the subject and completed the weighting of the indicators in the three-dimensional balanced public hospital performance incentive system through the method of AHP, the part of indicator weight in this study is still not representative. Adaptive adjustment is needed when applied in other hospitals.

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Annex A: Performance Evaluation Indicators for Public Tertiary Hospitals

First Level Indicators	Second Level Indicators	Third Level Indicators	Indicator Significance
Medical Care Quality	Function	1. Ratio of Outpatients to Discharged Patients	To observe the function fulfilled by hospitals.
		2. Number of Past-operation Patients	To mainly admit patients with difficult and complicated cases and patients in the acute stage of diseases, and to appropriately conduct up-down referral for other patients, in order to improve the utilization efficiency of medical resources.
		3. Ratio of Day Surgery to Elective Surgery	To optimize service procedure, improve service efficiency, and control medical cost.
		4. Proportion of Discharged Patients Undergoing Surgery	To encourage tertiary hospitals to input high-quality medical resources to difficult and complicated cases and to provide safe and guaranteed high-quality medical services.
		5. Proportion of Discharged Patients Undergoing Minimally Invasive Surgery	To pay attention to the amelioration and rehabilitation of patients' psychological, social, physical (ache), and spiritual situation, as well as life quality, in order to reduce their pain.
		6. Proportion of Discharged Patients Undergoing Level 4 Surgery	To measure the performance of difficult and complicated operations on inpatients.
		7. Proportion of Special Medical Services	To meet the needs of different patients.
	Quality and Safety	8. Complication Rate of Surgical Patients	To assess medical quality management. One of the important outcome indicators to measure medical technical capacity and management level.
		9. Surgical Site Infection Rate of Type I Incision	To reflect hospitals' infection management, prevention and control of patients undergoing type I incision surgery.

		10. Quality Control of Single Entity Diseases	To improve medical care quality and to promote rational use of medical resources. To reflect the differences among hospitals in terms of diagnosis and treatment capacity, technical level, and cost.
		11. Disease Positive Rate Revealed by Large Medical Equipment	To regularly evaluate the use and effect of existing large medical equipment, in order to give full play to its advantages in diagnosis and treatment, and promote the scientific configuration and rational use of large medical equipment.
		12. Maintenance and Quality Control of Large Medical Equipment	To guide hospitals to pay attention to the maintenance and quality control of large medical equipment and employ appropriate maintenance personnel and maintenance testing equipment.
		13. Number of Clinical Laboratory Test Items That Pass National External Quality Assessment	To reflect the comparability and homogeneity of test results and provide scientific basis for inter-accreditation of clinical laboratory results.
		14. Mortality Rate of Low-risk Group Case	To reflect hospitals' medical care quality and safety management, and indirectly reflect hospitals' treatment capacity and clinical procedure management level.
		15. Coverage Rate of High-quality Nursing Service Ward	To reflect hospitals' medical service quality.
	Rational Drug Use	16. Ratio of Reviewed Prescriptions to Total Prescriptions	To conduct intervention and tracking management on problems found in the review, with emphasis on abnormal medication and irrational drug use.
		17. Antibiotic Use Density (DDDs)	To measure hospitals' management level of rational drug use.
		18. Proportion of Essential Drugs in Prescriptions for Outpatients	To ensure people's basic needs, promote the guarantee system of drug supply, strengthen the function orientation of essential drugs, and advance grading diagnosis and treatment.
		19. Utilization Rate of Essential Drugs among Inpatients	To ensure people's basic needs, promote the guarantee system of drug supply, strengthen the function orientation of essential drugs, and advance grading diagnosis and treatment.
		20. Proportion of the Variety of Essential Drugs in Procurement	To strengthen the management of essential drugs' use and continuously increase the use of essential drugs in medical institutions.
		21. Using Ratio of Bid-winning Drugs in National Centralized Procurement of Drugs	To standardize drug use in medical institutions and support reform of public hospitals.

	Service Procedure	22. Average Rate of Diagnosis and Treatment among Outpatients with Medical Appointment	To measure and optimize medical treatment procedure, promote grading diagnosis and treatment and the information construction of hospitals.
		23. Average Waiting Time of Outpatients after Appointment	To increase people's sense of gain in health care.
		24. Grading of Application Function Level of Electronic Medical Records	To guide the scientific, rational, and orderly development of electronic medical records, making them a powerful tool for hospitals to improve medical quality and safety, and promote the construction of smart hospitals.
Function Efficiency	Resource Efficiency	25. Average Daily Hospitalization Workload of Each Licensed Physician	To understand the workload of doctors and the allocation of human resources in hospitals, promote grading diagnosis and treatment, and improve the working environment and logistics support for medical staff, thus creating conditions for better medical services in medical institutions.
		26. Number of Pharmacists Per Hundred Sickbeds	To gradually realize full coverage of pharmaceutical services. Clinical pharmacists are to provide personalized rational medication guidance to outpatients and inpatients.
	Revenue and Expenditure Structure	27. Ratio of Outpatient Service Income to Medical Income	To reflect hospitals' diagnosis and treatment situation.
		28. Proportion of Outpatient Service Income from Medical Insurance Fund	To reflect the impact of medical insurance system on the economic operation of hospitals.
		29. Ratio of Inpatient Service Income to Medical Income	To reflect hospitals' diagnosis and treatment situation.
		30. Proportion of Inpatient Service Income from Medical Insurance Fund	To reflect the proportion of medical insurance reimbursement in the hospitals' inpatient service income, manifesting the influence of medical insurance system on the economic operation of hospitals and the medical service conditions provided by hospitals within the scope of medical insurance reimbursement.
		31. Ratio of Medical Service Income (Excluding Drugs, Consumables, and Inspection Income) to Medical Income	To reflect hospitals' income structure.
		32. Proportion of Adjuvant Drug Income	To strengthen the management of clinical application of adjuvant drugs.

		33. Proportion of Personnel Expenses in Business Expenses	To measure hospitals' implementation of the Two Permission policy for medical institutions raised by President Xi Jinping. To improve the staff's income and optimize the expenditure structure of hospitals.
		34. Energy Consumption Expenditure of Per Ten Thousand Yuan Income	To guide hospitals to further strengthen the management of energy conservation and promote the construction of energy-saving hospitals.
		35. Revenue and Expenditure Surplus	To reflect hospitals' operational status and sustainability.
		36. Asset-liability Ratio	To reflect debt rationality, guide hospitals to avoid blind expansion and operation on borrowings, and reduce potential risks in their operation.
	Cost Control	37. Medical Income Growth	To reflect the overall annual growth of hospitals' medical expenses.
		38. Increase in Average Cost Per Visit	To measure patients' expenses burden and its growth.
		39. Increase in Average Drug Expenses Per Visit	To measure patients' drug expenses burden and its growth.
		40. Increase in Average Cost Per Hospitalization	To measure patients' expenses burden and its growth.
		41. Increase in Average Drug Expenses Per Hospitalization	To measure patients' drug expenses burden and its growth.
	Economic Management	42. Comprehensive Budget Management	To make overall arrangements for the business activities, investment activities, and financial activities within the budget period by means of budgeting methods. To disintegrate the total objectives into subobjectives, and conduct a series of management activities including control, accounting, analysis, evaluation, reward, and punishment in implementation process.
		43. Standardizing Establishment of Chief Accountant	Conducive to strengthening internal control, improving operational efficiency, and advancing economic management effectiveness of public hospitals.
Sustain	Personnel Structure	44. Title Structure of Health Technicians	To match the functions and tasks of hospitals.

-able Develop-ment		45. Proportion of Anesthesiologists, Pediatricians, ICU Physicians, Pathologists, and Traditional Chinese Medical Doctors	To employ more professionals who are urgently needed and in short supply.
		46. Doctor-to-nurse Ratio	To increase the number of licensed (assistant) physicians and registered nurses in per thousand residents.
	Talents Cultivation	47. Proportion of Medical Staff that Receive In-service Training in Other Hospitals (Especially Counterpart Assistance Hospitals and Hospitals in the Medical Treatment Partnerships) and Return to Work Independently in the Original Hospitals	To strengthen the ranks of community-level health care and family planning talents, and improve the service capacity of community-level medical institutions.
		48. Passing Rate of Resident Physicians Taking the Practitioners Exam for the First Time	To reflect the training quality of hospitals as a standardized training base for resident physicians, and indirectly reflect hospitals' emphasis on the standardized training for resident physicians and training achievements.
		49. Effectiveness of Medical Talent Cultivation Undertaken by Hospitals	To establish and improve the medical education system after graduation, enhance the incentive mechanism for clinical teaching, and strengthen the capacity of teaching staff.
	Discipline Construction	50. Research Project Outlay for Every Hundred Health Technicians	To assess the scientific research and innovation ability of hospitals.
		51. Profits Transformed from Scientific Research Achievements of Per Hundred Health Technicians	To examine hospitals' de-scaling ability and innovative achievements application ability.
	Credit Construction	52. Comprehensive Evaluation of Public Credit Grade	To urge hospitals to emphasize improving public credit grade by means of evaluation.
Satisfac-tion Degree Evalua	Satisfaction Degree of Patients	53.Satisfaction Degree of Outpatients	To enhance the reform of internal operation mechanism, thus promoting hospitals' healthy development. To refine services in a targeted way, and focus on building a

-tion			long-acting mechanism of surveying patients' satisfaction degree, providing patients with humanized services and humanistic care.
	Satisfaction Degree of Medical Staff	54.Satisfaction Degree of Inpatients	To enhance the internal operation mechanism reform, thus promoting hospitals' own healthy development. To refine services in a targeted way, and focus on building a long-acting mechanism of surveying patients' satisfaction degree, providing patients with humanized services and humanistic care.
		55. Satisfaction Degree of Medical Staff	To improve the satisfaction degree of medical staff and arouse their motivation.

Source: The table is designed with reference to the National Third-level Indicator Document (The Guiding Idea about Strengthening Performance Evaluation for Public Tertiary Hospitals of the General Office of the State Council, 2019) **and the indicator significance mentioned in *Operational Manual*** (绩, 2019)

Annex B: Summary of Policy Documents Related to National-Level Salary System Reform

SN	Document Number	Document Name	Document Abstract
1	No. 6 [2009] of the CPC Central Committee	Directives of the CPC Central Committee and the State Council on Deepening the Reform of the Medical and Health Care System	Reform the personnel system, improve the distribution and incentive mechanism, promote the employment system and post management system, strictly manage total salary, and implement a comprehensive performance assessment and post performance salary system focusing on service quality and post workload.
2	No. 12 [2009] of the State Council	Notice of the State Council on Issuing the Plan on Recent Priorities in Carrying out the Reform of Health Care System (2009-2011)	Push forward the pilot reforms in public hospitals, improve the professional title evaluation system for medical personnel, and implement the post performance pay system.
3	Letter No. 75 [2009] of the General Office of the State Council	Notice of the General Office of the State Council on Issuing the Work Arrangements for the Reform of the Medical and Health Care System in Five Key Aspects (2009)	Propose again to promote the pilot reform of public hospitals
4	No. 8 [2011] of the General Office of the State Council	Notice of the General Office of the State Council on Issuing the Work Arrangements for the Reform of the	Strengthen the training of health personnel and mobilize the enthusiasm of medical personnel. (1) Improve the institutional framework, training mode and policy system of standardized training for residents, carry out standardized training for residents, support the construction of key clinical specialties, and treat public and non-public hospitals equally; (2) formulate standardized documents for multi-sited practice of licensed doctors,

		Medical and Health Care System in Five Key Aspects (2011)	relax the conditions for pilot multi-sited practice for licensed doctors, increase the amount of practicing locations, expand the pilot scope to all cities with conditions, and encourage the rational flow of health professionals among public and non-public hospitals; (3) ensure reasonable treatment of medical and health personnel, and establish a long-term mechanism to promote the improvement of the practicing environment.
5	No. 10 [2011] of the General Office of the State Council	Notice of the General Office of the State Council on Issuing the Work Arrangements for the Pilot Reform of Public Hospitals in 2011	Reasonably determine the performance appraisal system of public hospitals, study and establish a public hospital performance appraisal system with public welfare as the core, gradually expand the scope of publicization of appraisal results, and combine appraisal results with the appointment and removal of directors, rewards and penalties, hospital financial subsidies, and average income levels of staff.
6	No. 306 [2010] of the Ministry of Finance and Ministry of Health	Financial Regulations for Hospitals	Organize budgets scientifically and reasonably; organize income in accordance with the law; improve financial management systems and internal control mechanisms; strengthen economic management, implement cost accounting, strengthen cost control, implement performance appraisals, and improve the efficiency of fund use; hospital budget management measures.
7	No. 11 [2012] of the State Council	Notice of the State Council on Issuing the General Plan for Deepening the Reform of the Healthcare System During the "Twelfth Five-Year Plan" Period and the Implementation Plans	Establish a performance evaluation system for public hospitals with public welfare and operating efficiency as the core, improve the internal distribution mechanism with service quality, quantity, and patient satisfaction as the core, increase the proportion of staff expenditures in business expenditures, improve treatment of medical staff, and the hospital management salary is determined by the government or the authorized council. It is strictly forbidden to link the personal income of medical staff with the hospital's drug and inspection income. It is necessary to improve the financial accounting system of public hospitals and strengthen cost accounting and control.
8	No. 20 [2012] of the General Office of the State Council	Notice of the General Office of the State Council on Issuing the Work Arrangements for Deepening of Medical System Reform in 2012	Improve the hospital's internal distribution incentive mechanism, and improve the internal distribution mechanism with service quality, quantity, and patient satisfaction as the core, so as to reflect more pay for more work and better performance. Increase the proportion of personnel expenditures in business expenditures and improve the treatment of medical personnel. The remuneration of the hospital president and hospital management shall be

determined by the government-run medical entity or the authorized council. It is strictly forbidden to link the personal income of medical personnel with the income of medicines and examinations.

