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Original Paper

Research on the Impact of DIP Reform on the Service Efficiency of Medical Institutions: A Case Study of H City, Hubei Province

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Abstract

Objective: *To evaluate the impact of the Diagnosis-Intervention Packet (DIP) payment policy on the service efficiency of medical institutions and provide evidence for the reform of medical insurance payment methods.*

Methods: *Based on quarterly data from 37 medical institutions in H City, Hubei Province, from 2020 to 2024, a common frontier Data Envelopment Analysis (DEA) and an Interrupted Time Series (ITS) model were employed to quantitatively analyze changes in efficiency before and after the implementation of DIP.*

Results*: The DIP policy significantly improved medical service efficiency, driving efficiency values closer to the optimal frontier while effectively controlling medical costs. However, three issues were identified:*

(1) Only a few institutions achieved the optimal Technology Gap Ratio (TGR);

(2) Cost control exhibited a "U-shaped" pattern, initially decreasing and then rising;

(3) There were significant differences in responses among medical institutions of different levels.

Conclusion*: It is recommended to enhance the policy effectiveness by improving supporting mechanisms, deepening internal refined management, and optimizing differentiated reform pathways, thereby providing a reference for further payment reforms.*

Keywords

Diagnosis-Intervention Packet (DIP) payment, Service efficiency, Data Envelopment Analysis (DEA), Interrupted Time Series (ITS)

1. Introduction

The report to the 20th National Congress of the Communist Party of China emphasized the need to advance the Healthy China initiative, deepen the reform of the medical and healthcare system, promote coordinated development and governance of healthcare security, medical services, and pharmaceuticals, and facilitate the expansion and regionally balanced distribution of high-quality medical resources (Xi, 2022). In response to multiple challenges, including the rapid growth of medical expenditures, deepening population aging, and significant shifts in disease patterns (Li & Wang, 2024), and to enhance the efficiency of healthcare fund utilization while motivating medical institutions to control costs and improve performance, the National Healthcare Security Administration (NHSA) launched a pilot reform of Diagnosis-Related Groups (DRG) payment in 2019. In 2024, the NHSA issued the *Diagnosis-Related Groups and Diagnosis-Intervention Packet Payment Version 2.0 Grouping Scheme*, mandating nationwide implementation by 2025. The Diagnosis-Intervention Packet (DIP) is a medical payment mechanism with distinctive Chinese characteristics (Zhang & Tan, 2024). It establishes disease groups and corresponding payment standards through cluster analysis based on “diagnosis + treatment approach” (Deng et al., 2023). This system is designed to control medical costs, improve service efficiency, and promote the rational use of healthcare funds alongside standardized medical development (Li & Chu, 2021).

The reform of the Diagnosis-Intervention Packet (DIP) payment method has become a significant topic in the field of health policy research. Existing literature primarily focuses on policy comparisons between DRG and DIP and their differential impacts on healthcare systems (Li & Wang, 2024; Li & Li, 2022; Yan, Zheng, & Xu, 2023; Ying, 2021; Zheng, 2022; Zhang, 2021; Fu et al., 2020; Yu, 2021; Feng et al., 2021). Additionally, studies analyze the heterogeneous effects of DIP reform on costs, efficiency, quality, and patient satisfaction across various types of medical institutions (Li & Chu, 2021; Lu et al., 2024; Zhao, 2017; Zhao, 2014; Rao, O'Donnell, & Battese, 2003; O'Kelly et al., 2020; Muselli et al., 2022; Wang et al., 2025; Yang, Luo, & Guo, 2024). Regarding DIP reform, some scholars affirm its effectiveness in promoting technological innovation and hospital development (Lu et al., 2024). However, other research points out that it intensifies operational and management pressures on public hospitals (Feng et al., 2021). At present, empirical studies on DIP reform remain insufficient, and assessments of its policy effects have yet to yield consistent conclusions (Peng et al., 2024).

Since the implementation of the DIP payment policy, H City in Hubei Province has actively adopted effective measures to advance and implement the deployment of DIP reform. However, what has been the actual impact of the reform so far? How has DIP influenced the service efficiency of medical institutions? These questions urgently require scientific evaluation. This study employs the meta-frontier DEA and interrupted time series analysis to empirically examine the effect of DIP reform on hospital service efficiency, thereby providing a basis for policy refinement.

2. Materials and Methods

2.1 Data Sources

This study evaluates the implementation effects of the Diagnosis-Intervention Packet (DIP) policy based on medical insurance settlement data from City H. The DIP payment reform in City H encompasses all healthcare institutions qualified to provide inpatient services. Although primary-level institutions fall within the policy scope, only 6 met the analysis requirements after systematic data cleaning and imputation due to high rates of missing original data, resulting in a relatively limited sample representation for this tier. Consequently, the primary sample of this study consists of secondary and tertiary institutions, specifically including 20 secondary institutions (representing 80% of all secondary institutions in the city) and 11 tertiary institutions (achieving full coverage). All 37 sample institutions were coded H-1 to H-37, comprising 22 general hospitals and 15 specialized hospitals. Regarding institutional composition, among tertiary institutions, 6 are specialized hospitals, accounting for 54.5%; among secondary institutions, 9 are specialized hospitals, constituting 45.0%. The observation period spans from the first quarter of 2020 to the fourth quarter of 2024, covering 20 quarters in total due to data availability constraints. City H fully implemented the DIP reform in June 2022. Considering a buffer phase for policy execution, this study defines the third quarter of 2022 as the starting point for the policy intervention.

