# Analysis of the Effect of DRG Medical Insurance Payment on the Performance of Hospital Service in Hunan Province

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**Research**

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# Analysis of the effect of DRG medical insurance payment on the performance of hospital service in Hunan Province

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## Abstract

**Background:** Performance evaluation is an important means to promote the hospital's medical ability and management ability. Therefore, the aim of this study was to explore the effect of DRG payment mode on the performance of inpatient services in large tertiary hospitals.

**Methods:** Based on the relevant report data of DRG pilot hospital and control hospital from 2015 to 2020, CN-DRG was used as grouping method, and case mix index (CMI), DRG group number, cost consumption index, time consumption index, low-risk group mortality and other indicators were used to analyze the impact of DRG on hospital inpatient service performance from the aspects of medical service ability, medical service efficiency, medical safety.

**Results:** The average annual growth rate of DRG group was 4.07%, the average annual growth rate of CMI was 0.95%, the time consumption index and cost consumption index were lower than 1, and the mortality rate of low-risk group decreased by 27.56%.

**Conclusions:** DRG medical insurance payment can improve the performance of inpatient service in the process of hospital management.

**Key Words:** Diagnosis related groups, Performance of inpatient services, Case mix index

## Background

Prepayment system generally refers to that before the occurrence of medical expenses, insurance institutions pay medical expenses to medical service providers in advance according to certain standards. The payment standard is fixed in a certain period of time, and then adjusted according to the actual situation after a period of time. Prepayment system mainly includes total prepayment system, capitation payment and DRGs payment [1-2]. The prepayment system was first used in the United States in 1983 [3]. In 1984, the payment mode of Medicare for hospitals was changed from payment by service items to DRGs prepayment system [4]. The application of DRGs prepaid payment system has not only greatly changed the medical service industry of the United States, but also had a great impact on the global medical insurance payment and medical system reform. In 1993, Germany began to enforce the total prepayment system, and the payment mode of medical insurance changed from the post payment system to the prepayment system based on the total prepayment. In 2010, the national unified DRGs payment mode was established in Germany [5].

As a special service, medical service itself has the characteristics of diversity, high

risk, information asymmetry and difficult to compare [6]. Scientific and reasonable evaluation of medical service performance is not only the basis of hospital management, but also the difficulty and focus. Performance evaluation is an important means to promote the hospital's medical ability and management ability. Because of the difference of hospital level and diagnosis and treatment ability, it is difficult to use a unified standard to evaluate [7]. Among many case mix tools, DRG is the most widely used in health care, and it is a more reasonable tool [8]. Based on the trial implementation of DRG in our country, this study analyzes the performance of inpatient medical services in a hospital in Hunan Province according to the changes of relevant indicators during the trial operation of DRG, and compares the situation of the same type of patients in different hospitals and departments, so as to provide reference for the promotion of DRG-PPS.

## Materials and Methods

### Materials

Based on the performance evaluation platform of inpatient medical service in Hunan Province, the relevant information of a Grade-A hospital in Hunan Province and other grade-3 general hospitals in Hunan Province (hereinafter referred to as the control hospital) from 2015 to 2020 were collected.

### Methods

According to the DRG related information fed back by the performance evaluation platform of inpatient medical services in Hunan Province, the index items that can be analyzed and queried include: enrollment rate, number of analyzed cases, number of DRG groups, CMI, cost consumption index, time consumption index, low-risk group mortality, medium and low-risk mortality. The evaluation of inpatient service is mainly analyzed from three aspects: ability, efficiency and medical safety. Based on DRG, the capacity of medical institutions includes: DRG number and CMI, which represent the coverage of cases in the hospital, the range of case types and the technical difficulty of cases [9]. Efficiency includes cost consumption index and time consumption index, which respectively indicate the cost of the same disease and the length of hospital stay [10]. The medical safety index uses low-risk mortality to reflect the probability of death in DRG group with low mortality in the whole province [11].