9	No. 33 [2012] of the General Office of the State Council	Notice of the General Office of the State Council on Issuing the Directives for Comprehensive Pilot Reforms of County-level Public Hospitals	Improve the hospital's internal income distribution and incentive mechanism, increase the proportion of hospital personnel expenditures to business expenses, gradually increase the treatment of medical personnel, strengthen personnel performance evaluation, and improve the internal distribution mechanism with service quality, quantity and patient satisfaction as the core to achieve more pay for more work and better performance and equal pay for equal work and reflect the value of medical staff technical services. The income distribution is tilted towards personnel in clinical posts, key positions, business backbones, and those who have made outstanding contribution, and appropriate gap is encouraged. It is strictly forbidden to link the personal income of medical personnel with the income of medicines and examinations in hospitals. Improve performance evaluation. Establish a performance evaluation system for public hospitals centered on the nature of public welfare and operational efficiency. All localities should formulate specific performance assessment indicators and establish strict assessment systems.
10	No. 57 [2012] of the State Council	Notice of the State Council on Issuing the "Twelfth Five-Year Plan" for the Health Industry	Strengthen the performance evaluation of public hospitals, and establish incentive and restraint systems such as president selection, appointment, reward and punishment evaluation. Promote the innovation of modern hospital management services, promote the professionalization of the hospital president team, and improve the level of refinement, professionalism, and scientific management of public hospitals. Promote the reform of the personnel system with the employment and post management systems as the main content, improve the evaluation system for medical personnel's professional titles, establish a reasonable distribution and incentive mechanism, and improve the treatment of medical personnel. Promote multi-sited license of registered doctors and fully mobilize the enthusiasm of medical staff.

11	No. 61 [2012] of the General Office of the Ministry of Health	Regulations on the Prevention and Control of the Integrity of Medical Services in Public Medical Institutions	Implement strict performance evaluation to improve the effectiveness of prevention and control. Investigate and establish an integrity risk prevention and control performance evaluation system, focusing on the power operation process, operation status, and prevention and control rules, and evaluate the actual effects of integrity risk prevention and control.
12	Letter No. 36 [2013] of the General Office of the State Council	Notice of the General Office of the State Council on Deepening the Division of Key Work for Income Distribution System Reform	In combination with the classified reform of public institutions, establish and improve a salary distribution system that is consistent with the characteristics of public institutions, reflects job performance, and classified management, improve the mechanism for allowing technological factors to participate in the distribution, establish a compensation system for scientific and technological innovation talents based on actual contributions, and encourage enterprises and public institutions to implement agreed wages and project wages for high-level, highly-skilled personnel who are in urgent need.
13	No. 6 [2013] of the State Council	Notice of the State Council on Approving and Relaying the Several Directives of the National Development and Reform Commission and Other Departments on Deepening Reform of the Income Distribution System	Implement the requirements of the 18th National Congress of the Communist Party of China to deepen the reform of the income distribution system to realize that the development results are shared by the people, further advance the implementation of the 12th Five-Year Plan, improve the income distribution institutions and systems, increase the income of urban and rural residents, reduce the income distribution gap and regulate income distribution order.
14	No. 31 Order of the Ministry of Supervision of the People's Republic of China	Provisions for Disciplinary Actions for Illegally Granting Allowances and Subsidies	According to provisions, those who covertly distribute state-owned or collective assets to individuals in the form of subsidies and allowance shall be recorded a serious demerit, those with relatively serious circumstance shall be given demoted or dismissed; if the circumstances are serious, they shall be discharged from public employment.

15	No. 80 [2013] of the General Office of the State Council	Notice of the General Office of the State Council on Issuing the Major Task List on Deepening the Medical and Health Care System Reform in 2013	Innovate the performance evaluation mechanism, encourage the introduction of third-party evaluation, strengthen quantitative evaluation and effect evaluation, and link the evaluation results with the total performance salary, financial subsidies, medical insurance payments, and the income of medical staff. All localities should proceed from the actual situation, and on the basis of the stable implementation of performance wages, appropriately increase the proportion of incentive performance wages and reasonably widen the income gap.
16	The Third Plenary Session of the Party's 18th National Congress	Decision of the Central Committee of the Communist Party of China on Several Important Issues Concerning Comprehensively Deepening the Reform	Accelerate the reform of public hospitals, fulfill government responsibilities, and establish a scientific medical performance evaluation mechanism and a talent training and personnel compensation system that adapts to industry characteristics.
17	No. 49 [2013] of the National Health and Family Planning Commission	Nine Prohibitions on Strengthening the Construction of Medical Ethics	It is explicitly forbidden to link the personal income of medical staff with the income of medicines and medical examinations; no billing or commission is allowed. The attitude of zero-tolerance should be adopted to seriously investigate and deal with cases of malpractices in which the health care system harms the interests of the masses.
18	No. 24 [2014] of the General Office of the State Council	Notice of the General Office of the State Council on Issuing the Major Task List on Deepening the Medical and Health Care System Reform in 2014	Establish a remuneration system that suits the characteristics of the medical industry. Study and formulate policies for the personnel compensation system of public hospitals that are suitable for the characteristics of the medical industry, and establish and improve the incentive mechanism for income distribution. It is strictly forbidden to issue income-generating indicators to medical personnel, and it is strictly forbidden to link the bonus and salary of medical personnel with the business income of drugs and medical examinations.
19	No. 14 [2015] of the General Office of the State Council	Notice of the General Office of the State Council on Issuing the Medical Service System Plan (2015-2020)	Improve the employment mechanism of public institutions with the employment under contract system and position management system as the main content. Improve the professional and technical title evaluation system to promote the growth of talents and rational talent flow. Deepen the reform of the income distribution system, establish an evaluation and incentive mechanism with service quality, service quantity, and service target satisfaction as the core and job responsibilities and performance as the basis. Adhere

to the principle of more pay for more work and better performance. The focus of personnel income distribution will be on the key positions, business backbones and medical and health personnel with outstanding achievements.

20	No. 33 [2015] of the General Office of the State Council	Implementation Directives of the General Office of the State Council on Comprehensively Promoting the Comprehensive Reform of All Public Hospitals at the County Level	Innovate the establishment management, implement dynamic management based on checking the total staffing of county-level public hospitals, gradually implement the establishment register system, and reform the personnel system. Implement county-level public hospitals' employment autonomy, optimize personnel structure, and change the identity management to post management via full implementation of the employment under contract system and the post management system by establishing a flexible employment mechanism where talents can move in, out, and up and down freely; establish a salary system that adapts to industry characteristics, in combination with the characteristics of the medical industry, establish a salary system for public hospitals, and improve the incentive and restraint mechanism for income distribution. It is strictly forbidden to set income-generating indicators for medical personnel. It is strictly forbidden to link the income of medical personnel with the income of hospitals such as medicines, inspections, and treatment. Establish a scientific performance evaluation mechanism to evaluate hospitals based on the nature of public welfare, operational efficiency, and mass satisfaction. Assess performance of medical staff by social benefits and work efficiency.
21	No. 34 [2015] of the General Office of the State Council	Notice of the General Office of the State Council on Issuing the 2014 Wrap-up Report and 2015 Major Task List on Deepening the Medical and Health Care System Reform	Establish a remuneration system that is in line with the characteristics of the medical and health industry. Relevant national departments should accelerate the study and formulation of a salary reform plan that is in line with the characteristics of the health industry. Pilot cities and counties (county-level cities) that are not included in the pilot reform of the public hospital salary system reform can explore and formulate a method for approving the total performance salary of public hospitals. Improve the performance-based pay system to reflect the principle of more pay for more work and better performance, and reasonably widen the income gap. It is strictly forbidden to set income-generating indicators for medical personnel, and the salaries of medical personnel should not be linked to the business income of drugs, consumables, and medical examinations.

22	No. 38 [2015] of the General Office of the State Council	Guiding Directives of the General Office of the State Council on Urban Public Hospital Comprehensive Reform Pilot	Establish a public welfare-oriented assessment mechanism. Highlight evaluation indicators such as functional positioning, responsibility fulfillment, expenditure control, operational performance, financial management, cost control, and social satisfaction. The performance evaluation results of public hospitals and the annual and term target responsibility evaluations of hospital presidents are made public and are linked with hospital salary, appointment and removal, and rewards and punishments to establish incentive and restraint mechanisms.
23	No. 89 [2015] of the National Health and Family Planning Commission and National Development and Reform Commission	Notice on Printing and Distributing Several Directives on Controlling Unreasonable Increase in Medical Expenses of Public Hospitals	Eight cost control measures are proposed, and 21 testing indicators are formulated. By the end of 2017, the public hospital's medical cost control testing and assessment mechanism will be gradually established and improved. The proportion of personal expenditure in medical expenses of insured patients will be gradually decreased, and the burden of medical treatment for residents will be further reduced.
24	No. 94 [2015] of the National Health and Family Planning Commission and Ministry of Human Resources and Social Security	Guiding Directives on Strengthening the Performance Evaluation of Public Medical and Health Institutions	Institutional performance evaluation should cover social benefits, service provision, comprehensive management and sustainable development. The performance evaluation of responsible persons should also include employee satisfaction. Personnel performance evaluation should be included as an important part of personnel assessment, and should be a part of ordinary assessment, annual assessment and employment assessment, highlighting the workload of the post, service quality, behavioral standards, technical difficulty, risk level, and service target satisfaction. The performance evaluation indicators should reflect the requirements of implementing the public welfare nature of public medical and health institutions and safeguarding health of the public, reflect the service and management process, focus on service results, and highlight target management and total quality management.

25	No. 263 [2015] of the Ministry of Finance and the National Health and Family Planning Commission	Guidance on Strengthening Financial and Budget Management in Public Hospitals	Explore the implementation of a budget management system for the total salary of public hospitals, allow hospitals to distribute salary independently according to internal performance allocation methods within the total salary range. Internal performance allocation in hospitals should not be linked to income from medicines, health materials, tests, and inspections. The increment of the total salary should not be linked to the aforementioned incomes, either. The administrative management expenditures of public hospitals can be strictly controlled with reference to the staffing levels of public institutions and public funding quotas, and the regional management fee quota standards can be gradually improved and formed.
26	No. 26 [2016] of the General Office of the State Council	Notice of the General Office of the State Council on Issuing the Major Task List on Deepening the Medical and Health Care System Reform in 2016	Accelerate the establishment of a salary system in line with the characteristics of the medical and health industry. Organize and improve the pilot work on the reform of the public hospital salary system, increase exploration, and summarize the pilot experience in a timely manner. Encourage pilot cities to explore and formulate methods for verifying total performance wages in public hospitals, establish a distribution and incentive mechanism that is closely linked to job responsibilities, work performance, and actual contributions, and strive to reflect the value of medical personnel's technical and labor services, standardize the income distribution order, gradually increase the income of medical personnel, and mobilize medical staff. The performance salary of the public hospital president can be determined by the government-run medical institution.
27	No. 77 [2016] of the State Council	Notice of the State Council on Printing and Distributing the Medical and Health Plan During the "Thirteenth Five-Year Plan"	It is strictly forbidden to set income-generating indicators for medical personnel, and the salaries of medical personnel should not be linked to the hospital income from drugs, consumables, inspections, and tests. Improve the employment mechanism of public institutions focusing on the employment under contract system and the post management system. Establish a personnel remuneration system in line with the characteristics of the medical industry, strive to reflect the value of medical personnel's technical labor, and optimize the professional development environment of medical personnel.