2.2 Selection of Service Efficiency Indicators

Based on the policy guidance outlined in documents such as *"The High-Quality Development Initiative for Public Hospitals (2021-2025)"* and "The Three-Year Action Plan for DRG/DIP Payment Reform", referencing the indicator systems established in existing research (Li & Chu, 2021; Yang & Lyu, 2023; Zhao, 2017), and considering practical conditions such as data availability, we constructed the indicator system for this study.

Table 1. Indicator System

Primary Indicator	Second-level Indicators	Third-level Indicators	Indicator Definition
Input	**Human Resources**	Number of Physicians	Quarterly employed physicians / persons
		Number of Nurses	Quarterly employed nurses / persons
	Physical Resources	Bed Complement	Quarterly actually available beds / units
	Financial Resources	Medical Costs	Quarterly expenditure on outpatient, inpatient, and emergency services / 10,000 CNY
output	**Outpatient Services**	Outpatient Visits	Quarterly outpatient visits / visits
	Inpatient Services	Inpatient Admissions	Quarterly inpatient admissions / admissions
	Operational Efficiency	Bed Occupancy Rate	(Total actual occupied bed days / Total actual available bed days) × 100%

Input indicators were selected across three dimensions—human resources, financial resources, and physical resources—in alignment with the fundamental requirements of DEA methodology for indicator selection (Zhao, 2014). The numbers of physicians and nurses serve as core human resource indicators, reflecting the fundamental service capacity of medical institutions. Bed complement represents the scale of hardware facilities and serves as essential physical infrastructure for delivering healthcare services. Medical costs are employed to measure the level of economic input. Regarding output indicators, this study primarily selected outpatient visits, inpatient admissions, and bed occupancy rate. From an input–output perspective, outpatient visits and inpatient admissions represent the service scale and capacity of medical institutions, while bed occupancy rate reflects the rationality of their resource allocation.

2.3 Research Methodology

2.3.1 Meta-frontier DEA

Data Envelopment Analysis (DEA) is a non-parametric method for efficiency evaluation. It measures the relative efficiency of Decision Making Units (DMUs) with multiple inputs and outputs by constructing a production frontier. A DMU with an efficiency score of 1 lies on the frontier, indicating relative efficiency, while a score below 1 suggests room for improvement. The two most commonly used DEA models are CCR and BCC. The CCR model assumes constant returns to scale (CRS), whereas the BCC model accommodates variable returns to scale (VRS). Given the significant scale variations and diverse returns to scale among the medical institutions studied, the BCC model is more appropriate.

To address the bias in frontier estimation caused by technological heterogeneity in traditional DEA, scholars such as Rao et al. (Rao, O'Donnell, & Battese, 2003) proposed a meta-frontier function framework. This framework employs a dual-layer structure comprising a meta-frontier and group-specific frontiers, effectively identifying efficiency differences under heterogeneous technology sets, making it suitable for efficiency analysis within a tiered healthcare service system. The specific model construction is as follows:

Assume that all DMUs are divided into k groups (where k > 1). The common technology set for the DMUs in the k-th group is defined as:

$$T^k = \{ (x, y): x \geq 0, y \geq 0, \text{x can produce y}\}$$

$$k = 1,2, \ldots, k \tag{1}$$

The group-specific input-output correspondence for the k-th group is defined as:：

$$P^k(x) = \{y: (x, y) \in T^k\} \tag{2}$$

The common technology set for all DMUs is defined as：

$$T = \{(x, y): x \geq 0, y \geq 0, \text{x can produce y}\} \tag{3}$$

Corresponding to it, the production possibility set is：

$$P(x) = \{y: (x, y) \in T\} \tag{4}$$

$$T = \{T^1 \cup T^2 \cup \ldots T^k\} \tag{5}$$

The frontier determined by $P^k(x)$ is the group-specific frontier, while the frontier formed by the union of all $P^k(x)$ constitutes the meta-frontier $P^k(x)$. That is, the group-specific production possibility set is a subset of the meta-production possibility set. The directional distance function from a decision-making unit to the meta-frontier is:

$$\begin{cases} \min[\theta - \varepsilon(\hat{e}^T s^- + e^T s^+)] \\ \text{s. t.} \sum_{j=1}^{n} \lambda_j x_j + s^- = \theta x_0 \\ \sum_{j=1}^{n} \lambda_j y_j - s^+ = y_0 \\ \lambda_j \geqslant 0; j = 1,2,\cdots,n \\ s^+ \geqslant 0; s^- \geqslant 0 \end{cases} \tag{6}$$

Where, $x_j \in X_j$ 、$y_j \in Y_j$, Input and output variables of medical institution $j(j = 1,2,\ldots,n)$, respectively. S^- and S^+ denote the input slack variables and output slack variables, respectively, for the j DMU; and λ is the weight vector. θ is the efficiency value. ε is a non-Archimedean infinitesimal. $\hat{e}^T = (1,1,\ldots,1) \in E_m, e^T = (1,1,\ldots,1) \in E$. When $\theta = 1$, Indicates that the decision-making unit lies on the meta-frontier.

