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ORIGINAL RESEARCH

Impact of China's Diagnosis-Intervention Packet Policy on Hospitalization Costs for Patients With Malignant Tumors: A 2019–2022 Interrupted Time Series Analysis

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Purpose: China's diagnosis-intervention packet (DIP) policy, a medical insurance payment system leveraging big data, was implemented in Wuhu, China, in January 2021. Studies have proven that the DIP has been effective in reducing medication costs for elderly hospital patients with hypertension. However, research on hospitalization costs for other patients remains limited. As the incidence of malignant tumors has increased dramatically in China, this study assesses the system's impact on hospitalization costs for patients with malignant tumors to confirm its broader effects.

Patients and Methods: Data on patients with malignant tumors (ICD codes C00-C97) were collected from a tertiary medical institution in Wuhu, using the policy's implementation in January 2021 as the beginning timepoint. Outcome indicators included average monthly hospitalization expenses and sub-expenses for hospitalized patients with malignant tumors. A 48-month time-series database was constructed and the interruption time series model used to evaluate the changing trends in expenses before and after the DIP implementation.

Results: After DIP implementation, average hospitalization costs for patients with malignant tumors showed a statistically significant downward trend. Subgroup analysis revealed that patients with shorter hospital stays (1–5 days) and cured outcomes saw the biggest expense drop from hospital cost-control effects. The DIP policy also affected cost structures, initially increasing diagnostic fees and consumable costs, but significantly reducing treatment fees, medication costs, and other related costs.

Conclusion: The study confirmed the effectiveness of the DIP policy in controlling hospitalization costs for patients with malignant tumors. Going forward, the government should optimize DIP rules to clarify cost calculation methods and prevent excessive use of high-cost diagnostics and consumables. Continued monitoring and evaluation are essential to ensure that the policy's benefits are maintained over time. Medical institutions should improve resource allocation, diagnosis, and treatment efficiency; reduce unnecessary stays; and provide tailored treatment plans and cost support for patients with poor prognosis.

Keywords: medical insurance payment system, malignant tumor, medical costs, hospital expense cost structures

Introduction

Malignant tumors are deadly forms of a disease that pose severe threats to human health.[1] In China, the incidence of malignant tumors has increased in recent years, leading to a significant rise in related medical expenses and placing a heavy financial burden on patients and society.[2,3] To address this, China introduced the diagnosis-intervention packet (DIP), an innovative medical insurance payment method, to control unreasonable medical costs and ensure the safe and effective use of medical insurance. Previous studies have shown that DIP policy reduced the medication burden of elderly hospital patients with hypertension with lasting effects.[4] However, the effectiveness of such policy intervention will differ across clinical departments and patient subpopulations, and its use alters cost structures. To assess the broader

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impacts of the policy, our study analyzes the changes in hospitalization costs for patients with malignant tumors before and after the DIP reform, using inpatients from a select hospital as our sample. Our results provide empirical support for further advancements in medical insurance payment reform in China.

Methods

Study Design

We assessed the impact of the DIP policy by applying an interrupted time-series (ITS) analysis. Using 48-months of data from a tertiary medical institution in Wuhu City, China, we analyzed changes in hospitalization costs for patients with malignant tumors before (January 2019 to December 2020) and after (January 2021 to December 2022) DIP implementation. Our objective was to evaluate how DIP affected the hospitalization costs of Medicare patients specifically.

Data Sources

Our data came from a tertiary hospital in Wuhu. The records were from basic medical insurance patients discharged between January 1, 2019, and December 31, 2022, whose hospitalization costs were settled via the DIP system. According to the International Classification of Diseases and Related Health Problems (ICD-10), we selected the records of patients with malignant tumors (main diagnostic code range: C00-C97). We collected information on the patient's sex, age, length of hospital stays, disease coding, disease diagnosis, treatment, and hospitalization costs.