28	No. 78 [2016] of the State Council	Notice of the State Council on Issuing the 13th Five-Year Plan for Deepening the Reform of the Medical and Health System	Establish a staffing and salary system that complies with the characteristics of the medical and health industry; establish a quality-centered and public welfare-oriented hospital evaluation mechanism.
29	No. 10 [2017] of the Ministry of Human Resources and Social Security	Guiding Directives of the Ministry of Human Resources and Social Security, the Ministry of Finance, the National Health and Family Planning Commission and the State Administration of Traditional Chinese Medicine on the Pilot Work on the Reform of the Salary System of Public Hospitals	(1) Optimize the salary structure of public hospitals; (2) Reasonably determine the salary level of public hospitals; (3) Promote the salary reform of the public hospital presidents; (4) Implement the distribution autonomy of public hospitals; (5) Improve assessment and evaluation mechanism oriented by the public welfare nature.
30	No. 32 [2017] of the General Office of the State Council	Guiding Directives of the General Office of the State Council on Promoting the Construction and Development of Medical Alliance	Improve personnel security and incentive mechanism. In accordance with the requirement of "allowing medical and health institutions to break through the current level of wage adjustment and control in public institutions, and allowing medical service income deducting costs and withdrawing funds according to regulations to be used for personnel rewards", improve the performance-based pay policy that is compatible with the medical alliance, improve the distribution and incentive mechanism closely related to job responsibilities, work performance, and actual contributions, innovate the personnel management system, improve the promotion method of the professional title that is compatible with the medical alliance, implements scientific evaluation, and expands the career development room of medical personnel.
31	No. 37 [2017] of the General Office of the State Council	Notice of the General Office of the State Council on Issuing the Major Task List on Deepening the Medical and Health Care System Reform in 2017	Fully launch pilot construction of various forms of medical alliance. All tertiary public hospitals must take part in and play a leading role. Establish an assessment and incentive mechanism that promotes the up-and-down of high-quality medical resources, and enhance the ability of grassroots services to facilitate the nearby medical treatment.

32	No. 67 [2017] of the General Office of the State Council	Guiding Directives of the General Office of the State Council on Establishing a Modern Hospital Management System	Improve human resources management system. Establish and improve personnel recruitment management, post management, job title management, medical practitioner management, nursing staff management, income distribution management and other systems. In terms of job settings, income distribution, job title evaluation, management and use, etc., the overall internal and external staffing considerations are considered. Public hospitals make independent allocations within the total amount of salary approved, reflecting job differences, taking into account the balance of disciplines, achieving more work, more performance, and excellent performance. According to relevant regulations, hospitals can explore the implementation of target annual salary system and agreed salary. The salaries of medical personnel shall not be linked to the business income of drugs, sanitary materials, inspections, and laboratory tests.
33	No. 3 [2018] of the General Office of the State Council	Directives of the General Office of the State Council on Reforming and Improving the Training and Use of Incentive Mechanisms for General Practitioners	Reform and improve the remuneration system of general practitioners. Promote the reform of medical service prices. Reflect the value of technical services for medical staff, including general practitioners. In accordance with the requirements of "allowing medical and health institutions to break through the current level of wage regulation in public institutions, and allowing medical service income deducting costs and withdrawing funds in accordance with regulations to be used for personnel rewards", reasonably identify the salary level of general practitioners at government-run primary medical and health institutions, and make sure that their salary level is compatible with that of clinicians with the same conditions in the local county-level general hospitals.
34	No. 83 [2018] of the General Office of the State Council	Notice of the General Office of the State Council on Issuing the Major Task List on Deepening the Medical and Health Care System Reform in the Second Half of 2018	Implement financial security policies, and implement the requirements of "allowing medical and health institutions to break through the current level of wage regulation in public institutions, and allowing medical service income deducting costs and withdrawing funds in accordance with regulations to be used for personnel rewards" ("two allowings"). According to the actual situation of different medical and health institutions, we will improve the salary distribution policy in a targeted manner to promote the salaries of medical staff to a reasonable level; summarize the pilot experience of public hospital salary system reform in a timely manner, and promote the establishment of a salary system that is in line with the characteristics of the industry.

Annex C: Survey of Management and Application of Key Performance Indicators of Public Tertiary Hospitals

This questionnaire divided the managerial process into Organizational Goals (Ex-ante control), Process Indicators (Execution management) and Outcome Indicators (Post hoc control) based on the *55 Key Performance Indicators of China's Public Tertiary Hospitals* issued by Chinese government. Please select the corresponding dimension based on your own understanding. Thank you for your support!

1.1 Evaluation of indicators of medical care quality [Matrix Single Selection]

	Organizational Goals (Ex-ante control)	Process Indicators (Execution management)	Outcome Indicators (Post hoc control)	Difficult to identify
(1) Ratio of outpatients to discharges	○	○	○	○
(2) Number of transferred patients (outpatient, emergency, inpatient)	○	○	○	○
(3) Proportion of day surgery in elective surgery	○	○	○	○
(4) Proportion of surgery received by discharged patients	○	○	○	○
(5) Proportion of discharged patients receiving minimally invasive surgery	○	○	○	○
(6) Proportion of discharged patients receiving grade 4 surgery	○	○	○	○

(7) Proportion of special medical services	○	○	○	○
(8) Incidence of complications in surgical patients	○	○	○	○
(9) Infection rate of type I incision surgery	○	○	○	○
(10) Single disease quality control	○	○	○	○
(11) Positive rate of large medical equipment inspection	○	○	○	○
(12) Maintenance and quality control of large medical equipment	○	○	○	○
(13) Number of clinical test projects that have passed the external quality assessment	○	○	○	○
（14）Mortality of low-risk group case	○	○	○	○
(15) Coverage of ward with high quality nursing service	○	○	○	○
(16) Proportion of prescriptions with comment in total prescriptions	○	○	○	○
(17) Antibacterial use intensity (DDDs)	○	○	○	○
(18) Proportion of basic drug	○	○	○	○

	Organizational Goals (Ex-ante control)	Process Indicators (Execution management)	Outcome Indicators (Post hoc control)	Difficult to identify
prescriptions for outpatients				
(19) Rate of basic drug use in hospitalized patients	○	○	○	○
(20) Proportion of types of basic drugs purchased	○	○	○	○
(21) Proportion of drugs used in the national procurement of centralized drug procurement	○	○	○	○
(22) Average rate of outpatient appointment	○	○	○	○
(23) Average waiting time for outpatients with appointments	○	○	○	○
(24) Classification of functions of electronic medical record	○	○	○	○

2.2 Evaluation of indicators of operation efficiency [Matrix Single Selection]

	Organizational Goals (Ex-ante control)	Process Indicators (Execution management)	Outcome Indicators (Post hoc control)	Difficult to identify
(25) Daily hospitalization workload for each certified physician	○	○	○	○
(26) Number of pharmacists per 100 beds	○	○	○	○
(27) Proportion of outpatient income in medical income	○	○	○	○

(28) Proportion of outpatient income from health insurance funds	○	○	○	○
(29) Proportion of hospitalization income in medical income	○	○	○	○
(30) Proportion of hospitalization income from health insurance funds	○	○	○	○
(31) Proportion of revenue from medical services (excluding pharmaceuticals, consumables, inspection and inspection income) in medical income	○	○	○	○
(32) Proportion of supplementary medicine income	○	○	○	○
(33) Proportion of staff expenditure in business expenditure	○	○	○	○
(34) total energy consumption per CNY10,000 income	○	○	○	○
(35) Income and expenditure balance	○	○	○	○
(36) Asset-liability ratio	○	○	○	○
(37) Increase in medical income	○	○	○	○
(38) Average increase in	○	○	○	○

outpatient cost per visit				
(39) Average increase in outpatient drug cost per visit	○	○	○	○
(40) Average increase in hospitalization cost per hospital stay	○	○	○	○
(41) Average increase in drug cost per hospital stay	○	○	○	○
(42) Comprehensive budget management	○	○	○	○
(43) Standard of chief accountant	○	○	○	○

3.3 Evaluation of related indicators in continuous development [Matrix Single Selection]

	Organizational Goals (Ex-ante control)	Process Indicators (Execution management)	Outcome Indicators (Post hoc control)	Difficult to identify
(44) Title structure of health technicians	○	○	○	○
(45) Proportion of anesthesiologists, pediatricians, intensive physicians, pathologists, and TCM physicians	○	○	○	○
(46) Ratio of nurses to physicians	○	○	○	○
(47) Proportion of staffs receiving training in other hospitals (especially partner assistance hospitals and hospitals in integrated healthcare system) and returning to work	○	○	○	○

independently in the original hospital				
(48) Passing rate of first-time physician qualification exam for resident physicians	○	○	○	○
(49) The working results of training medical talents that hospital undertakes	○	○	○	○
(50) Funding for scientific research projects per 100 health technicians	○	○	○	○
(51) Amount of transitionally scientific research results per 100 health technicians	○	○	○	○
(52) Comprehensive rating of public credit	○	○	○	○

4.4 Evaluation of indicators in satisfaction evaluation [Matrix Single Selection]

	Organizational Goals (Ex-ante control)	Process Indicators (Execution management)	Outcome Indicators (Post hoc control)	Difficult to identify
(53) Outpatient Satisfaction	○	○	○	○
(54) Inpatient Satisfaction	○	○	○	○
(55) Medical Staff Satisfaction	○	○	○	○

In order to facilitate the statistics of this questionnaire, please answer following questions concerning your personal information (sensitive information is not required). The following questions do not involve sensitive personal information.

5. Your Gender: [Single selection]

○A Male   ○B Female

6. Your Age: [Single selection]

○A Under 30   ○B 30-40   ○C 41-50   ○D Above 50

7. Your Working position: [Single selection] *

○Hospital Management

○Hospital Administrative Management

○Hospital Department Management

○Administrative Department

○Business-related Agencies

8. Your years of working:

[please enter a number between 1-40] *

_____

9. Your highest academic qualification: [Single selection] *

○PhD degree

○Master Degree

○Bachelor Degree

○Post-secondary Education

○High School or vocational education

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Annex D: Five-point Likert Scale - Questionnaire

According to the description of the following questions, choose the option that is in line with your perception. [Click the corresponding number 1-5] Among them, 1- strongly disagree; 2- disagree; 3- neither agree nor disagree; 4- agree; 5- strongly agree.

1. Goals management

Table d.1 Goals Management Dimensions

Goals management	1	2	3	4	5
I think comprehensive budget management fits into the category of organizational goals management.					
I think standard of chief accountant fits into the category of organizational goals management.					
I think title structure of health technicians fits into the category of organizational goals management					
I think ratio of nurses to physicians fits into the category of organizational goals management.					
I think proportion of anesthesiologists, pediatricians, intensive physicians, pathologists, and TCM physicians fits into the category of organizational goals management.					
I think proportion of types of basic drugs purchased fits into the category of organizational goals management.					
I think proportion of drugs used in the national procurement of centralized drug procurement fits into the category of organizational goals management.					
I think proportion of staff expenditure in business expenditure fits into the category of organizational goals management.					
I think number of pharmacists per 100 beds fits into the category of organizational goals management.					
I think proportion of basic drug prescriptions for outpatients fits into the category of organizational goals management.					
I think classification of functions of electronic medical record fits into the category of organizational goals management.					
I think proportion of prescriptions with comment in total prescriptions fits into the category of organizational goals management.					
I think rate of basic drug use in hospitalized patients fits into the category of organizational goals management.					
I think funding for scientific research projects per 100 health technicians fits into the category of organizational goals management.					
I think proportion of staffs receiving training in other hospitals (especially partner assistance hospitals and hospitals in integrated healthcare system) and returning to work independently in the original hospital fits into the category of organizational goals management.					