If a DMU belongs to the $k - th$ group, then the directional distance function from the DMU to the *group-k* frontier is:

$$\begin{cases} \min[\varphi - \varepsilon(\hat{e}^T s^- + e^T s^+)] \\ \text{s. t.} \sum_{j=1}^{n} \lambda_j x_j^k + s^- = \varphi x_0 \\ \sum_{j=1}^{n} \lambda_j y_j^k - s^+ = y_0 \\ \lambda_j \geqslant 0; j = 1,2,\cdots,n^k \\ s^+ \geqslant 0; s^- \geqslant 0 \end{cases} \tag{7}$$

Where, x_j^k、y_j^k denotes the input and output variables of medical institution $j(j = 1,2,\ldots,n^k)$ within the $k - th$ group, respectively. φ is the efficiency value. When $\varphi = 1$, this indicates that the decision-making unit lies on its group-specific frontier. Based on the definition of output-oriented technical efficiency (TE), Rao (2003) expressed the Technology Gap Ratio (TGR) as:

$$TGR_0^k(x,y) = \frac{TE_0^*(x,y)}{TE_0^k(x,y)}$$

That is, the ratio of the meta-frontier to the group-specific frontier. Given the relationship $\theta \leq \varphi$ between the meta-frontier and the group-specific frontier, the Technology Gap Ratio (TGR) is defined as:

$$TGR = \frac{\theta}{\varphi} \quad TGR \in (0,1)$$

A higher TGR value indicates that the group-specific frontier technology is closer to the meta-frontier technology. If TGR equals 1, it signifies no gap between the group-specific frontier technology and the meta-frontier technology.

2.3.2 Interrupted Time Series Analysis

Interrupted time series analysis is an effective quasi-experimental design strategy widely used in the field of public health policy evaluation and intervention assessment. This study examines the impact of the DIP policy implementation on the service efficiency of medical institutions in City H of Hubei Province. The research does not require a control group, the policy has a clear implementation timeline, and data before and after the implementation are relatively complete. Therefore, the interrupted time series analysis method is particularly suitable for this study. Model construction:

$$Y_t = \beta_0 + \beta_1 time + \beta_2 intervention + \beta_3 posttime + \varepsilon_t \quad (8)$$

Where Y_t represents the service efficiency indicators of medical institutions in City H at time t; β_0 denotes the baseline efficiency level of medical institutions before the policy intervention, β_1 indicates the trend of medical institution performance over time before the policy implementation, β_2 measures the immediate change in performance at the point of policy intervention, and β_3 captures the change in the slope resulting from the intervention. Time refers to the time variable, intervention is a dummy variable distinguishing the periods before and after the policy implementation (0 for before, 1 for after). Posttime is a counter for time elapsed after the intervention, starting from 0 and incrementing to reflect cumulative time, while ε_t represents the random error term.

3. Results

3.1 Descriptive Statistical Analysis

Table 2 presents the descriptive statistical results of the study variables. Since the numbers of doctors, nurses, and beds remained relatively stable during the study period without significant changes before and after the policy reform, they are not listed in the table. Regarding central tendency, the median medical costs of healthcare institutions at all levels showed a significant decrease after the reform, with reductions of 17.63%, 9.02%, and 4.77%, respectively. In contrast, the number of outpatient visits and inpatient admissions exhibited a clear upward trend, with the magnitude of increase growing as the hospital level decreased. Notably, outpatient service volume at primary-level institutions surged dramatically by 816.65%, while tertiary-level institutions accounted for as high as 81.5% of inpatient service volume. In terms of dispersion, the interquartile ranges (IQRs) for costs and bed occupancy rates narrowed across all institution levels. However, the IQRs for inpatient admissions generally expanded, with increases exceeding 100% in most cases. The IQR for outpatient visits at primary-level institutions decreased. Regarding distribution shape, the skewness of all indicators declined significantly, indicating a reduction in outliers within the data distributions. Except for medical costs, the maximum and minimum values of all other indicators increased substantially.

Table 2. Descriptive Statistical Analysis of Data

Indicator	Institution Level	Medical Cost (10,000 CNY)		Inpatient Admissions (persons)		Outpatient Visits (persons)		Bed Occupancy Rate (%)	
		Pre-reform	Post-reform	Pre-reform	Post-reform	Pre-reform	Post-reform	Pre-reform	Post-reform
Median	Primary	38.4283	31.6547	89	365.5	576.5	5284.5	65.45	79.39
	Secondary	141.7318	128.9465	174.5	524	1346.5	4693.5	70.3	84.955
	Tertiary	1347.9167	1283.6509	1471.5	3913	15228	40667.5	73.6	93.935
Interquartile Range (IQR)	Primary	128.9406	121.5188	242.5	636.5	3731	3692.5	5.524	4.49
	Secondary	372.8976	334.7039	459.5	1144.5	5297	12239.5	4.075	3.205
	Tertiary	2716.8857	2557.4085	2679	8091	37568	62415	2.95	2.71
Minimum	Primary	14.6782	2.2866	3	36	50	584	65.8	69.83
	Secondary	3.3555	1.0811	3	7	5	188	74.5	76.23
	Tertiary	107.8257	36.3318	14	125	22	3183	85.2	87.23
Maximum	Primary	571.1246	342.6155	1007	1526	8310	12146	80.2	87.7
	Secondary	4833.416	3242.1428	5586	7771	23758	56397	89.9	91.5
	Tertiary	29077.613	21576.8357	15394	19920	179742	208556	93.2	97.46
Skewness	Primary	1.263	0.984	1.925	0.855	1.041	0.202	-0.664	-0.152
	Secondary	3.224	2.024	3.827	2.066	1.554	1.363	-0.581	-0.25
	Tertiary	2.507	1.83	2.356	1.091	2.19	1.509	-0.974	-0.151