Outcome Measures

Our primary outcome measure was the average monthly hospitalization cost for these patients. We also conducted stratified analyses based on length of stay (1–5, 6–10, 11–15, 16–20, 21 and above days) and treatment outcomes (cured, improved, not recovered, deceased, and other) to assess the DIP impact on different patient groups.

Our secondary outcome measures included sub-costs of the average hospitalization costs and an evaluation of the effect of the DIP on the hospital's cost structure. We extracted 28 detailed data points on hospitalization expenses. The average structural data for hospitalization costs were sorted according to the Notice on the Revision of the Front Page of Inpatient Medical Records. The comprehensive medical treatment, basic treatment, rehabilitation, and traditional Chinese medicine were combined into "treatment fees." Western medicine and traditional Chinese medicine were combined into "medication costs." Blood product costs were included in the scope of other costs. The original category analyzed diagnostic fees and consumable costs.

Statistical Analysis

To evaluate the effects of the DIP policy on controlling medical expenses, we aggregated the hospitalization costs by monthly discharge date and created the 48-month time-series database. Since the DIP was implemented in Wuhu on January 1, 2021, we chose this date as the starting point.[5] Thus, the pre-intervention period was from January 2019 to December 2020 (24 months), and the post-intervention period was from January 2021 to December 2022 (24 months).

We used the ITS model to evaluate the impact of the DIP on patient hospitalization and sub-costs.[6,7] We applied segmented regression models with baseline trend control to estimate changes in the outcome variables after DIP implementation. We also used the Newey-West method for least squares estimation for adjusted Durbin-Watson (DW) values between 1.5 and 2.5, indicating no significant autocorrelation.[8] For DW values <1.5 or >2.5, indicating significant autocorrelation, we used the Prais-Winsten method for the generalized least squares estimation and adjusted DW values to assess model performance.[9] The regression model was as follows:

$$Y_t=\beta_0+\beta_1 Time+\beta_1 Intervention+\beta_3 Post+\varepsilon$$

Y_t is the outcome variable at time t (month); Time is a continuous variable ranging from 0 to 47; Intervention is a dummy variable (zero before the reform and one after); Post is a continuous variable set to zero before the intervention and (time point - intervention point + one) after; β_0 is the baseline level before the intervention; β_1 is the pre-intervention

slope; β_2 is the post-intervention level change reflecting immediate effects; β_3 is the difference in slopes before and after intervention representing sustained effects; and ε is the unexplained random error. We conducted the statistical analyses using Stata 18.0, with a significance level of $\alpha = 0.05$.

DIP Policy Measures

The Development and Application of DIP in China

DIP is a medical insurance payment system summarized and refined based on local practices in China. It originated in Huaian City, Jiangsu Province. In October 2003, the Huaian Municipal People's Government Office issued relevant documents, first proposing the adoption of DIP payment methods for basic medical insurance payments, with the aim of better controlling medical expenses and improving medical service efficiency.[10] With the successful practice of the DIP payment system in Huaian City, Jiangsu Province, and other regions, this system has gradually been borrowed and promoted by more areas.

Since June 2017, China has begun to encourage the implementation of medical insurance payment reform focused on DIP. This reform aims to control medical expenses, improve medical service efficiency, and optimize resource allocation through more scientific and reasonable medical insurance payment methods.

In October 2020, the National Healthcare Security Administration issued the "Pilot Work Plan for Total Budget Control Based on Regional Point System and Payment by Diagnosis-Related Groups (DIP)."[11] This plan officially initiated a pilot reform program that combines the total budget of medical insurance with a point system, utilizes big data for payment by diagnosis-related groups, with prefecture-level cities serving as the coordinating units.

DIP Payment Principles

Value-based Purchasing: Emphasize regional cap budget management and payment standard setting, reflecting the complexity and inherent laws of medical services.

Based on Big Data and Informatization: Utilize big data for disease grouping, regional cap budgeting, point value calculation, etc., ensuring the scientificity and rationality of the payment system.