2. Process management

Table d.2 Process Management Dimensions

Process management	1	2	3	4	5
I think single disease quality control is a process management indicator.					
I think antibacterial use intensity (DDDs) is a process management indicator.					
I think coverage of ward with high quality nursing service is a process management indicator.					
I think infection rate of type I incision surgery is a process management indicator.					
I think daily hospitalization workload for each certified physician is a process management indicator.					
I think incidence of complications in surgical patients is a process management indicator.					

3. Outcome control

Table d.3 Outcome Control Management Dimensions

Outcome control	1	2	3	4	5
I think inpatient satisfaction is an outcome indicator.					
I think proportion of discharged patients receiving grade 4 surgery is an outcome indicator.					
I think medical staff satisfaction is an outcome indicator.					
I think outpatient satisfaction is an outcome indicator.					
I think mortality of low-risk group case is an outcome indicator.					
I think proportion of surgery received by discharged patients is an outcome indicator.					

Annex E: Interview Outline Design

Interviewees include experienced experts in hospital performance management, heads of administrative department of public health performance, presidents of public hospitals, executives of hospital performance department and clinicians.

I. Organizational objectives:

1. Do you think the following indicators are suitable for the organizational objectives set at the hospital level? Can these indicators represent the organizational benefits of hospitals? Which indicators are suitable, and which are not? Why?

2. Can the following indicators reflect the organizational benefits of hospitals as well as adequately express and set organizational objectives?

3. Can the following indicators work in realizing prior control of management quality?

4. Will the interests of hospitals and doctors be taken into account if the following indicators are applied?

Or, which of the following indicators does not meet the above requirements? Why?

Organizational Objectives
OB4 Doctor-to-nurse Ratio
OB1 Comprehensive Budget Management
OB2 Standardizing Establishment of Chief Accountant
OB3 Title Structure of Health Technicians
OB5 Proportion of Anesthesiologists, Pediatricians, ICU Physicians, Pathologists, and Traditional Chinese Medical Doctors
OB6 Proportion of the Variety of Essential Drugs in Procurement
OB7 Using Ratio of Bid-winning Drugs in National Centralized Procurement of Drugs
OB10 Proportion of Essential Drugs in Prescriptions for Outpatients
OB12 Ratio of Reviewed Prescriptions to Total Prescriptions
OB14 Research Project Outlay for Every Hundred Health Technicians
OB13 Ratio of Essential Drugs Used among Inpatients
OB15 Proportion of Medical Staff that Receive In-service Training in Other Hospitals and Return to Work Independently in the Original Hospitals

II. Process indicators:

1. Can the following process indicators effectively represent the quality of medical care? Please

give a clear definition of doctors' workload indicators.

2. Can the following indicators evaluate the value of doctors' work?

3. Can the following indicators directly influence patient safety outcomes?

4．Apart from the above indicators, do you have any other suggestions?

Process Indicators	
PR1	Quality Control of Single Entity Diseases
PR6	Complication Rate of Surgical Patients
PR5	Average Daily Hospitalization Workload of Each Licensed Physician

III. Outcome indicators:

1. Can the following indicators express the requirements for medical service results?

2. Can the following indicators reflect doctors' interests?

3. Can the following indicators reflect patients' rights and interests?

4. Are there any interest conflicts in outcome-controlling indicators?

5. Are the following indicators correlated with any indicators in organizational objectives?

Outcome Control	
RE4	Satisfaction Degree of Outpatients
RE1	Satisfaction Degree of Inpatients
RE5	Mortality Rate of Low-risk Group Case
RE6	Proportion of Discharged Patients Undergoing Surgery
RE3	Satisfaction Degree of Medical Staff
RE2	Proportion of Discharged Patients Undergoing Level 4 Surgery

IV. Except the "organization – process – outcome" procedure,

1．Do you have anything to supplement the above indicator setting?

2．Do you think that indicator setting can solve all management problems?

3．If not, what problems cannot be solved with management indicators?

Annex F: Questionnaire on the Weight of Performance Indicator System in Tertiary Public Hospitals

1. Notice on the filling of the form

Please make a pairwise comparison of the indicators in the matrix table according to the relative importance, and fill in your comparison judgment in the corresponding position (you can only fill in the diagonal blank side.). The importance comparison is the ratio of the vertical indicators to the horizontal indicators.

Here the AHP uses a method of multi-factor, multi-standard pairwise comparison to list the priority and weight coefficients of each indicator in an indicator system.

Table f.1 The definition of judgment matrix scale

sacle	Explanation
$a_{ij}=1$	Element i is as important as the above level elements to j.
$a_{ij}=3$	Element i is slightly more important to j compared with the above level elements.
$a_{ij}=5$	Element i is more important to j compared with the above level elements.
$a_{ij}=7$	Element i is strongly more important to j compared with the above level elements.
$a_{ij}=9$	Element i is definitely more important to j compared with the above level elements.
Reciprocal	If the importance ratio of i and j is a_{ij},the importance ratio of j and i is $a_{ji}=1/a_{ij}$

Table f.2 First and second level indicators

First-level indicators	Line No.	Second-level indicators	
Objective	u_1	Doctor-to-nurse ratio	
	u_2	Comprehensive budget management	
	u_3	Normatively setting up the post of chief accountant	
	u_4	Structure of professional titles of the medical technicians	
	u_5	Proportion of doctors in the departments of anesthesia, pediatrics, severe diseases, pathology and traditional Chinese medicine	
	u_6	Proportion of each purchased essential drugs	
	u_7	Proportion of drug use in the centralized drug procurement organized by the state	

	u_8	Proportion of the essential drugs in the prescriptions for outpatients	
	u_9	Proportion of comment prescriptions to the total prescriptions	
	u_{10}	Funding for scientific research projects per 100 medical technicians	
	u_{11}	Utilization rate of essential drugs among inpatients	
	u_{12}	The proportion of the staff who accepted further studies in other hospitals and then returned to the original hospital to work independently	
Process	u_{13}	Quality control of single disease	
	u_{14}	Incidence of complications in patients receiving surgeries	
	u_{15}	Average daily workload of each medical practitioner	
Outcome	u_{16}	Outpatient satisfaction	
	u_{17}	Inpatient satisfaction	
	u_{18}	Mortality rate of patients in low risks	
	u_{19}	Proportion of discharged patients undergoing surgeries	
	u_{20}	Medical staff satisfaction	
	u_{21}	Proportion of discharged patients undergoing the fourth-level operation.	

1. Expert judgment matrix (the first-level indicators)

Please directly fill in the blanks with the values you think are appropriate. The intensity of importance is the ratio of vertical indicators to horizontal indicators. For example, if you think that the dimensions of "objective" and "process" in the first-level indicators are of the same importance, please fill in "1" in the corresponding blank; if "objective" is slightly more important, fill in "3"; if obviously important, fill in "5" … if you think the "objective" is slightly less important, fill in "1/3"; if it is obviously not important, fill in "1/5" …

Table f.3 The first-level indicator matrix

The first-level indicators	Objective	Process	Outcome
Objective	1		
Process	——	1	

Outcome	——	——	1

2. Expert judgment matrix (the second-level indicators)

Please fill the tale as you fill the above table; the intensity of importance is the ratio of the vertical indicators to horizontal indicators.

Table f.4 The second-level indicator matrix-the dimension of objective

The second-level indicators	u1	u2	u3	u4	u5	u6	u7	u8		u9	u10	u11	u12
u1	1												
u2	——	1											
u3	——	——	1										
u4	——	——	——	1									
u5	——	——	——	—	1								
u6	——	——	——	—	—	1							
u7	——	——	——	—	—	—	1						
u8	——	——	——	—	—	—	—	1					
u9	——	——	——	—	—	—	—	—		1			
u10	——	——	——	—	—	—	—	—		—	1		
u11	——	——	——	—	—	—	—	—		—	—	1	
u12	——	——	——	—	—	—	—	—		—	—	—	1

Table f.5 The second-level indicator matrix-the dimension of process

The second-level indicators	u13	u14	u15
u13	1		
u14	——	1	
u15	——	——	1

Table f.6 The second-level indicator matrix-the dimension of outcome

The second-level indicators	u16	u17	u18	u19	u20	u21
u16	1					
u17	——	1				
u18	——	——	1			
u19	——	——	——	1		
u20	——	——	——	——	1	
u21	——	——	——	——	——	1

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Annex G: One-way Analysis of Variance (ANOVA)

Table 1 The influence of age on goal management indicators

Multiple Comparisons

Dependent Variable: Goal management indicators

LSD

(I) Age group	(J) Age group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	Upper Bound
18~25	**26~30**	**-.11743**	**.07042**	**.096**	**-.2557**	**.0208**
	31~40	.09067	.07112	.203	-.0489	.2303
	41~50	-.03788	.07785	.627	-.1907	.1150
	51~60	**.19527***	**.09636**	**.043**	**.0061**	**.3844**
	Above 60	**.91194***	**.29934**	**.002**	**.3243**	**1.4996**
26~30	18~25	.11743	.07042	.096	-.0208	.2557
	31~40	**.20810***	**.05404**	**.000**	**.1020**	**.3142**
	41~50	.07955	.06264	.204	-.0434	.2025
	51~60	.31270*	.08454	.000	.1467	.4787
	Above 60	1.02937*	.29575	.001	.4488	1.6099
31~40	18~25	-.09067	.07112	.203	-.2303	.0489
	26~30	-.20810*	.05404	.000	-.3142	-.1020
	41~50	-.12855*	.06342	.043	-.2530	-.0040
	51~60	.10461	.08513	.220	-.0625	.2717
	Above 60	**.82127***	**.29591**	**.006**	**.2404**	**1.4022**
41~50	18~25	.03788	.07785	.627	-.1150	.1907
	26~30	-.07955	.06264	.204	-.2025	.0434
	31~40	.12855*	.06342	.043	.0040	.2530
	51~60	**.23315***	**.09083**	**.010**	**.0549**	**.4115**
	Above 60	**.94982***	**.29760**	**.001**	**.3656**	**1.5340**
51~60	18~25	-.19527*	.09636	.043	-.3844	-.0061
	26~30	-.31270*	.08454	.000	-.4787	-.1467
	31~40	-.10461	.08513	.220	-.2717	.0625
	41~50	-.23315*	.09083	.010	-.4115	-.0549

	Above 60	.71667*	.30297	.018	.1219	1.3114
Above 60	18~25	-.91194*	.29934	.002	-1.4996	-.3243
	26~30	-1.02937*	.29575	.001	-1.6099	-.4488
	31~40	-.82127*	.29591	.006	-1.4022	-.2404
	41~50	-.94982*	.29760	.001	-1.5340	-.3656
	51~60	-.71667*	.30297	.018	-1.3114	-.1219

*. The mean difference is significant at the 0.05 level.

Table 2 The influence of the position on the goal management indicators

Multiple Comparisons

Dependent Variable: Goal management indicators

LSD

(I) Position	(J) Position	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Hospital management	**Administration & logistics**	**-.45694***	**.18764**	**.015**	**-.8253**	**-.0886**
	Clinical medical care	**-.40579***	**.18115**	**.025**	**-.7614**	**-.0502**
	Medical auxiliary & medical technology	**-.32237**	**.18606**	**.084**	**-.6876**	**.0429**
	Superior department	.14394	.38711	.710	-.6160	.9039
Administration & logistics	Hospital management	.45694*	.18764	.015	.0886	.8253
	Clinical medical care	.05114	.06167	.407	-.0699	.1722
	Medical auxiliary & medical technology	**.13457**	**.07486**	**.073**	**-.0124**	**.2815**
	Superior department	.60088	.34762	.084	-.0815	1.2833
Clinical medical care	Hospital management	.40579*	.18115	.025	.0502	.7614
	Administration & logistics	-.05114	.06167	.407	-.1722	.0699
	Medical auxiliary & medical technology	.08342	.05666	.141	-.0278	.1946
	Superior department	.54973	.34416	.111	-.1259	1.2253
Medical auxiliary & medical technology	Hospital management	.32237	.18606	.084	-.0429	.6876
	Administration & logistics	-.13457	.07486	.073	-.2815	.0124
	Clinical medical care	-.08342	.05666	.141	-.1946	.0278
	Superior department	.46631	.34677	.179	-.2144	1.1470
Superior department	Hospital management	-.14394	.38711	.710	-.9039	.6160

Administration & logistics	-.60088		.34762	.084	-1.2833	.0815
Clinical medical care	-.54973		.34416	.111	-1.2253	.1259
Medical auxiliary & medical technology	-.46631		.34677	.179	-1.1470	.2144

*. The mean difference is significant at the 0.05 level.