3.2 Results of Service Efficiency in Medical Institutions in City H

This study employs a comprehensive two-stage analytical framework aimed at holistically evaluating the impact of the DIP payment reform from both the "mechanism" and "outcome" dimensions. Firstly, the efficiency measurement results based on the DEARUN software indicate a significant improvement in the overall efficiency of the 37 medical institutions in City H after the DIP reform, with specific data presented in Table 3. Specifically, the average meta-frontier efficiency increased from 0.147 to 0.318, the average group-frontier efficiency rose from 0.246 to 0.525, and the average Technology Gap Ratio (TGR) climbed from 0.582 to 0.604. These represent growth rates of 116.78%, 113.78%, and 3.82% respectively, suggesting that the DIP reform has driven medical institutions closer to the meta-frontier level. Significant differences in TGR and efficiency values were observed across different levels of medical institutions. Among tertiary institutions, the TGR reached 1 for five general hospitals (H-1 to H-4 and H-7), indicating their production technology is at the industry's frontier level. In contrast, the two specialized hospitals, H-5 and H-6, had a TGR below 0.5, suggesting substantial room for improvement in their technical efficiency. Regarding efficiency changes, H-4 showed the most significant improvement, with its efficiency value increasing from 0.441 to 0.914. Among secondary institutions, three specialized hospitals H-15, H-25, and H-28 performed most prominently, achieving a TGR of 1. H-29 demonstrated notable progress, with its TGR improving from 0.447 to 0.908. Except for H-12, efficiency values increased for all other secondary institutions. For primary institutions, H-34 maintained a TGR of 1 and achieved a leap in its efficiency value from 0.083 to 0.608, demonstrating a positive response to the policy. To test the robustness of the conclusions, this study conducted sensitivity tests by adding or removing indicators. After recalculating efficiency by removing any single input or output indicator, the ranking order of decision-making units remained highly consistent (all Spearman correlation coefficients were greater than 0.9). This indicates that the core findings regarding efficiency differences in this study are robust.

Table 3. Medical Institution Service Efficiency Results

DMU	Institution Level	Meta-Frontier Results		Group-Frontier Results		TGR Results	
		Pre-Reform	Post-Reform	Pre-Reform	Post-Reform	Pre-Reform	Post-Reform
H-1	3	0.137	0.317	0.137	0.317	1.000	1.000
H-2	3	0.130	0.376	0.130	0.376	1.000	1.000
H-3	3	0.135	0.449	0.135	0.449	1.000	1.000
H-4	3	0.441	0.914	0.441	0.914	1.000	1.000
H-5	3	0.136	0.286	0.362	0.761	0.375	0.376
H-6	3	0.226	0.365	0.648	0.881	0.348	0.414
H-7	3	0.177	0.783	0.177	0.783	1.000	1.000
H-8	3	0.114	0.225	0.147	0.291	0.774	0.774
H-9	3	0.069	0.208	0.076	0.242	0.908	0.860
H-10	3	0.135	0.239	0.156	0.278	0.864	0.860
H-11	3	0.020	0.110	0.025	0.157	0.812	0.700
H-12	2	0.058	0.087	0.226	0.229	0.256	0.381
H-13	2	0.190	0.220	0.336	0.354	0.565	0.621
H-14	2	0.027	0.106	0.097	0.386	0.276	0.275
H-15	2	0.720	0.743	0.720	0.743	1.000	1.000
H-16	2	0.098	0.170	0.342	0.583	0.285	0.292
H-17	2	0.012	0.106	0.043	0.335	0.289	0.317
H-18	2	0.102	0.198	0.335	0.335	0.303	0.592
H-19	2	0.218	0.134	0.404	0.522	0.539	0.256
H-20	2	0.070	0.287	0.178	0.718	0.392	0.399
H-21	2	0.034	0.082	0.112	0.137	0.298	0.595
H-22	2	0.092	0.317	0.183	0.668	0.501	0.475
H-23	2	0.077	0.098	0.274	0.349	0.280	0.280

H-24	2	0.106	0.363	0.239	0.800	0.446	0.454
H-25	2	0.416	0.887	0.416	0.887	1.000	1.000
H-26	2	0.081	0.268	0.198	0.651	0.411	0.412
H-27	2	0.143	0.358	0.358	0.842	0.400	0.425
H-28	2	0.244	0.613	0.244	0.613	1.000	1.000
H-29	2	0.043	0.153	0.096	0.168	0.447	0.908
H-30	2	0.059	0.126	0.147	0.316	0.400	0.398
H-31	2	0.042	0.130	0.154	0.520	0.274	0.250
H-32	1	0.132	0.333	0.333	0.846	0.396	0.394
H-33	1	0.537	0.575	0.718	0.814	0.748	0.706
H-34	1	0.083	0.608	0.083	0.608	1.000	1.000
H-35	1	0.021	0.102	0.070	0.357	0.294	0.287
H-36	1	0.086	0.381	0.180	0.798	0.476	0.478
H-37	1	0.028	0.069	0.165	0.395	0.171	0.174
Average		0.147	0.318	0.246	0.525	0.582	0.604