## Results

### Indicators of medical service capacity

#### Number of DRG groups

DRG group number represents the disease range of patients in the hospital, which reflects the breadth of diagnosis and treatment [12]. Because the number of DRG groups in each tertiary general hospital could not be transferred, the number of DRG groups in the pilot hospital was compared with the total number of DRG groups in the control hospital, and the change of disease range in the pilot hospital from 2015 to 2020 was analyzed. The proportion of general hospitals in the pilot group was gradually increasing, and the proportion of all tertiary hospitals in the pilot group was increasing. The average annual growth rate of pilot hospitals was 4.07%, and that of control hospitals was 1.44%, as shown in Table 1.

Table 1. Number of DRG groups in pilot hospitals and control hospitals from 2015 to 2020 (Group)

| year | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|
| Pilot | 525 | 551 | 568 | 593 | 618 | 641 |

| | | | | | | |
|---|---|---|---|---|---|---|
| hospital | | | | | | |
| Control hospital | 632 | 639 | 692 | 657 | 668 | 679 |

CMI

CMI of a medical institution refers to the average DRG weight value of a medical institution. The index can reflect the medical technical difficulty of medical institutions. If the index is greater than 1, the medical technical difficulty of medical institutions is higher than the average level [13]. The CMI of pilot hospitals will gradually increase from 2015 to 2020, with an average annual growth rate of 0.95%, while that of control hospitals will decrease by 0.19%, as shown in Table 2.

Table 2. CMI changes of pilot hospitals and control hospitals from 2015 to 2020

| year | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|
| Pilot hospital | 1.03 | 1.05 | 1.07 | 1.06 | 1.07 | 1.08 |
| Control hospital | 1.04 | 1.02 | 1.03 | 1.04 | 1.03 | 1.03 |

**Indicators of efficiency management**

**Cost consumption index**

The cost consumption index refers to the average value of the ratio sum of the average case cost of each DRG group in a medical institution and the average case cost of each DRG group in the same level hospitals in the whole province. The index greater than 1 indicates that the cost of diagnosis and treatment of diseases in medical institutions is higher than the average level [14]. The cost consumption index of pilot hospitals in 2015-2020 is less than 1, showing a decreasing trend, which is lower than the cost consumption index of tertiary general hospitals every year, as shown in Table 3. From 2015 to 2020, the average inpatient cost is gradually increasing, which is 1000-2000 yuan lower than that of tertiary general hospitals.

Table 3. Cost consumption index of pilot hospitals and control hospitals from 2015 to 2020

| year | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|
| Pilot hospital | 0.92 | 0.91 | 0.89 | 0.88 | 0.88 | 0.86 |
| Control hospital | 1.02 | 1.00 | 0.98 | 0.96 | 0.95 | 0.95 |

**Time consumption index**

The time consumption index refers to the average of the ratio sum of the average length of stay of each DRG group in a medical institution and the average length of stay of each DRG group in the same level hospitals in the province. The index greater than 1 indicates that the time consumption of diagnosis and treatment of diseases in medical institutions is higher than the average level [15]. From 2015 to 2020, the time consumption index of pilot hospitals is less than 1, showing a decreasing trend, which is basically the same as the time consumption index of tertiary general hospitals. See Table 4. The average annual decrease

of specific length of stay is 3.65%.

Table 4. Time consumption index of pilot hospitals and control hospitals from 2015 to 2020

| year | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|
| Pilot hospital | 0.95 | 0.95 | 0.94 | 0.96 | 0.94 | 0.93 |
| Control hospital | 0.95 | 0.95 | 0.94 | 0.95 | 0.94 | 0.94 |

**Process management indicators**

**Proportion of inpatient drugs**

The proportion of inpatient drugs is the proportion of drug cost to average case cost. The drug cost provided by Hunan information platform includes blood products related cost. The index reflects the level of medical quality management and the rationality of drug use in a certain way [16]. The proportion of drugs in pilot hospitals showed a decreasing trend from 2015 to 2020, with an average annual reduction rate of 10.50%, and that in control hospitals was 7.23%, as shown in Table 5. The proportion of drugs in pilot hospitals was higher than that in control hospitals, but the trend of decrease was obvious in recent five years. The absolute value of specific drug cost was the same as that in control hospitals, but lower than that in control hospitals in recent two years.