Table 3 The influence of position on goal management indicators -3

Multiple Comparisons

Dependent Variable: Goal management indicators

LSD

(I) Position level	(J) Position level	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Main leaders	**Middle-level cadres**	**.79291***	**.27193**	**.004**	.2591	1.3267
	General staff	**.93845***	**.26541**	**.000**	.4174	1.4595
Middle-level cadres	Main leaders	-.79291*	.27193	.004	-1.3267	-.2591
	General staff	**.14553***	**.06734**	**.031**	.0133	.2777
General staff	Main leaders	-.93845*	.26541	.000	-1.4595	-.4174
	Middle-level cadres	-.14553*	.06734	.031	-.2777	-.0133

*. The mean difference is significant at the 0.05 level.

Table 4 The influence of age on process management indicators -3

Multiple Comparisons

Dependent Variable: Process management indicators

LSD

(I) Age group	(J) Age group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
18~25	26~30	-.11954	.08925	.181	-.2948	.0557
	31~40	.16260	.09014	.072	-.0144	.3396
	41~50	.03211	.09867	.745	-.1616	.2258
	51~60	**.34330***	**.12213**	**.005**	**.1035**	**.5831**
	Above 60	**.85997***	**.37939**	**.024**	**.1152**	**1.6047**
26~30	18~25	.11954	.08925	.181	-.0557	.2948
	31~40	**.28214***	**.06849**	**.000**	.1477	.4166
	41~50	**.15165**	**.07939**	**.056**	-.0042	.3075
	51~60	**.46284***	**.10715**	**.000**	.2525	.6732

	Above 60	**.97951***	**.37483**	**.009**	**.2437**	**1.7153**
31~40	18~25	-.16260	.09014	.072	-.3396	.0144
	26~30	-.28214*	.06849	.000	-.4166	-.1477
	41~50	-.13049	.08038	.105	-.2883	.0273
	51~60	**.18070**	**.10789**	**.094**	**-.0311**	**.3925**
	Above 60	**.69737**	**.37504**	**.063**	**-.0389**	**1.4336**
41~50	18~25	-.03211	.09867	.745	-.2258	.1616
	26~30	-.15165	.07939	.056	-.3075	.0042
	31~40	.13049	.08038	.105	-.0273	.2883
	51~60	.31119*	.11512	.007	.0852	.5372
	Above 60	.82786*	.37719	.028	.0874	1.5683
51~60	18~25	-.34330*	.12213	.005	-.5831	-.1035
	26~30	-.46284*	.10715	.000	-.6732	-.2525
	31~40	-.18070	.10789	.094	-.3925	.0311
	41~50	-.31119*	.11512	.007	-.5372	-.0852
	Above 60	.51667	.38399	.179	-.2371	1.2705
Above 60	18~25	-.85997*	.37939	.024	-1.6047	-.1152
	26~30	-.97951*	.37483	.009	-1.7153	-.2437
	31~40	-.69737	.37504	.063	-1.4336	.0389
	41~50	-.82786*	.37719	.028	-1.5683	-.0874
	51~60	-.51667	.38399	.179	-1.2705	.2371

*. The mean difference is significant at the 0.05 level.

Table 5 The influence of position on outcome management indicators -3

Multiple Comparisons

Dependent Variable: Outcome management indicators

LSD

(I) Position	(J) Position	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Hospital management	Administration & logistics	-.51741*	.20743	.013	-.9246	-.1102
	Clinical medical care	-.37604	.20025	.061	-.7691	.0171

	Medical auxiliary & medical technology	-.33043	.20567	.109	-.7342	.0733
	Superior department	-.34343	.42792	.422	-1.1835	.4966
Administration & logistics	Hospital management	.51741*	.20743	.013	.1102	.9246
	Clinical medical care	.14138*	.06818	.038	.0075	.2752
	Medical auxiliary & medical technology	.18698*	.08275	.024	.0245	.3494
	Superior department	.17398	.38427	.651	-.5804	.9283
Clinical medical care	Hospital management	.37604	.20025	.061	-.0171	.7691
	Administration & logistics	-.14138*	.06818	.038	-.2752	-.0075
	Medical auxiliary & medical technology	.04560	.06263	.467	-.0773	.1686
	Superior department	.03260	.38045	.932	-.7142	.7794
Medical auxiliary & medical technology	Hospital management	.33043	.20567	.109	-.0733	.7342
	Administration & logistics	-.18698*	.08275	.024	-.3494	-.0245
	Clinical medical care	-.04560	.06263	.467	-.1686	.0773
	Superior department	-.01300	.38333	.973	-.7655	.7395
Superior department	Hospital management	.34343	.42792	.422	-.4966	1.1835

Administration & logistics	-.17398	.38427	.651	-.9283	.5804
Clinical medical care	-.03260	.38045	.932	-.7794	.7142
Medical auxiliary & medical technology	.01300	.38333	.973	-.7395	.7655

*. The mean difference is significant at the 0.05 level.

Table 6 The influence of position level on outcome management indicators

Multiple Comparisons

Dependent Variable: Outcome management indicators

LSD

(I) Position level	(J) Position level	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Main leaders	Middle-level cadres	.59579*	.30139	.048	.0041	1.1874
	General staff	.76180*	.29417	.010	.1843	1.3393
Middle-level cadres	Main leaders	-.59579*	.30139	.048	-1.1874	-.0041
	General staff	.16601*	.07463	.026	.0195	.3125
General staff	Main leaders	-.76180*	.29417	.010	-1.3393	-.1843
	Middle-level cadres	-.16601*	.07463	.026	-.3125	-.0195

*. The mean difference is significant at the 0.05 level.

Annex H: Results of Data Analysis

1. Sample composition

This research focuses on the combination of the "55 indicators for the assessment of national tertiary public hospitals" and the hospital performance. A total of 991 valid samples were collected. The basic information of the sample includes gender, age, type of post, working years and the highest educational qualification. The tables and figures drawn from the sample information are shown below.

Table 1 Sample composition

		Frequency	Percentage	Effective percentage	Cumulative percentage
Gender	Male	559	56.4	56.4	56.4
	Female	432	43.6	43.6	100.0
Age	30 years old and under	9	0.9	0.9	0.9
	31-40 years old	190	19.2	19.2	20.1
	41-50 years old	576	58.1	58.1	78.2
	Over 50 years old	216	21.8	21.8	100.0
Type of post	Hospital-level management	252	25.4	25.4	25.4
	Intra-hospital administration	234	23.6	23.6	49.0
	Department management	379	38.2	38.2	87.3
	Competent administrative units	9	0.9	0.9	88.2
	Business related units	117	11.8	11.8	100.0
Working years	1	18	1.8	1.8	1.8
	2	9	0.9	0.9	30.1
	3	18	1.8	1.8	71.8
	5	27	2.7	2.7	93.6
	7	18	1.8	1.8	95.5
	8	27	2.7	2.7	98.2
	9	18	1.8	1.8	100.0
	10	53	5.3	5.3	7.2
	11	27	2.7	2.7	9.9
	13	36	3.6	3.6	13.5
	14	20	2.0	2.0	15.5
	15	45	4.5	4.5	20.1