Guiding Rational Resource Allocation: Combine the point method with regional cap budgeting to guide the rational allocation of medical and health resources, reflecting the technical labor value of medical staff.

Ensuring Basic Medical Needs: Effectively safeguard the basic medical needs of insured individuals and promote the steady and efficient operation of medical insurance funds.

Technical Requirements for DIP Payment

Data Processing Capability: The ability to process and analyze large amounts of medical data, including case information, cost information, etc.

Information System Construction: The need to establish a complete information system to support data collection, storage, analysis, transmission, and other functions.

Professional Team Support: The requirement for a professional talent team in medical care, statistics, information technology, etc., to ensure the correct implementation and effective management of the DIP method.

Implementation Costs and Time Consumption of DIP Payment

The implementation costs of the DIP method mainly include information system construction costs, data processing costs, professional team operating costs, etc. These costs vary by region, hospital size, and other factors, but overall, the implementation of the DIP method requires significant initial investment and ongoing operation and maintenance costs.

In terms of time consumption, the implementation of the DIP method involves multiple stages, including data preparation, information system construction, disease grouping, regional cap budget formulation, point value calculation, etc. These stages require some time, but the specific duration varies by region, hospital size, and other factors. It takes several months or even years from the initiation of implementation to full application.

The DIP Payment Measures in Wuhu

The Wuhu Healthcare Security Administration implemented specific DIP measures based on China's medical insurance payment reform plan. The intervention has been in place since January 2021 and includes four main parts: 1. determining the disease category grouping directory; 2. the disease category score; 3. the weight coefficient of medical institutions; and 4. the medical insurance payment cost.[12]

1. The system objective is to determine disease category grouping directories. A directory is based on data from medical insurance hospitalization cases in designated medical institutions in Wuhu City over the past three years. It considers factors such as the nature of the disease, treatment costs, and resource consumption and follows the rules of disease diagnosis and surgical operation. The main goal is to cover common and frequently occurring diseases using the International Classification of Diseases, 10th Revision (ICD-10) disease diagnosis standard and the ICD-9-CM-3 surgical coding classification. The DIP disease category directory is then created based on the above.

2. The disease score is determined based on the principle of one RMB (Chinese yuan). Scores that are significantly higher or lower are avoided. Specific scores are assigned according to the treatment of the disease, whether surgical or nonsurgical. Unpublished disease scores refer to medical insurance payments within 80% of the costs. The score is determined by comparing medical institutions of the same level. The unit price of the disease score is also calculated. In exceptional circumstances, a particular case list is referenced.

3. The settlement weight coefficient of the medical institution needs to be determined. This coefficient is based on the level of the medical institution. It also considers treatment methods categorized as nonsurgical and surgical. The settlement weight coefficient is dynamically adjusted.

4. The medical insurance payment costs need to be determined. The payment of medical insurance expenses follows a monthly pre-settlement and year-end liquidation process. The total budget of the medical insurance fund for hospitalization expenses in Wuhu is considered. It encompasses factors such as the type, quantity, disease category score, unit price of monthly scores, and settlement weight coefficient of medical institutions. Medical insurance payment costs are determined based on these factors.

Evaluation Methods and Applications Similar to DIP Payment

It is understood that the DIP payment system shares many similarities with the International Diagnosis Related Groups (DRG) payment system while possessing its unique characteristics. Specifically, the payment method based on case value is fundamentally aligned with DRG in terms of grouping criteria and operational logic. It conforms to DRG's case grouping based on standardized coding data, where patients within each group exhibit homogeneity.

In practice, DIP encounters significant cost variations among individual cases within the same disease category, falling short of meeting the basic conditions for DRG application. However, DIP's advantage lies in its relatively straightforward requirements for technology and management, making it more suitable for the current management capabilities of China's healthcare insurance authorities and easier to promote. Therefore, implementing DIP payment is conducive to enhancing the level of medical record management and healthcare insurance information management, laying the foundation for future transition to the more technically advanced DRG.