Table 5. Changes of drug proportion in pilot hospitals and control hospitals from 2015 to 2020 (%)

| year | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|
| Pilot hospital | 38.57 | 37.23 | 33.58 | 30.52 | 25.13 | 22.15 |
| Control hospital | 32.14 | 30.38 | 27.89 | 25.71 | 23.33 | 22.08 |

**Proportion of inpatient consumption**

The proportion of inpatient consumption is the proportion of consumables cost to the average cost. The index reflects the level of medical quality management and the rationality of consumables use [17]. From 2015 to 2020, the proportion of consumption in pilot hospitals showed an increasing trend, with an average annual growth rate of 4.85%, and that in control hospitals was 3.29%, as shown in Table 6. The proportion of consumption in pilot hospitals is lower than that in control hospitals, but there is a certain growth trend in recent five years. In terms of absolute cost, the average consumption cost of consumables in pilot hospitals is 500-1000 yuan lower than that in control hospitals.

Table 6. The change of consumption proportion between pilot hospitals and control hospitals from 2015 to 2020 (%)

| year | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|
| Pilot hospital | 34.12 | 35.59 | 36.53 | 38.56 | 41.48 | 43.23 |
| Control hospital | 36.45 | 37.19 | 38.35 | 39.53 | 41.57 | 42.86 |

**Indicators of medical quality**

**Mortality in low risk group**

Medical safety indicators can use "low risk group mortality" to reflect the probability of death of non-fatal disease cases [18]. From 2015 to 2020, the mortality rate of low-risk group in pilot hospitals showed a decreasing trend, with an average annual reduction rate of 21.21%, and that of control hospitals was 9.71%, as shown in Table 7.

Table 7. Mortality of low risk group in pilot hospitals and control hospitals from 2015 to 2020 (%)

| year | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|
| Pilot hospital | 0.12 | 0.08 | 0.06 | 0.07 | 0.05 | 0.03 |
| Control hospital | 0.05 | 0.04 | 0.05 | 0.02 | 0.04 | 0.03 |

**Treatment and quality evaluation of key diseases**

The development of medical quality and discipline construction is closely related to the breadth and difficulty of diseases. The application of the number of moderate risk cases and mortality can objectively reflect the level of discipline construction [19]。 From 2015 to 2020, the number of cases in the high-risk group of pilot hospitals increased gradually, with an average annual growth rate of 10.32%, and the mortality showed a decreasing trend, with an average annual reduction rate of 4.95%. From 2015 to 2020, the number of cases in the high-risk group of control hospitals increased gradually, with an average annual growth rate of 4.35%, and the mortality showed a decreasing trend, with an average annual reduction rate of 1.62%, as shown in tables 8 and 9.

Table 8. Cases of medium and high risk groups in pilot hospitals and control hospitals from 2015 to 2020 (cases)

| year | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|
| Pilot hospital | 4923 | 5132 | 5978 | 6468 | 7652 | 8046 |
| Control hospital | 5113 | 5356 | 5689 | 6045 | 6135 | 6325 |

Table 9. Mortality rate of high risk group in pilot hospital and control hospital from 2015 to 2020(%)

| year | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|
| Pilot hospital | 2.72 | 2.65 | 3.12 | 1.98 | 2.25 | 2.11 |
| Control hospital | 2.68 | 2.59 | 2.87 | 2.53 | 2.39 | 2.47 |

**Discussion and suggestions**

**Rationality and challenges of DRG in improving performance evaluation of inpatient services in pilot hospitals**

Since 2015, DRG has been applied to clinical departments in pilot hospitals, and relevant assessment indicators have been formulated, such as average length of stay, average case cost, mortality rate, DRG group number, CMI, drug consumption ratio and absolute value, which have achieved good results. Through the assessment of clinical

departments, the overall hospital service evaluation has achieved good results.

**Analysis of medical service ability**

From the two indicators of DRG group number and CMI, the indicators of pilot hospitals showed a good trend in the past five years. The hospitals attached importance to the balanced development of various disciplines, and gave some policy support to vulnerable disciplines. The number of DRG groups did not increase year by year due to the adjustment of DRG grouping device, but the proportion of DRG groups in the total DRG groups of tertiary general hospitals increased year by year. The hospital attaches great importance to the admission and treatment of patients with acute and critical diseases, formulates assessment indicators for CMI of departments, encourages departments to admit patients with severe diseases, formulates system guarantee for emergency treatment priority, and strengthens discipline reform based on organ system and multi-disciplinary cooperation, which makes it more difficult for hospitals to admit and treat patients.