	16	9	0.9	0.9	21.0
	17	18	1.8	1.8	22.8
	18	45	4.5	4.5	27.3
	19	18	1.8	1.8	29.2
	20	63	6.4	6.4	36.4
	21	45	4.5	4.5	41.0
	22	54	5.4	5.4	46.4
	23	36	3.6	3.6	50.1
	24	45	4.5	4.5	54.6
	25	36	3.6	3.6	58.2
	26	36	3.6	3.6	61.9
	27	27	2.7	2.7	64.6
	28	27	2.7	2.7	67.3
	29	27	2.7	2.7	70.0
	30	81	8.2	8.2	80.0
	31	9	0.9	0.9	80.9
	32	36	3.6	3.6	84.6
	35	27	2.7	2.7	87.3
	37	9	0.9	0.9	88.2
	40	27	2.7	2.7	90.9
Highest educational qualification	Doctor	27	2.7	2.7	2.7
	Master	198	20.0	20.0	22.7
	Bachelor	748	75.5	75.5	98.2
	Graduate of junior college	9	0.9	0.9	99.1
	Below	9	0.9	0.9	100.0
	Total	991	100.0	100.0	
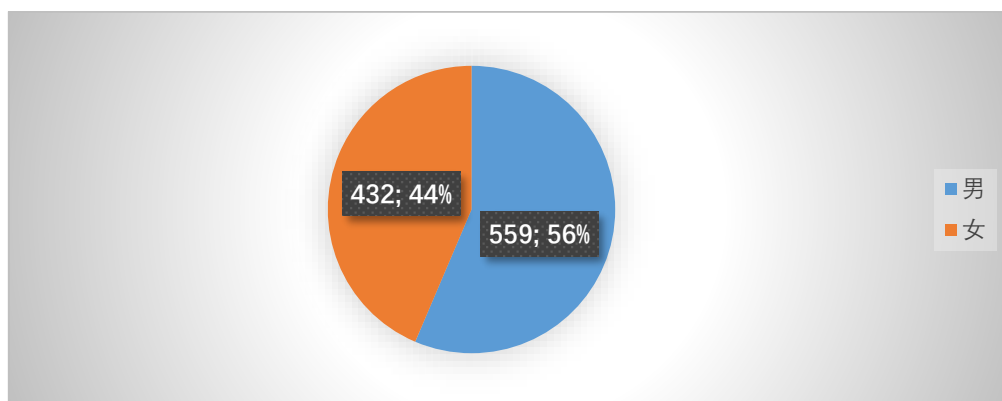
Figure 1 Gender composition of the sample
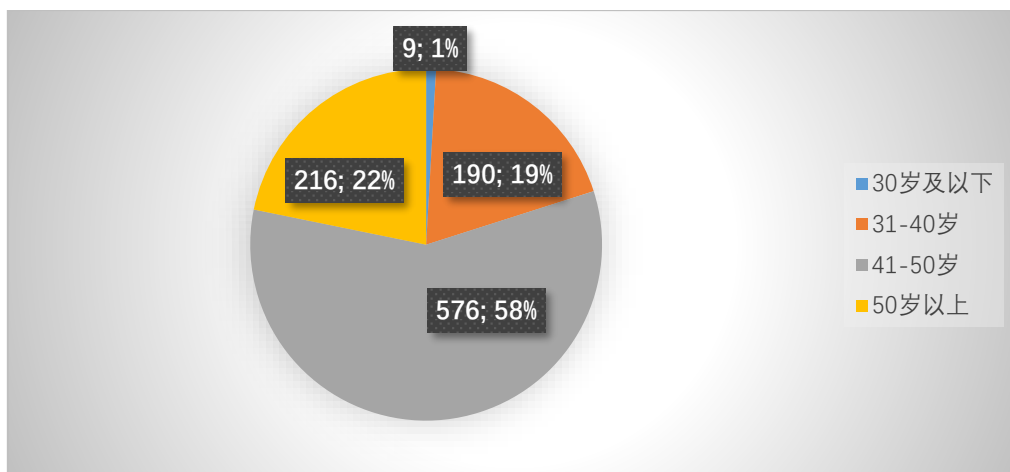
Figure 2 Age composition of the sample
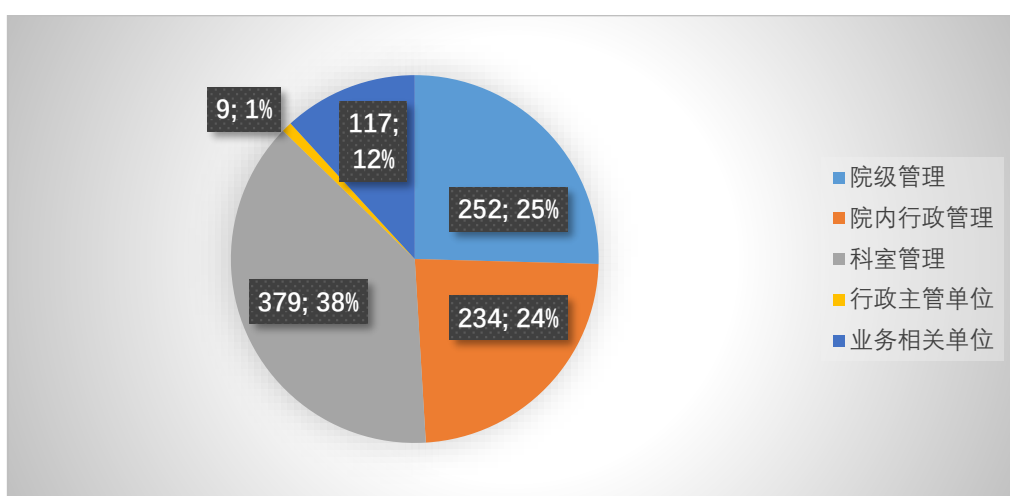
Figure 3 Post category composition of the sample
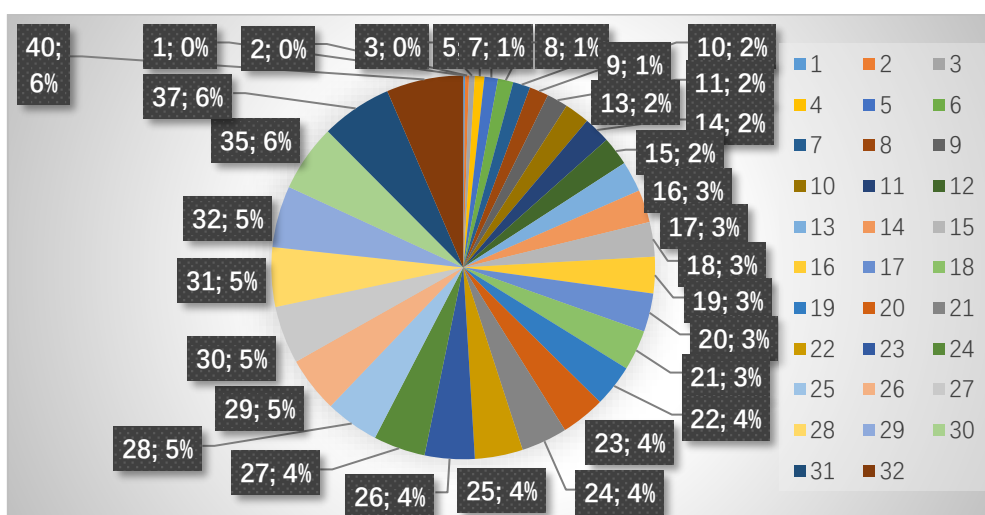
Figure 4 Working years of the sample
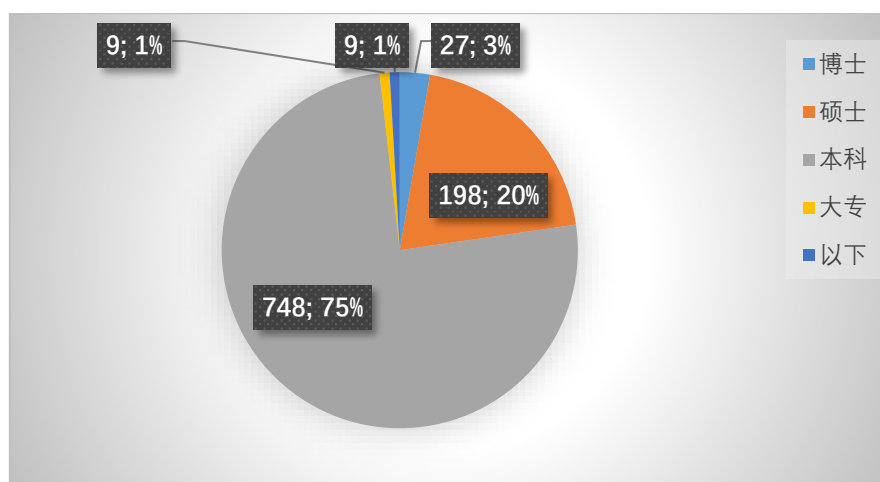
Figure 5 The highest educational qualification of the sample

2. Evaluation of relevant indicators of medical quality

Four options are set for each item, which are organizational goal (feedforward control), process indicator (executive management), outcome indicator (feedback control) and difficult to identify. We conducted frequency analysis and frequency comparison to determine the options most recognized by the respondents, and marked them in a bold way.

1.1 Evaluation of relevant indicators of medical quality (1.1 Evaluation of relevant indicators of medical quality - (1) Proportion of the outpatients to the discharged patients)

		Frequency	Percentage	Effective percentage	Cumulative percentage
Effective	Organizational goal (feedforward control)	234	23.6	23.6	23.6
	Process indicator (executive management)	263	26.5	26.5	50.2
	Outcome indicator (feedback control)	**404**	**40.8**	**40.8**	**90.9**
	Difficult to identify	90	9.1	9.1	100.0
	Total	991	100.0	100.0	

1.1 Evaluation of relevant indicators of medical quality (1. (2) The number of referrals (outpatients, emergency patients, and inpatients)

		Frequency	Percentage	Effective percentage	Cumulative percentage
Effective	Organizational goal (feedforward control)	261	26.3	26.3	26.3
	Process indicator (executive management)	388	39.2	39.2	65.5
	Outcome indicator (feedback control)	306	30.9	30.9	96.4
	Difficult to identify	36	3.6	3.6	100.0
	Total	991	100.0	100.0	

1.1 Evaluation of the indicators of medical quality (1. (3) Proportion of daytime surgeries to elective surgeries

		Frequency	Percentage	Effective percentage	Cumulative percentage
Effective	*Organizational goal (feedforward control)*	*351*	*35.4*	*35.4*	*35.4*
	Process indicator (executive management)	*370*	*37.3*	*37.3*	*72.8*
	Outcome indicator (feedback control)	*207*	*20.9*	*20.9*	*93.6*
	Difficult to identify	*63*	*6.4*	*6.4*	*100.0*
	Total	*991*	*100.0*	*100.0*	

1.1 Evaluation of relevant indicators of medical quality (1. (4) Proportion of discharged patients undergoing surgeries)

		Frequency	Percentage	Effective percentage	Cumulative percentage
Effective	*Organizational goal (feedforward control)*	*180*	*18.2*	*18.2*	*18.2*
	Process indicator (executive management)	*215*	*21.7*	*21.7*	*39.9*
	Outcome indicator (feedback control)	*524*	*52.9*	*52.9*	*92.7*
	Difficult to identify	*72*	*7.3*	*7.3*	*100.0*
	Total	*991*	*100.0*	*100.0*	

1.1 Evaluation of relevant indicators of medical quality (1. (5) Proportion of discharged patients undergoing minimally invasive surgeries)

		Frequency	Percentage	Effective percentage	Cumulative percentage
Effective	*-2*	*9*	*.9*	*.9*	*.9*
	Organizational goal (feedforward control)	*261*	*26.3*	*26.3*	*27.2*
	Process indicator (executive management)	*251*	*25.3*	*25.3*	*52.6*
	Outcome indicator (feedback control)	*425*	*42.9*	*42.9*	*95.5*
	Difficult to identify	*45*	*4.5*	*4.5*	*100.0*
	Total	*991*	*100.0*	*100.0*	

1.1 Evaluation of relevant indicators of medical quality (1. (6) Proportion of discharged patients undergoing fourth-level surgeries)

		Frequency	Percentage	Effective percentage	Cumulative percentage
Effective	*Organizational goal (feedforward control)*	*216*	*21.8*	*21.8*	*21.8*
	Process indicator (executive management)	*215*	*21.7*	*21.7*	*43.5*
	Outcome indicator (feedback control)	*497*	*50.2*	*50.2*	*93.6*
	Difficult to identify	*63*	*6.4*	*6.4*	*100.0*
	Total	*991*	*100.0*	*100.0*	

1.1 Evaluation of relevant indicators of medical quality (1. (7) Proportion of special medical services)

	Frequency	Percentage	Effective percentage	Cumulative percentage
Effective Organizational goal (feedforward control)	396	40.0	40.0	40.0
Process indicator (executive management)	262	26.4	26.4	66.4
Outcome indicator (feedback control)	171	17.3	17.3	83.7
Difficult to identify	162	16.3	16.3	100.0
Total	991	100.0	100.0	

1.1 Evaluation of relevant indicators of medical quality (1. (8) Complication rate of surgical patients)

	Frequency	Percentage	Effective percentage	Cumulative percentage
Effective -2	9	.9	.9	.9
Organizational goal (feedforward control)	227	22.9	22.9	23.8
Process indicator (executive management)	297	30.0	30.0	53.8
Outcome indicator (feedback control)	395	39.9	39.9	93.6
Difficult to identify	63	6.4	6.4	100.0
Total	991	100.0	100.0	

1.1 Evaluation of relevant indicators of medical quality (1. (9) Infection rate of surgical site of Type I incision surgeries)

	Frequency	Percentage	Effective percentage	Cumulative percentage
Effective Organizational goal (feedforward control)	353	35.6	35.6	35.6
Process indicator (executive management)	252	25.4	25.4	61.0
Outcome indicator (feedback control)	341	34.4	34.4	95.5
Difficult to identify	45	4.5	4.5	100.0
Total	991	100.0	100.0	

1.1 Evaluation of relevant indicators of medical quality (1. (10) Quality control of single disease)

	Frequency	Percentage	Effective percentage	Cumulative percentage
Effective Organizational goal (feedforward control)	496	50.1	50.1	50.1
Process indicator (executive management)	342	34.5	34.5	84.6
Outcome indicator (feedback control)	108	10.9	10.9	95.5
Difficult to identify	45	4.5	4.5	100.0
Total	991	100.0	100.0	

1.1 Evaluation of relevant indicators of medical quality (1. (11) Positive rate of large medical equipment examination)

		Frequency	Percentage	Effective percentage	Cumulative percentage
Effective	Organizational goal (feedforward control)	334	33.7	33.7	33.7
	Process indicator (executive management)	279	28.2	28.2	61.9
	Outcome indicator (feedback control)	315	31.8	31.8	93.6
	Difficult to identify	63	6.4	6.4	100.0
	Total	991	100.0	100.0	

1.1 Evaluation of relevant indicators of medical quality (1. (12) Maintenance and quality control management of large medical equipment)

		Frequency	Percentage	Effective percentage	Cumulative percentage
Effective	Organizational goal (feedforward control)	433	43.7	43.7	43.7
	Process indicator (executive management)	369	37.2	37.2	80.9
	Outcome indicator (feedback control)	153	15.4	15.4	96.4
	Difficult to identify	36	3.6	3.6	100.0
	Total	991	100.0	100.0	

1.1 Evaluation of relevant indicators of medical quality (1. (13) The number of clinical tests that have passed the national external quality assessment)

		Frequency	Percentage	Effective percentage	Cumulative percentage
Effective	Organizational goal (feedforward control)	442	44.6	44.6	44.6
	Process indicator (executive management)	270	27.2	27.2	71.8
	Outcome indicator (feedback control)	207	20.9	20.9	92.7
	Difficult to identify	72	7.3	7.3	100.0
	Total	991	100.0	100.0	

1.1 Evaluation of relevant indicators of medical quality (1. (14) Mortality rate of the case group with low risk)

		Frequency	Percentage	Effective percentage	Cumulative percentage
Effective	Organizational goal (feedforward control)	263	26.5	26.5	26.5
	Process indicator (executive management)	350	35.3	35.3	61.9
	Outcome indicator (feedback control)	306	30.9	30.9	92.7
	Difficult to identify	72	7.3	7.3	100.0
	Total	991	100.0	100.0	