Table 4 shows that after the DIP reform, the efficiency of medical institutions at all levels in City H improved significantly, yet hierarchical differences were observed. Regarding efficiency improvement, primary institutions—the cornerstone of the primary healthcare system—saw their meta-frontier efficiency and group-frontier efficiency increase by 133% and 147%, respectively. Secondary institutions, representing the intermediate level, recorded growth rates of 92.37% and 99.01% in these two metrics. Among them, specialized hospitals achieved increases of 69% and 87%, while general hospitals saw efficiency improvements of 159% and 123%. Tertiary institutions experienced efficiency growth of 126% and 123%, with specialized hospitals reaching 161% and 157%, and general hospitals showing high increases of 131% and 98%, maintaining their technological leadership. These results also indicate that the DIP reform had the greatest efficiency-enhancing effect on general hospitals at the secondary level, while its impact on specialized hospitals was most pronounced at the tertiary level. In terms of changes in the Technology Gap Ratio (TGR), secondary institutions saw their TGR rise by 10.33%**,** serving as the main driver for the overall TGR increase of 1.75%. Within this group, specialized hospitals contributed a 19% increase. In contrast, the TGR for primary and tertiary institutions experienced slight declines of 1.56% and 1.09%, respectively. Among tertiary institutions, the TGR for general hospitals decreased by 2.1%**,** while that for specialized hospitals dropped by 0.1%. Although the TGR for tertiary institutions remains at a relatively high level (above 0.8), there is a need to strengthen the maintenance of frontier technologies under the DIP reform.

Table 4. Comparison of Service Efficiency among Medical Institutions at Different Levels

Institution Level	Meta-frontier Results		Group-frontier Results		TGR Results	
	Pre-reform	Post-reform	Pre-reform	Post-reform	Pre-reform	Post-reform
Primary Medical Institutions	0.148	0.345	0.258	0.636	0.514	0.506
Secondary Medical Institutions	0.142	0.272	0.255	0.508	0.468	0.516
Tertiary Medical Institutions	0.156	0.388	0.221	0.495	0.826	0.817
Average	0.148	0.335	0.245	0.546	0.603	0.613

3.3 Results of Interrupted Time Series Analysis on the Service Efficiency of Medical Institutions in City H

3.3.1 Autocorrelation Test

A triple-check was employed in this study to confirm the absence of autocorrelation in the model residuals. The results indicate no significant first-order autocorrelation based on the Durbin-Watson test (d=1.595). The Breusch-Godfrey test (p>0.05) shows no autocorrelation up to lags 1-3. Furthermore, the Ljung-Box test (Q=4.966, p=0.4201) confirms the absence of an autocorrelation structure. The conclusions from these three tests collectively support that the model residuals satisfy the assumption of independence.

3.3.2 Single-Group Interrupted Time Series Results

To directly examine whether the core objective of the DIP policy—controlling the unreasonable growth of medical expenses—was achieved, an interrupted time series analysis was also conducted on medical costs, with details presented in Table 5 and Figure 1. The results show that the initial level of the quarterly average medical cost was 24.9286 million yuan (P < 0.001). Before the reform, medical costs showed a trend of decreasing by 0.1694 million yuan per quarter, but this was not statistically significant (P = 0.731). In the first quarter of the reform, costs decreased significantly by 19.6680 million yuan (P < 0.001). However, after the reform, medical costs shifted to a significant upward trend, increasing by 1.6566 million yuan per quarter (P = 0.002), with a growth rate significantly higher than the pre-reform level. This indicates that the DIP reform in City H was effective in controlling medical costs initially, but signs of cost increase emerged afterward. If this trend continues, costs are projected to return to pre-reform levels after 12 quarters, suggesting the need to monitor the sustainability of policy implementation.

Table 5. Interrupted Time Series Analysis of Medical Costs

Variable	Coefficient	Standard Error	T-value	P-value
Pre-intervention trend β_1	-16.96	49.34	-0.34	0.731
Level change β_2	-1966.80***	316.73	-6.21	＜0.001
Trend change β_3	165.66***	53.63	3.09	0.002
Initial value β_0	2492.86***	244.59	10.19	＜0.001

*, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

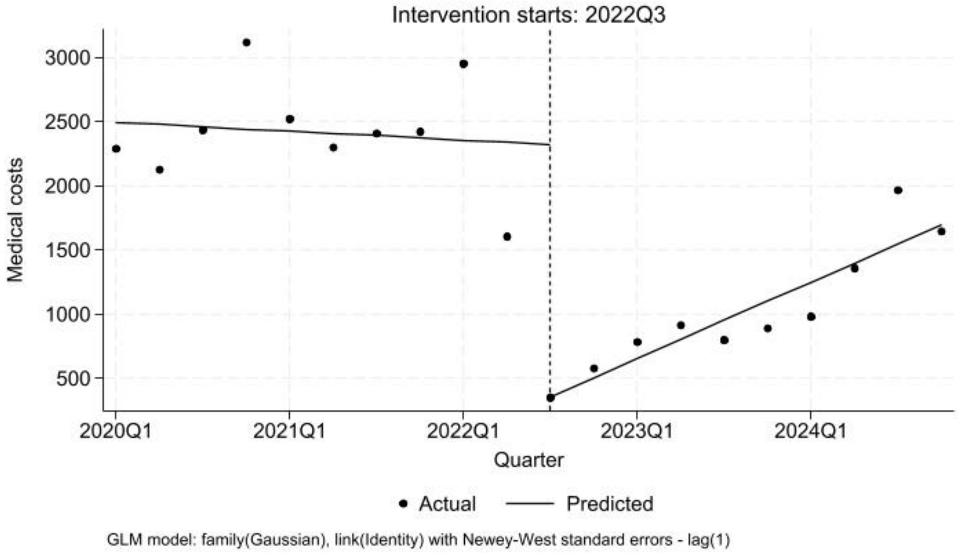

Figure 1. Interrupted Time Series Analysis Results of Medical Costs

This study employs Interrupted Time Series Analysis (ITSA) to evaluate the impact of the DIP reform on the efficiency values of medical institutions. To control for potential confounding factors, two sets of dummy variables were included in the model: first, quarterly dummy variables, where the first and fourth quarters of each year were assigned a value of 1 and the remaining quarters a value of 0, to capture seasonal fluctuations in healthcare demand; second, a pandemic dummy variable, where the fourth quarter of 2022—a period of high pandemic incidence—was assigned a value of 1, while all other quarters of that year and all quarters of other years were assigned a value of 0, to control for the abnormal impact during the peak of the pandemic. Based on the results from Table 6 and Figures 2–4, after effectively controlling for seasonality and the pandemic shock, the DIP reform remains a significant factor in enhancing the service efficiency of medical institutions. Specifically, after controlling for potential confounding factors such as seasonal healthcare-seeking behavior and the pandemic peak, the meta-frontier model shows an immediate post-intervention increase of 12.75 percentage points ($P=0.001$) and a sustained trend growth of 0.99 percentage points ($P<0.05$). The group-frontier model further confirms the robustness of this effect, with a level change reaching 9.64 percentage points ($P<0.001$). Regarding the technology gap ratio, although the pre-intervention trend and the initial value were significant, neither the level change nor the trend change showed statistical significance ($P>0.1$). Overall, following the implementation of the DIP policy, a significant immediate level increase and a sustained growth effect were observed, which remained unaffected by seasonal healthcare-seeking patterns or the pandemic peak, indicating consistent and robust results.

Table 6. Interrupted Time Series Analysis Results of Medical Institution Service Efficiency

Model	Variable	Coefficient	Standard Error	T-value	P-value
Meta-frontier Results	Pre-intervention trend	0.0175^{***}	0.004	4.120	0.001
	Level change	0.1275^{***}	0.031	4.170	0.001
	Trend change	0.0099^{*}	0.006	1.750	0.046
	Seasonal healthcare behavior	0.019	0.038	0.500	0.623
	Pandemic peak	-0.005	0.036	-0.130	0.899
	Constant	0.0276^{***}	0.0302469	5.22	<0.001
Group-frontier Results	Pre-intervention trend	0.0185^{***}	0.003	6.580	<0.001
	Level change	0.0964^{***}	0.020	4.760	<0.001
	Trend change	0.0070^{***}	0.004	1.870	0.086
	Seasonal healthcare behavior	0.030	0.024	1.240	0.240
	Pandemic peak	0.001	0.024	0.040	0.970
	Constant	0.0845^{***}	0.020	4.210	0.001
TGR Results	Pre-intervention trend	0.0250^{*}	0.010	2.490	0.028
	Level change	0.120	0.072	1.660	0.123
	Trend change	-0.017	0.013	-1.270	0.227
	Seasonal healthcare behavior	0.100	0.086	1.150	0.272
	Pandemic peak	-0.011	0.085	-0.120	0.903
	Constant	0.455^{***}	0.058	7.810	<0.001

*, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

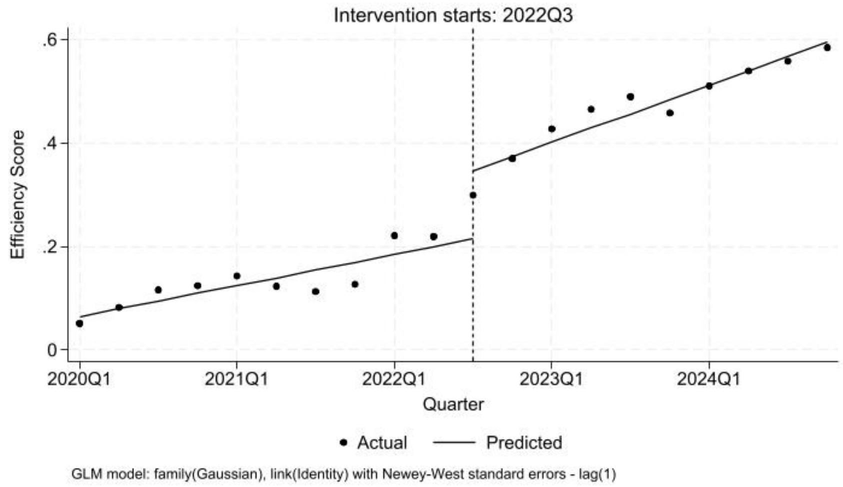

Figure 2. Interrupted Time Series Analysis Results of Meta-frontier Average Efficiency