The DIP method demonstrates significant advantages and effectiveness in China's healthcare insurance sector, but its applicability in other countries needs to consider various factors. Meanwhile, other countries are actively evaluating and implementing similar payment methods to accommodate their respective healthcare systems and healthcare insurance policy needs.

Results

Characteristics

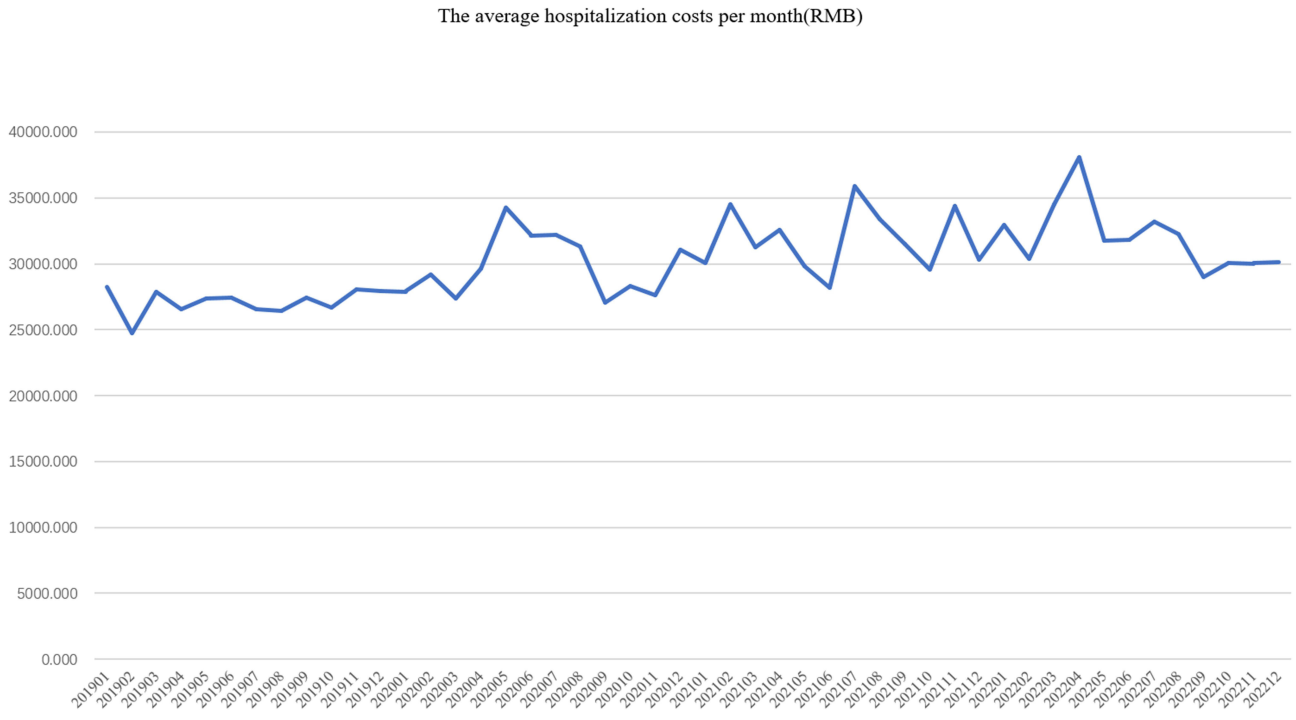
Our study included 24,908 inpatients with malignant tumors at a medical institution in Wuhu. The data distribution across the years is shown in Table 1. Pre-DIP data included 13,080 patients, and post-DIP data included 11,828 patients. Before the DIP policy, the highest average hospitalization cost was 3,4257.605 RMB in May 2020, and the lowest was 2,4720.864 RMB in February 2019. After the DIP implementation, the highest average hospitalization cost was 3,8093.173 RMB in April 2022, and the lowest was 2,8218.563 RMB in June 2021 (Figure 1).