**Hospital efficiency analysis**

In the past five years, the cost consumption index and time consumption index of the pilot hospitals are in the third quadrant level, that is, the cost of treating similar diseases is lower, and the length of stay is shorter. Although the absolute cost has increased, it is still lower than that of the same level hospitals. Because of the implementation of management by objectives and performance management, hospitalization days have a downward trend. Overall, the efficiency management is at a better level.

**Analysis of process index results**

Due to the management requirements of the superior management department for the proportion of drugs and consumption, according to the same level and similar standards, the hospital implemented target management for departments. From the results, the proportion of drugs decreased to a certain extent, and the proportion of consumption increased to a certain extent, but the drug cost was slightly higher than that of the control hospital, and the consumption of consumables was lower than that of the control hospital. Based on the case cost analysis, the absolute cost of drugs and consumables in the pilot hospitals is relatively reasonable, and the main reason for the higher proportion is the lack of inspection and treatment projects.

**Analysis of medical quality and safety index**

From the results, the low-risk mortality rate of the pilot hospitals has decreased significantly. The main reason is that the hospital attaches great importance to the filling quality of the first page of medical records, has carried out many times of training for various clinical departments, and has applied information management tools to electronize the first page of medical records, which requires diagnosis planning, and the correct rate of main diagnosis selection has been greatly improved.

**Restriction of DRG grouping conditions**

Through DRG management, the pilot hospitals have achieved good results, and some problems have been found in the application process, such as DRG grouping conditions do not include transfer factors, patients in the same group sometimes have great differences due to transfer factors. The update of grouping device can not keep up with the development of medical technology, and some new technologies and new businesses are not reflected in the grouping device.

**Suggestions**

**Clinical pathway management of major DRG groups**

Through the analysis of DRG groups, the main DRG groups in the hospital were selected, the cost and time of main diseases were analyzed by DRG, and the clinical pathway of main DRG groups was formulated. To sort out the clinical pathway of the main DRG groups, the management department carries out the index monitoring of the main groups every month, finds out the problems, puts forward the corrective measures in time, and makes continuous improvement [20].

**DRG was used to evaluate the attending physician group**

The application of DRG in performance evaluation among different departments will inevitably be unfair because of the different kinds of diseases in the Department. However, the application of DRG in performance evaluation and analysis among different attending physician groups in the same discipline is highly comparable, which is conducive to the fine management of the discipline. At the same time, it is convenient for the department management to implement the management objectives level by level, so as to ensure its full play use [21].

**Evaluation and improvement of discipline construction**

The application of DRG in the evaluation and improvement of discipline construction is mainly through the analysis of disease data [22]. At present, we mainly select the re-entry indicators, such as the breadth and difficulty of diseases, the proportion of medical records at various risks, the mortality and re admission and re operation, the efficiency analysis of main diseases and the treatment effect analysis. It can provide reference for the development of each specialty, intervene and manage the dominant and missing diseases, and further improve the level of discipline development [23].

**Strengthening the construction of medical information system**

With the promotion of DRG payment mode, it is necessary to continuously strengthen the information level of medical institutions to meet the current demand of DRG payment management. DRG system needs to collect a large amount of data and develop electronic health records including personal information, disease information, treatment information, length of stay, cost, etc [24]. Perfect electronic health records can timely track the health status of patients and ensure that patients get the required medical services [25]. In addition, based on the powerful hospital information system, we can review the historical cost data, carry out hospital cost analysis, assist performance management, and ensure the smooth operation of the hospital. At present, the standardization level of medical insurance informatization and hospital information system is not high, and the interconnection is not mutual, which leads to the supervision work cannot be fully in place. Reliable information detection system is an important link to improve the effect of medical services. Through health monitoring, it can predict the future health status of residents, early warn the potential risks of the medical system, promote the government's planning for disease prevention, increase the investment in disease prevention, explore and develop the early warning model of disease risk, and intervene the people who may be sick in advance, so as to improve the health resources Allocation and use efficiency, to protect the health of the population [26-27].

**Abbreviations**

DRG: Diagnosis Related Groups; CMI: Case Mix Index; CN-DRG: DRG-PPS: Diagnosis Related Groups-Prospective Payment System

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