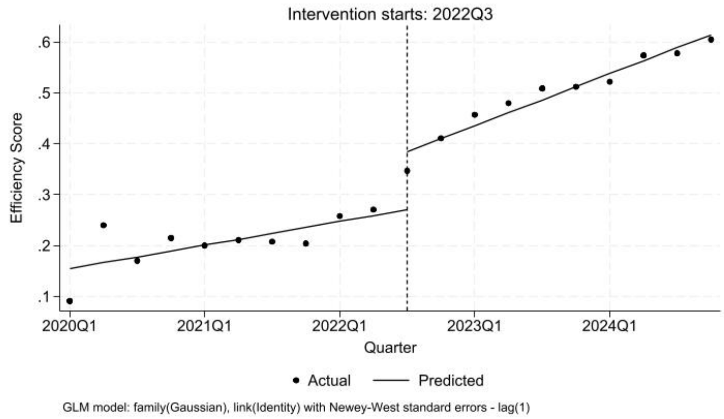

Figure 3. Interrupted Time Series Analysis Results of Group-frontier Average Efficiency

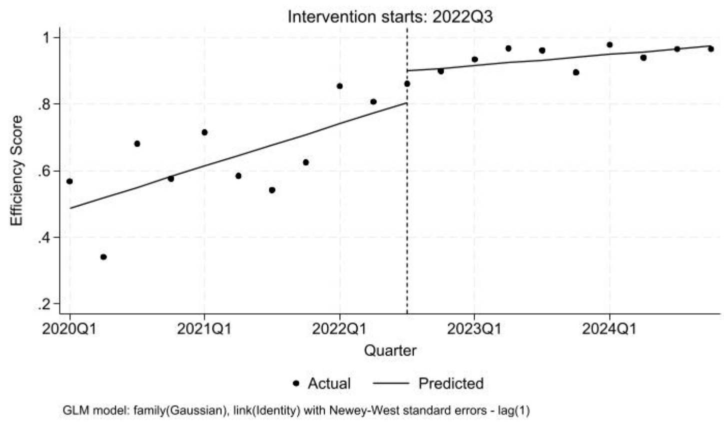

Figure 4. Interrupted Time Series Analysis Results of TGR Average Values

3.3.3 Multi-group Interrupted Time Series Results

After controlling for confounding factors such as seasonal healthcare-seeking behavior and the pandemic peak period, this study analyzes the effects of the DIP policy implementation across three tiers of medical institutions in City H. The results are presented in Table 7 and Figures 5-7. Regarding meta-frontier efficiency, the efficiency of all institution types already exhibited a stable upward trend prior to the DIP policy implementation. Among them, tertiary hospitals showed the highest annual growth rate at 0.019 ($P < 0.001$). Following the intervention, all institutional levels demonstrated a significant immediate efficiency jump, with tertiary hospitals experiencing the largest increase of 0.192 ($P < 0.001$). Concurrently, secondary and tertiary hospitals also showed sustained post-intervention trend growths of 0.014 ($P = 0.004$) and 0.007 ($P = 0.006$), respectively.

Further analysis using the group-frontier model indicates that the policy induced the most pronounced immediate level increases for primary-level and tertiary hospitals, with rises of 0.164 ($P < 0.001$) and 0.155 ($P < 0.001$), respectively. However, secondary hospitals demonstrated the most significant capacity for sustained post-policy improvement, with a trend increase of 0.016 ($P = 0.002$). In terms of the technology gap ratio (TGR), although secondary hospitals exhibited the fastest pre-intervention TGR growth at 0.040 (P < 0.001), the policy itself did not have a statistically significant impact on TGR for any institution type. It is important to note that neither the seasonal healthcare-seeking behavior variable nor the pandemic peak variable reached statistical significance, indicating that the observed policy effects were not confounded by these external factors.

In summary, the DIP policy proved highly effective in enhancing the operational efficiency of medical institutions. Tertiary hospitals demonstrated a strong capacity for immediate response, while secondary hospitals showed greater potential for sustained improvement. However, the policy's effect on narrowing the technological gaps between different institutional tiers was not evident. Future efforts should focus on establishing mechanisms for cross-level technological collaboration and resource sharing.

Table 7. Results of the Multiple-Group Interrupted Time Series Analysis

Level	Indicator	Primary Institutions	Healthcare	Secondary Institutions	Healthcare	Tertiary Institutions	Healthcare
		Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
Meta-Frontier Results	Pre-intervention Trend	0.012*	0.036	0.014***	＜0.001	0.019***	＜0.001
	Level Change	0.142**	0.008	0.088**	0.003	0.192***	＜0.001
	Trend Change	0.014	0.099	0.014**	0.004	0.007**	0.006
	Seasonal Healthcare-seeking Behavior	-0.017	0.452	-0.015	0.218	-0.021	0.18
	Pandemic Peak Period	0.069	0.236	0.008	0.799	-0.035	0.365
	Constant	-24.129*	0.037	-28.895***	＜0.001	-37.991***	＜0.001
Group-Frontier Results	Pre-intervention Trend	0.013**	0.004	0.010**	0.004	0.018***	＜0.001
	Level Change	0.164***	＜0.001	0.066*	0.022	0.155***	＜0.001
	Trend Change	0.007	0.216	0.016**	0.002	0.009	0.139
	Seasonal Healthcare-seeking Behavior	-0.008	0.623	-0.023	0.085	-0.03	0.092
	Pandemic Peak Period	0.077	0.08	0.021	0.507	-0.035	0.421
	Constant	-26.051**	0.004	-20.361**	0.004	-36.063***	＜0.001
TGR Results	Pre-intervention Trend	0.038**	0.008	0.040***	＜0.001	0.020*	0.048
	Level Change	0.041	0.706	0.109	0.169	0.053	0.534
	Trend Change	-0.022	0.252	-0.024	0.084	-0.019	0.205
	Seasonal Healthcare-seeking Behavior	0.005	0.923	0.006	0.873	0.015	0.712
	Pandemic Peak Period	0.056	0.678	-0.007	0.938	0.022	0.828
	Constant	-75.818**	0.008	-80.792***	＜0.001	-40.357	0.052