Table 1 Basic Characteristics of Patients With Malignant Tumors in Sample Hospitals From 2019 to 2022

	2019 (%)	2020 (%)	2021 (%)	2022 (%)
N	7092	5988	5791	6037
Hospitalization time				
1–5 days	868 (12.24)	940 (15.70)	1316 (22.72)	1411 (11.07)
6–10 days	2317 (32.67)	1914 (31.96)	1843 (31.83)	1928 (31.94)
11–15 days	1802 (24.41)	1416 (23.65)	1266 (21.86)	1336 (22.13)
16–20 days	1084 (15.28)	859 (14.35)	699 (12.07)	668 (11.07)
≥21 days	1021 (14.40)	859 (14.35)	667 (11.52)	694 (11.50)
Treatment outcome				
Cured	899 (12.68)	1075 (17.95)	1555 (26.85)	1692 (28.03)
Improved	5514 (77.75%)	3724 (62.19)	3244 (56.02)	3398 (56.29)
Uncured	173 (2.44)	474 (7.92)	376 (6.49)	322 (5.33)
Deceased	172 (2.43)	158 (2.64)	145 (2.50)	142 (2.35)
Other	334 (4.71)	557 (9.30)	471 (8.13)	483 (8.00)

The Effect of the DIP Policy on Hospitalization and Itemized Costs

We applied ITS modeling using patients' average monthly hospitalization costs as the dependent variable. The autocorrelation test showed that the distribution of the DW or adjusted DW value ranged from 1.171 to 2.302. Table 2 lists the detailed model parameters. Before the DIP policy, the average monthly hospital bill for patients with malignant tumors had increased by 181.164 RMB per month ($p = 0.004$), implying that these increases were not likely not due to chance. Immediately after the DIP was implemented, this bill still increased, but the change was not statistically significant (1,530.650 RMB/month, $p = 0.277$). However, 24 months after DIP implementation, the average bill had started to decrease by 212.313 RMB per month ($p = 0.015$), showing a significant decrease.



Notes: RMB (Renminbi) is the official currency of the People's Republic of China. In this figure, all costs are denoted in RMB to reflect the economic values relevant to the study context.

Figure 1 Trend of average hospitalization costs per month of Patients with Malignant Tumors in Wuhu from 2019 to 2022.

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Table 2 Trends of Average Hospitalization Cost and Sub-Item Cost After Implementation of DIP Policy Intervention

	Constant	Pre-Intervention Trend(P)	Change in Level(P)	Change in Slope Per Month(P)
Average hospitalization cost[a]	26395.500	181.164(0.004)	1530.650(0.277)	−212.313(0.015)
Treatment Fees[b]	5716.477	169.650(0.000)	109.302(0.849)	−172.118(0.001)
Diagnostic Fees[a]	5934.264	−7.021(0.242)	440.446(0.010)	58.627(0.000)
Medication Costs[a]	7990.724	49.226(0.242)	−100.326(0.904)	−106.136(0.034)
Consumable Costs[a]	6501.313	−31.206(0.104)	835.601(0.036)	22.132(0.462)
Other Costs[a]	299.765	1.099(0.659)	97.835(0.084)	−11.563(0.001)

Notes: [a]Calculated by Newey-West method; [b]Calculated by Prais-Winston method.

The subgroup analysis results are presented in Table 2. Following the DIP implementation, the diagnostic fees and consumable cost components of average hospitalization costs rose for patients with malignant tumors. Diagnostic fees increased by 440.446 RMB per month ($p = 0.010$) and consumable costs by 835.601 RMB per month ($p = 0.036$). Diagnostic fees also continued to rise by 58.627 RMB per month ($p < 0.001$). However, treatment fees, medication, and other related costs decreased significantly. Treatment fees fell by 172.118 RMB per month ($p = 0.001$), medication costs by 106.14 RMB per month ($p = 0.034$), and other costs by 11.563 RMB per month ($p = 0.001$).