1.1 Evaluation of relevant indicators of medical quality (1. (15) Coverage rate of high-quality nursing service wards)

		Frequency	Percentage	Effective percentage	Cumulative percentage
Effective	*Organizational goal (feedforward control)*	*612*	*61.8*	*61.8*	*61.8*
	Process indicator (executive management)	*236*	*23.8*	*23.8*	*85.6*
	Outcome indicator (feedback control)	*98*	*9.9*	*9.9*	*95.5*
	Difficult to identify	*45*	*4.5*	*4.5*	*100.0*
	Total	*991*	*100.0*	*100.0*	

1.1 Evaluation of relevant indicators of medical quality (1. (16) Proportion of reviewed prescriptions to total prescriptions)

		Frequency	Percentage	Effective percentage	Cumulative percentage
Effective	*Organizational goal (feedforward control)*	*504*	*50.9*	*50.9*	*50.9*
	Process indicator (executive management)	*227*	*22.9*	*22.9*	*73.8*
	Outcome indicator (feedback control)	*224*	*22.6*	*22.6*	*96.4*
	Difficult to identify	*36*	*3.6*	*3.6*	*100.0*
	Total	*991*	*100.0*	*100.0*	

1.1 Evaluation of relevant indicators of medical quality (1. (17) Defined daily doses (DDDs))

		Frequency	Percentage	Effective percentage	Cumulative percentage
Effective	*Organizational goal (feedforward control)*	*522*	*52.7*	*52.7*	*52.7*
	Process indicator (executive management)	*299*	*30.2*	*30.2*	*82.8*
	Outcome indicator (feedback control)	*152*	*15.3*	*15.3*	*98.2*
	Difficult to identify	*18*	*1.8*	*1.8*	*100.0*
	Total	*991*	*100.0*	*100.0*	

1.1 Evaluation of relevant indicators of medical quality (1. (18) Proportion of prescriptions of essential drugs for outpatients)

		Frequency	Percentage	Effective percentage	Cumulative percentage
Effective	*-2*	*9*	*.9*	*.9*	*.9*
	Organizational goal (feedforward control)	*558*	*56.3*	*56.3*	*57.2*
	Process indicator (executive management)	*254*	*25.6*	*25.6*	*82.8*
	Outcome indicator (feedback control)	*161*	*16.2*	*16.2*	*99.1*
	Difficult to identify	*9*	*.9*	*.9*	*100.0*
	Total	*991*	*100.0*	*100.0*	

1.1 Evaluation of relevant indicators of medical quality (1. (19) Utilization rate of essential drugs among inpatients)

		Frequency	Percentage	Effective percentage	Cumulative percentage
Effective	Organizational goal (feedforward control)	540	54.5	54.5	54.5
	Process indicator (executive management)	308	31.1	31.1	85.6
	Outcome indicator (feedback control)	125	12.6	12.6	98.2
	Difficult to identify	18	1.8	1.8	100.0
	Total	991	100.0	100.0	

1.1 Evaluation of relevant indicators of medical quality (1. (20) Proportion of the varieties of purchased essential drugs)

		Frequency	Percentage	Effective percentage	Cumulative percentage
Effective	Organizational goal (feedforward control)	665	67.1	67.1	67.1
	Process indicator (executive management)	164	16.5	16.5	83.7
	Outcome indicator (feedback control)	135	13.6	13.6	97.3
	Difficult to identify	27	2.7	2.7	100.0
	Total	991	100.0	100.0	

1.1 Evaluation of relevant indicators of medical quality (1. (21) Utilization rate of the drugs that have won the bid for the centralized procurement of drugs organized by the state)

		Frequency	Percentage	Effective percentage	Cumulative percentage
Effective	Organizational goal (feedforward control)	658	66.4	66.4	66.4
	Process indicator (executive management)	162	16.3	16.3	82.7
	Outcome indicator (feedback control)	153	15.4	15.4	98.2
	Difficult to identify	18	1.8	1.8	100.0
	Total	991	100.0	100.0	

1.1 Evaluation of relevant indicators of medical quality (1. (22) Average appointment rate of outpatients)

		Frequency	Percentage	Effective percentage	Cumulative percentage
Effective	Organizational goal (feedforward control)	371	37.4	37.4	37.4
	Process indicator (executive management)	386	39.0	39.0	76.4
	Outcome indicator (feedback control)	171	17.3	17.3	93.6
	Difficult to identify	63	6.4	6.4	100.0
	Total	991	100.0	100.0	

1.1 Evaluation of relevant indicators of medical quality (1. (23) Average waiting time of outpatients after their appointments)

		Frequency	Percentage	Effective percentage	Cumulative percentage
Effective	Organizational goal (feedforward control)	316	31.9	31.9	31.9
	Process indicator (executive management)	441	44.5	44.5	76.4
	Outcome indicator (feedback control)	180	18.2	18.2	94.6
	Difficult to identify	54	5.4	5.4	100.0
	Total	991	100.0	100.0	

1.1 Evaluation of relevant indicators of medical quality (1. (24) Grading of the application function of the electronic medical record)

		Frequency	Percentage	Effective percentage	Cumulative percentage
Effective	-2	9	.9	.9	.9
	Organizational goal (feedforward control)	551	55.6	55.6	56.5
	Process indicator (executive management)	189	19.1	19.1	75.6
	Outcome indicator (feedback control)	170	17.2	17.2	92.7
	Difficult to identify	72	7.3	7.3	100.0
	Total	991	100.0	100.0	

3. Evaluation of relevant indicators of operational efficiency

Four options are set for each item, which are organizational goal (feedforward control), process indicator (executive management), outcome indicator (feedback control) and difficult to identify. We conducted frequency analysis and frequency comparison to determine the options most recognized by the respondents, and marked them in a bold way.

2.2 Evaluation of relevant indicators of operational efficiency (2. 2 Evaluation of relevant indicators of operational efficiency – (25) Average daily inpatient burden per licensed physician)

		Frequency	Percentage	Effective percentage	Cumulative percentage
Effective	Organizational goal (feedforward control)	261	26.3	26.3	26.3
	Process indicator (executive management)	308	31.1	31.1	57.4
	Outcome indicator (feedback control)	314	31.7	31.7	89.1
	Difficult to identify	108	10.9	10.9	100.0
	Total	991	100.0	100.0	

2.2 Evaluation of relevant indicators of operational efficiency (2. (26) The number of pharmacists per 100 beds)

	Frequency	Percentage	Effective percentage	Cumulative percentage
Effective **Organizational goal (feedforward control)**	**605**	**61.0**	**61.0**	**61.0**
Process indicator (executive management)	117	11.8	11.8	72.9
Outcome indicator (feedback control)	170	17.2	17.2	90.0
Difficult to identify	99	10.0	10.0	100.0
Total	991	100.0	100.0	

2.2 Evaluation of relevant indicators of operational efficiency (2. (27) Proportion of outpatient income to medical income)

	Frequency	Percentage	Effective percentage	Cumulative percentage
Effective Organizational goal (feedforward control)	306	30.9	30.9	30.9
Process indicator (executive management)	236	23.8	23.8	54.7
Outcome indicator (feedback control)	**413**	**41.7**	**41.7**	**96.4**
Difficult to identify	36	3.6	3.6	100.0
Total	991	100.0	100.0	

2.2 Evaluation of relevant indicators of operational efficiency (2. (28) Proportion of outpatient income from the health insurance funds)

	Frequency	Percentage	Effective percentage	Cumulative percentage
Effective -2	9	.9	.9	.9
Organizational goal (feedforward control)	288	29.1	29.1	30.0
Process indicator (executive management)	245	24.7	24.7	54.7
Outcome indicator (feedback control)	**386**	**39.0**	**39.0**	**93.6**
Difficult to identify	63	6.4	6.4	100.0
Total	991	100.0	100.0	

2.2 Evaluation of relevant indicators of operational efficiency (2. (29) Proportion of inpatient income to medical income)

	Frequency	Percentage	Effective percentage	Cumulative percentage
Effective -2	9	.9	.9	.9
Organizational goal (feedforward control)	**351**	**35.4**	**35.4**	**36.3**
Process indicator (executive management)	245	24.7	24.7	61.0
Outcome indicator (feedback control)	341	34.4	34.4	95.5
Difficult to identify	45	4.5	4.5	100.0
Total	991	100.0	100.0	

2.2 Evaluation of relevant indicators of operational efficiency (2. (30) Proportion of inpatient income from the health insurance funds)

		Frequency	Percentage	Effective percentage	Cumulative percentage
Effective	-2	9	.9	.9	.9
	Organizational goal (feedforward control)	306	30.9	30.9	31.8
	Process indicator (executive management)	261	26.3	26.3	58.1
	Outcome indicator (feedback control)	**352**	**35.5**	**35.5**	**93.6**
	Difficult to identify	63	6.4	6.4	100.0
	Total	991	100.0	100.0	

2.2 Evaluation of relevant indicators of operational efficiency (2. (31) Proportion of medical service income (excluding the income from drugs, consumables, and inspections) to medical income)

		Frequency	Percentage	Effective percentage	Cumulative percentage
Effective	-2	18	1.8	1.8	1.8
	Organizational goal (feedforward control)	405	40.9	40.9	42.7
	Process indicator (executive management)	234	23.6	23.6	66.3
	Outcome indicator (feedback control)	325	32.8	32.8	99.1
	Difficult to identify	9	.9	.9	100.0
	Total	991	100.0	100.0	

2.2 Evaluation of relevant indicators of operational efficiency (2. (32) Proportion of income from adjuvant medicines)

		Frequency	Percentage	Effective percentage	Cumulative percentage
Effective	Organizational goal (feedforward control)	486	49.0	49.0	49.0
	Process indicator (executive management)	270	27.2	27.2	76.3
	Outcome indicator (feedback control)	208	21.0	21.0	97.3
	Difficult to identify	27	2.7	2.7	100.0
	Total	991	100.0	100.0	

2.2 Evaluation of relevant indicators of operational efficiency (2. (33) Proportion of personnel expenditure to business expenditure)

		Frequency	Percentage	Effective percentage	Cumulative percentage
Effective	-2	18	1.8	1.8	1.8
	Organizational goal (feedforward control)	497	50.2	50.2	52.0

	Frequency	Percentage	Effective percentage	Cumulative percentage
Process indicator (executive management)	215	21.7	21.7	73.7
Outcome indicator (feedback control)	252	25.4	25.4	99.1
Difficult to identify	9	.9	.9	100.0
Total	991	100.0	100.0	

2.2 Evaluation of relevant indicators of operational efficiency (2. (34) Expenditure of energy consumption per 10,000 revenue)

	Frequency	Percentage	Effective percentage	Cumulative percentage
Effective -2	9	.9	.9	.9
Organizational goal (feedforward control)	**461**	**46.5**	**46.5**	**47.4**
Process indicator (executive management)	269	27.1	27.1	74.6
Outcome indicator (feedback control)	234	23.6	23.6	98.2
Difficult to identify	18	1.8	1.8	100.0
Total	991	100.0	100.0	

2.2 Evaluation of relevant indicators of operational efficiency (2. (35) Balance of income and expenditure)

	Frequency	Percentage	Effective percentage	Cumulative percentage
Effective -2	9	.9	.9	.9
Organizational goal (feedforward control)	261	26.3	26.3	27.2
Process indicator (executive management)	252	25.4	25.4	52.7
Outcome indicator (feedback control)	**424**	**42.8**	**42.8**	**95.5**
Difficult to identify	45	4.5	4.5	100.0
Total	991	100.0	100.0	

2.2 Evaluation of relevant indicators of operational efficiency (2. (36) Ratio of assets to liabilities)

	Frequency	Percentage	Effective percentage	Cumulative percentage
Effective -2	18	1.8	1.8	1.8
Organizational goal (feedforward control)	**396**	**40.0**	**40.0**	**41.8**
Process indicator (executive management)	208	21.0	21.0	62.8
Outcome indicator (feedback control)	306	30.9	30.9	93.6
Difficult to identify	63	6.4	6.4	100.0
Total	991	100.0	100.0	