The Effect of the DIP Policy on Hospitalization Costs for Different Patients

In Table 3, our results indicated that for patients who were in the hospital for short periods (1–5 days), their average bill started high at 4,668.88 RMB before DIP and continued to increase by 393.295 RMB per month ($P<0.001$). After DIP intervention, however, these bills dropped sharply by 3,216.845 RMB per month ($p = 0.001$) and thereafter more slowly by 221.735 RMB per month ($p = 0.001$). For patients who were in the hospital the longest (≥21 days), their bills initially increased sharply by 1,5401.920 RMB per month after DIP implementation ($p = 0.013$), and then started to decrease by 811.638 RMB per month after 24 months ($p = 0.028$). For patients in the hospital between 6 and 20 days, their bills generally increased immediately after DIP implementation as well; however, these changes were only significant for short periods: 6–10 days (2,514.231 RMB/month, $p = 0.038$), 11–15 days (2,825.903 RMB/month, $p = 0.019$), and 16–20 days (6527.343 RMB/month, $P = 0.007$). Thus, the long-term effects were not statistically significant.

Finally, for patients who were cured of the disease, their bills increased by 464.325 RMB per month before DIP implementation ($p<0.001$) and then showed a significant long-term drop of 826.788 RMB per month ($p<0.001$) after implementation.

Table 3 Segmented Regression Analysis of Monthly Average Hospitalization Cost of Patients With Malignant Tumors

	Constant	Pre-Intervention Trend (P)	Change in Level (P)	Change in Slope Per Month (P)
Hospitalization time				
1–5days[a]	4668.879	393.295 (0.000)	−3216.845 (0.001)	−221.735 (0.001)
6–10days[a]	13558.990	192.431 (0.004)	2514.231 (0.038)	−107.588 (0.244)
11–15days[a]	24949.520	190.614 (0.003)	2825.903 (0.019)	−29.919 (0.738)
16–20days[a]	39859.620	10.283 (0.912)	6527.343 (0.007)	17.750 (0.896)
≥21days[a]	60567.960	345.665 (0.209)	15.401.920 (0.013)	−811.638 (0.028)
Treatment outcome				
Cured[a]	23475.090	464.325 (0.000)	1429.753 (0.357)	−826.788 (0.000)
Improved[a]	27451.150	238.365 (0.036)	898.606 (0.705)	−128.620 (0.341)
Uncured[a]	12644.850	280.820 (0.388)	−530.583 (0.918)	−244.195 (0.530)
Deceased[a]	30398.100	608.323 (0.181)	8663.141 (0.373)	−1178.371 (0.129)
Other[a]	19175.300	−294.482 (0.184)	2130.000 (0.291)	229.787 (0.000)

Notes: [a]Calculated by Newey-West method.

Discussion

Our study is the first to use accurate cost data from a hospital to quantitatively analyze hospital expenses and the expense structure for inpatients with malignant tumors before and after the DIP policy. Our results confirm that the DIP system significantly reduces hospital expenses for patients with malignant tumors. Before the DIP policy, the average hospital cost for patients showed a monthly increasing trend, possibly associated with advancements in medical technology, diversification of treatment methods, and the application of new drugs.[13,14] Emerging novel therapeutic approaches, such as targeted therapy, immunotherapy (particularly cellular immunotherapies like CAR-T, NK, TILs, etc)., and proton-heavy ion therapy, have demonstrated immense potential in prolonging patients' survival and enhancing their quality of life.[15] These factors contributed to the rising costs of healthcare services, making it challenging to contain medical expenses solely through payment reforms.