2.2 Evaluation of relevant indicators of operational efficiency (2. (37) Increase in medical income)

		Frequency	Percentage	Effective percentage	Cumulative percentage
Effective	**Organizational goal (feedforward control)**	**443**	**44.7**	**44.7**	**44.7**
	Process indicator (executive management)	*243*	*24.5*	*24.5*	*69.2*
	Outcome indicator (feedback control)	*269*	*27.1*	*27.1*	*96.4*
	Difficult to identify	*36*	*3.6*	*3.6*	*100.0*
	Total	*991*	*100.0*	*100.0*	

2.2 Evaluation of relevant indicators of operational efficiency (2. (38) Increase in average outpatient fee per visit)

		Frequency	Percentage	Effective percentage	Cumulative percentage
Effective	**Organizational goal (feedforward control)**	**470**	**47.4**	**47.4**	**47.4**
	Process indicator (executive management)	*234*	*23.6*	*23.6*	*71.0*
	Outcome indicator (feedback control)	*260*	*26.2*	*26.2*	*97.3*
	Difficult to identify	*27*	*2.7*	*2.7*	*100.0*
	Total	*991*	*100.0*	*100.0*	

2.2 Evaluation of relevant indicators of operational efficiency (2. (39) Increase in average drug cost per outpatient)

		Frequency	Percentage	Effective percentage	Cumulative percentage
Effective	**Organizational goal (feedforward control)**	**461**	**46.5**	**46.5**	**46.5**
	Process indicator (executive management)	*278*	*28.1*	*28.1*	*74.6*
	Outcome indicator (feedback control)	*216*	*21.8*	*21.8*	*96.4*
	Difficult to identify	*36*	*3.6*	*3.6*	*100.0*
	Total	*991*	*100.0*	*100.0*	

2.2 Evaluation of relevant indicators of operational efficiency (2. (40) Increase in average cost per hospitalization)

		Frequency	Percentage	Effective percentage	Cumulative percentage
Effective	**Organizational goal (feedforward control)**	**452**	**45.6**	**45.6**	**45.6**
	Process indicator (executive management)	*305*	*30.8*	*30.8*	*76.4*
	Outcome indicator (feedback control)	*198*	*20.0*	*20.0*	*96.4*
	Difficult to identify	*36*	*3.6*	*3.6*	*100.0*

Total	*991*	*100.0*	*100.0*

2.2 Evaluation of relevant indicators of operational efficiency (2. (41) Increase in drug cost per hospitalization)

	Frequency	*Percentage*	*Effective percentage*	*Cumulative percentage*
Effective -2	*9*	*.9*	*.9*	*.9*
Organizational goal *(feedforward control)*	***452***	***45.6***	***45.6***	***46.5***
Process indicator (executive management)	*260*	*26.2*	*26.2*	*72.8*
Outcome indicator (feedback control)	*243*	*24.5*	*24.5*	*97.3*
Difficult to identify	*27*	*2.7*	*2.7*	*100.0*
Total	*991*	*100.0*	*100.0*	

2.2 Evaluation of relevant indicators of operational efficiency (2. (42) Comprehensive budget management)

	Frequency	*Percentage*	*Effective percentage*	*Cumulative percentage*
Effective -2	*9*	*.9*	*.9*	*.9*
Organizational goal *(feedforward control)*	***729***	***73.6***	***73.6***	***74.5***
Process indicator (executive management)	*109*	*11.0*	*11.0*	*85.5*
Outcome indicator (feedback control)	*108*	*10.9*	*10.9*	*96.4*
Difficult to identify	*36*	*3.6*	*3.6*	*100.0*
Total	*991*	*100.0*	*100.0*	

2.2 Evaluation of relevant indicators of operational efficiency (2. (43) Standardizing the establishment of chief accountant)

	Frequency	*Percentage*	*Effective percentage*	*Cumulative percentage*
Effective -2	*9*	*.9*	*.9*	*.9*
Organizational goal *(feedforward control)*	***704***	***71.0***	***71.0***	***71.9***
Process indicator (executive management)	*99*	*10.0*	*10.0*	*81.9*
Outcome indicator (feedback control)	*62*	*6.3*	*6.3*	*88.2*
Difficult to identify	*117*	*11.8*	*11.8*	*100.0*
Total	*991*	*100.0*	*100.0*	

4. Evaluation of relevant indicators of sustainable development

Four options are set for each item, which are organizational goal (feedforward control), process indicator (executive management), outcome indicator (feedback control) and difficult

to identify. We conducted frequency analysis and frequency comparison to determine the options most recognized by the respondents, and marked them in a bold way.

3.3 Evaluation of relevant indicators of sustainable development (3.3 Evaluation of relevant indicators of sustainable development – (44) Structure of the professional titles of health technicians)

		Frequency	*Percentage*	*Effective percentage*	*Cumulative percentage*
Effective	**Organizational goal (feedforward control)**	**704**	**71.0**	**71.0**	**71.0**
	Process indicator (executive management)	*161*	*16.2*	*16.2*	*87.3*
	Outcome indicator (feedback control)	*108*	*10.9*	*10.9*	*98.2*
	Difficult to identify	*18*	*1.8*	*1.8*	*100.0*
	Total	*991*	*100.0*	*100.0*	

3.3 Evaluation of relevant indicators of sustainable development (3. (45) Proportions of doctors in anesthesia, pediatrics, severe diseases, pathology and traditional Chinese medicine)

		Frequency	*Percentage*	*Effective percentage*	*Cumulative percentage*
Effective	*-2*	*9*	*.9*	*.9*	*.9*
	Organizational goal (feedforward control)	**677**	**68.3**	**68.3**	**69.2**
	Process indicator (executive management)	*144*	*14.5*	*14.5*	*83.8*
	Outcome indicator (feedback control)	*98*	*9.9*	*9.9*	*93.6*
	Difficult to identify	*63*	*6.4*	*6.4*	*100.0*
	Total	*991*	*100.0*	*100.0*	

3.3 Evaluation of relevant indicators of sustainable development (3. (46) Ratio of doctors and nurses)

		Frequency	*Percentage*	*Effective percentage*	*Cumulative percentage*
Effective	**Organizational goal (feedforward control)**	**686**	**69.2**	**69.2**	**69.2**
	Process indicator (executive management)	*180*	*18.2*	*18.2*	*87.4*
	Outcome indicator (feedback control)	*107*	*10.8*	*10.8*	*98.2*
	Difficult to identify	*18*	*1.8*	*1.8*	*100.0*
	Total	*991*	*100.0*	*100.0*	

3.3 Evaluation of relevant indicators of sustainable development (3. (47) Proportion of the medical staff who received further studies in other hospitals (especially counterpart support hospitals and hospitals in medical alliance) and returned to their original hospitals to work independently)

	Frequency	Percentage	Effective percentage	Cumulative percentage
Effective -2	36	3.6	3.6	3.6
Organizational goal (feedforward control)	**506**	**51.1**	**51.1**	**54.7**
Process indicator (executive management)	179	18.1	18.1	72.8
Outcome indicator (feedback control)	189	19.1	19.1	91.8
Difficult to identify	81	8.2	8.2	100.0
Total	991	100.0	100.0	

3.3 Evaluation of relevant indicators of sustainable development (3. (48) The pass rate of the hospital physicians taking part in the physician qualification examination for the first time)

	Frequency	Percentage	Effective percentage	Cumulative percentage
Effective Organizational goal (feedforward control)	290	29.3	29.3	29.3
Process indicator (executive management)	251	25.3	25.3	54.6
Outcome indicator (feedback control)	**396**	**40.0**	**40.0**	**94.6**
Difficult to identify	54	5.4	5.4	100.0
Total	991	100.0	100.0	

3.3 Evaluation of relevant indicators of sustainable development (3. (49) The work effectiveness of hospitals in cultivating medical talents)

	Frequency	Percentage	Effective percentage	Cumulative percentage
Effective **Organizational goal (feedforward control)**	**353**	**35.6**	**35.6**	**35.6**
Process indicator (executive management)	224	22.6	22.6	58.2
Outcome indicator (feedback control)	342	34.5	34.5	92.7
Difficult to identify	72	7.3	7.3	100.0
Total	991	100.0	100.0	

3.3 Evaluation of relevant indicators of sustainable development (3. (50) Funds for scientific research projects per 100 health technicians)

	Frequency	Percentage	Effective percentage	Cumulative percentage

		Frequency	Percentage	Effective percentage	Cumulative percentage
Effective	**Organizational goal** **(feedforward control)**	**542**	**54.7**	**54.7**	**54.7**
	Process indicator (executive management)	*153*	*15.4*	*15.4*	*70.1*
	Outcome indicator (feedback control)	*188*	*19.0*	*19.0*	*89.1*
	Difficult to identify	*108*	*10.9*	*10.9*	*100.0*
	Total	*991*	*100.0*	*100.0*	

3.3 Evaluation of relevant indicators of sustainable development (3. (51) Conversion amount of scientific research achievements per 100 health technicians)

		Frequency	Percentage	Effective percentage	Cumulative percentage
Effective	*Organizational goal (feedforward control)*	*252*	*25.4*	*25.4*	*25.4*
	Process indicator (executive management)	*209*	*21.1*	*21.1*	*46.5*
	Outcome indicator **(feedback control)**	**350**	**35.3**	**35.3**	**81.8**
	Difficult to identify	*180*	*18.2*	*18.2*	*100.0*
	Total	*991*	*100.0*	*100.0*	

3.3 Evaluation of relevant indicators of sustainable development (3. (52) Comprehensive evaluation rating of public credit)

		Frequency	Percentage	Effective percentage	Cumulative percentage
Effective	**Organizational goal** **(feedforward control)**	**342**	**34.5**	**34.5**	**34.5**
	Process indicator (executive management)	*191*	*19.3*	*19.3*	*53.8*
	Outcome indicator (feedback control)	*341*	*34.4*	*34.4*	*88.2*
	Difficult to identify	*117*	*11.8*	*11.8*	*100.0*
	Total	*991*	*100.0*	*100.0*	

5. Evaluation of relevant indicators of satisfaction

Four options are set for each item, which are organizational goal (feedforward control), process indicator (executive management), outcome indicator (feedback control) and difficult to identify. We conducted frequency analysis and frequency comparison to determine the options most recognized by the respondents, and marked them in a bold way.

4.4 Evaluation of relevant indicators of satisfaction (4.4 Evaluation of relevant indicators of satisfaction – (53) Outpatient satisfaction)

		Frequency	Percentage	Effective percentage	Cumulative percentage
Effective	*-2*	*18*	*1.8*	*1.8*	*1.8*
	Organizational goal (feedforward control)	*261*	*26.3*	*26.3*	*28.2*

	Frequency	Percentage	Effective percentage	Cumulative percentage
Process indicator (executive management)	*298*	*30.1*	*30.1*	*58.2*
Outcome indicator (feedback control)	**351**	**35.4**	**35.4**	**93.6**
Difficult to identify	*63*	*6.4*	*6.4*	*100.0*
Total	*991*	*100.0*	*100.0*	

4.4 Evaluation of relevant indicators of satisfaction (4. (54) Inpatient satisfaction)

		Frequency	Percentage	Effective percentage	Cumulative percentage
Effective	*-2*	*9*	*.9*	*.9*	*.9*
	Organizational goal (feedforward control)	*288*	*29.1*	*29.1*	*30.0*
	Process indicator (executive management)	*298*	*30.1*	*30.1*	*60.0*
	Outcome indicator (feedback control)	**342**	**34.5**	**34.5**	**94.6**
	Difficult to identify	*54*	*5.4*	*5.4*	*100.0*
	Total	*991*	*100.0*	*100.0*	

4.4 Evaluation of relevant indicators of satisfaction (4. (55) Medical staff satisfaction)

		Frequency	Percentage	Effective percentage	Cumulative percentage
Effective	*Organizational goal* (feedforward control)	*270*	*27.2*	*27.2*	*27.2*
	Process indicator (executive management)	*298*	*30.1*	*30.1*	*57.3*
	Outcome indicator (feedback control)	**387**	**39.1**	**39.1**	**96.4**
	Difficult to identify	*36*	*3.6*	*3.6*	*100.0*
	Total	*991*	*100.0*	*100.0*	