However, after the DIP policy implementation, average hospital costs showed a clear downward trend, suggesting that the policy had a notable effect on controlling growth in medical expenses. These results align with expectations, as the DIP policy is aimed at incentivizing medical institutions through a refined disease-based payment mechanism to improve efficiency and reduce unnecessary medical resource waste.[16,17]

The DIP policy also changed the itemized expenses of hospitalized patients with malignant tumors. In the early stages of the policy implementation, diagnostic fees and consumable costs increased, possible due to adjustments made by medical institutions in response to the new policy, such as improving diagnostic accuracy and using more advanced materials.[18,19] However, as the policy's effects continued, treatment fees, medication costs, and other costs also went down significantly. The implication is that the DIP policy played a positive role in guiding medical institutions to optimize treatment plans and reduce medication and material costs.[20] Notably, diagnostic fees continued to increase after the DIP policy was implemented, which may relate to continuously upgrading diagnostic technology as well as increasing patient demand.[21]

Our study also revealed that the impact of the DIP policy varied significantly among tumor patients with different hospital stays. For patients with shorter hospital stays (1–5 days), average hospital costs decreased significantly in the short term after policy implementation and maintained a downward trend over the long term. This may be because the DIP policy encourages medical institutions to enhance their diagnostic efficiency and reduce unnecessary hospital stays. Although expenses initially increased after the policy was implemented, costs for patients with longer hospital stays (≥21 days) also showed a downward trend in the long run. This may be due to the policy's cost-control mechanisms for long-term hospitalized patients.[22]

Since the essence of the DIP system is to take advantage of big data,[23] it aims at standardizing each disease and treatment combination. However, if a hospital's cost control measures are unfavorable, various consequences may arise, as hospitals are mandated to comply with the DIP settlement policy. Therefore, although a hospital's total score may increase, it will also bear additional costs. These include the share cost of reducing the unit price of the score. There is also a high risk of audit violation and refusal to pay.[24,25] Hence, cost control is often the primary focus for hospitals.

For patients with an intermediate length of stay, the impact of the DIP policy was manifested in short-term expense increases, which may relate to adjustments made by medical institutions in response to the new policy. At the Wuhu hospital, its medical insurance department has improved its auditing of hospital violations while implementing the DIP policy. These violations include short-term arrangements for patients who are re-hospitalized multiple times as the hospital is required to cure or stabilize the patient's condition in one hospitalization stay. This requirement also applies to medical insurance patients.[26,27] It is aimed at preventing the possibility of readmission in the short term and avoiding medical insurance audit deductions caused by such readmissions.

The intervention effects also varied among patients with different treatment outcomes. Specifically, for patients who were cured, the average hospital costs had a significant downward trend after the policy was implemented, reflecting the policy's positive role in improving medical quality and reducing medical costs. This finding is consistent with previous research results.[28,29] However, after the policy was implemented, average hospital expenses increased for patients with other treatment outcomes. This may be due to the complexity of their conditions, treatment difficulties, and higher

medical resource use.[30,31] Further analysis of these patients' specific situations is necessary to develop more effective cost-control strategies.

Despite these insights, our study has several limitations. Firstly, the data source was limited to one medical institution in Wuhu, possibly resulting in insufficient representativeness. There may also be significant differences in the implementation of the DIP policy in different regions, specifically in the allocation of medical resources and the characteristics of patients and levels of medical institutions, thus affecting the universality of the results.[32] Nonetheless, as a practical case, our study illustrates that the rapid increase in hospitalization costs can be effectively controlled in China.

Second, we only observed cost changes 48 months before and after the policy's implementation, which may only partially explain its long-term effects. Treating malignant tumors is often a long-term process, and the impact of the DIP policy on hospitalization costs may take longer to manifest fully.

Finally, we did not consider the potential impact of external factors, such as medical technology progress and new drug research and development on hospital expenses. These factors may lead to changes in hospitalization costs that do not directly relate to the DIP policy but may be difficult to separate from the data completely.[33,34] To address this limitation, future research should incorporate these external factors to provide a more comprehensive understanding of the DIP policy's effects on hospital expenses.

Moreover, the long-term sustainability of medical cost reductions achieved through the DIP policy warrants further exploration. While the policy has demonstrated short-term success in reducing costs, continued monitoring and evaluation are essential to ensure that these reductions are maintained over time. Additionally, as medical technology continues to advance, it is crucial to assess how these changes impact the DIP policy and its ability to control costs effectively.

Conclusion

We conducted an ITS analysis using the average and itemized hospital expenses of patients with malignant tumors from a medical institution in Wuhu City between 2019 and 2022, demonstrating high novelty in research content. The DIP policy significantly affected the growth of hospital expenses for these patients. However, we observed different trends for different itemized expenses, lengths of hospital stay, and treatment outcomes. The cost control effect was more pronounced for patients with shorter hospital stays (1–5 days) than for those with extended stays; and for patients who were cured than for those with other outcomes. Additionally, implementing the DIP policy led to changes in patient expense structures, such as an initial increase in diagnosis fees, but significant decreases in treatment fees, medication costs, and other expenses.

In the future, the Chinese government should continue to play a leading role in considering these factors, and taking corresponding measures to optimize policy effects to achieve reasonable control of medical expense growth. In response to the increase in diagnosis fees and material costs in the early stages of the policy's implementation, we recommend that details of the DIP policy are further clarified, along with the calculation methods and standards for various expenses. Medical institutions should also be prevented from overusing high-cost diagnostic technologies and materials to pursue higher scores. For patients with tumors requiring extended hospital stays, medical institutions should optimize the allocation of medical resources, strengthen disease management and rehabilitation guidance, and improve diagnostic efficiency, with the aim of reducing the hospital stay. More precise treatment plans and financial support should be provided for patients with unfavorable treatment outcomes as well.

Moreover, external factors such as advancements in medical technology and the introduction of new treatment methods could potentially influence the cost structure of healthcare services. These factors may lead to changes in the use of high-cost diagnostics and consumables, as well as changes in patient outcomes and length of stay, which could in turn affect the effectiveness of the DIP policy in controlling medical expenses.

Therefore, future research should incorporate these external factors to provide a more comprehensive understanding of the DIP policy's effects on hospital expenses. Additionally, policymakers should consider the potential impact of these external factors when designing and implementing payment reforms to ensure their long-term effectiveness and sustainability. By addressing both internal and external challenges, we can work towards creating a more efficient and equitable healthcare system that benefits patients, providers, and society as a whole.

Data Sharing Statement

This study was previously preregistered on the WHO International Clinical Trials Registry Platform (www.chictr.org; registered number: ChiCTR2200066973). The summary data are available from the corresponding author upon request.

Ethics Approval and Informed Consent

This study was approved by the Ethics Committee of Wannan Medical College (No. 199 in 2024). It utilized retrospective data for evaluation, ensuring no physical harm to the patients involved and avoiding any involvement with personal privacy or commercial interests. All patient information mentioned in this paper has been anonymized, excluding names and other sensitive or identifiable personal details. According to Article 32 of the Notice on the Issuance of Ethical Review Measures for Human Life Sciences and Medical Research issued by the National Health Commission of China and other departments on February 18,2023,

> Ethical review may be exempted for life sciences and medical research involving human subjects that use human information data or biological samples, provided that no harm is caused to the human body and no sensitive personal information or commercial interests are involved. This exemption aims to reduce unnecessary burdens on researchers and promote the conduct of life sciences and medical research involving human subjects.

The document also specifies that ethical review may be exempted for research using anonymized information data.[35] Therefore, after deliberation by the Ethics Committee of Wannan Medical College, this study has been approved for conduct, and patient informed consent may be exempted. Our study complies with the Declaration of Helsinki.

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Author Contributions

All authors made a significant contribution to the work reported, whether in the conception, study design, execution, acquisition of data, analysis, interpretation, or all these areas; took part in drafting, revising, or critically reviewing the article; gave final approval of the version to be published; agreed on the journal to which the article has been submitted; and agreed to be accountable for all aspects of the work.

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Disclosure

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