*, **, *** TGR = Technology Gap Ratio. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

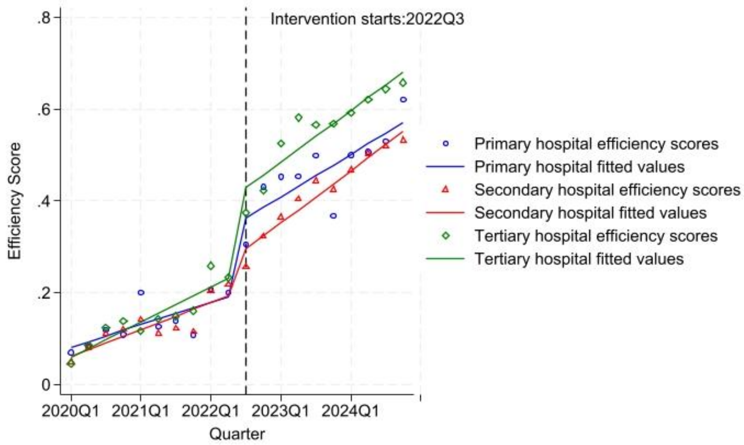

Figure 6. Trends in Average Meta-Frontier Efficiency: A Multiple-Group Interrupted Time Series Analysis

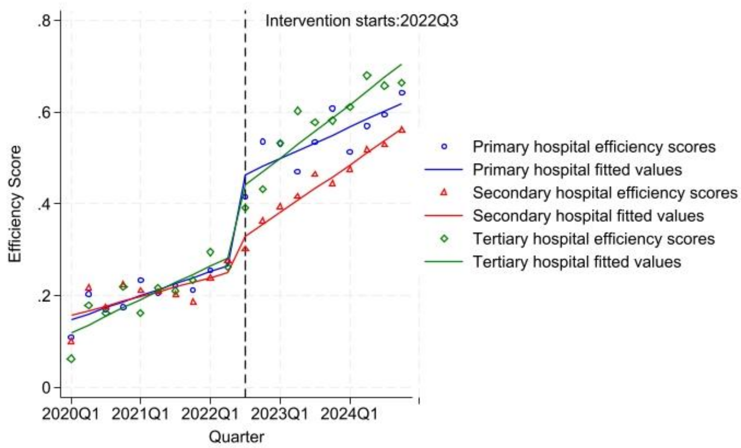

Figure 7. Trends in Average Group-Frontier Efficiency: A Multiple-Group Interrupted Time Series Analysis

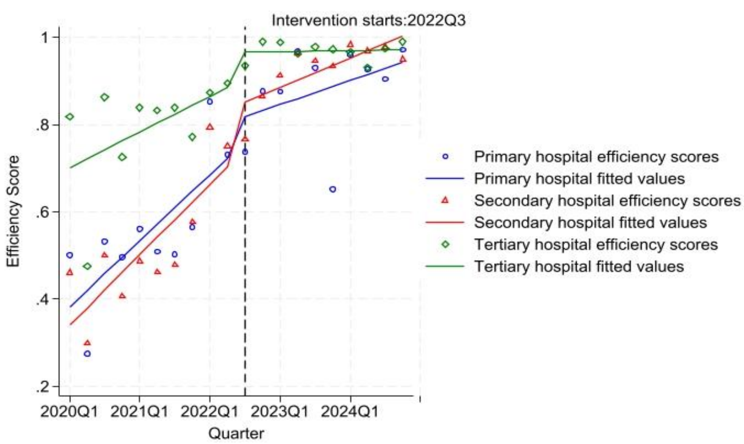

Figure 8. Trends in TGR (Technology Gap Ratio) Mean: A Multiple-Group Interrupted Time Series Analysis

3.3.4 Robustness Checks

The results of the robustness checks are presented in Table 9. To further verify the reliability of the baseline results, this study employed a placebo test by setting the hypothetical intervention timing to the third quarter of 2023. The test results show that neither the immediate effect nor the long-term trend change of the hypothetical intervention is statistically significant. This indicates that the policy effects observed earlier are not attributable to random fluctuations in time trends. Furthermore, the goodness-of-fit measures for all models fall within reasonable ranges, providing additional support for the validity of the model specifications. Specifically, the model fit statistics are within acceptable bounds ($R^2 \in [0, 1]$). These findings collectively suggest that the policy effects identified in the baseline regressions indeed stem from the policy itself rather than from coincidental time trends, confirming the robustness of the research conclusions.

Table 8. Robustness Checks

Model	Variable	Baseline Model	Placebo Test
Meta-Frontier Results	Pre-intervention Trend	0.0175***	0.025***
	Level Change	0.1275***	0.095*
	Trend Change	0.0099*	-0.003
	Seasonal Healthcare-seeking Behavior	0.019	-0.012
	Pandemic Peak Period	-0.005	0.071
	Constant	0.0276***	-50.013***
	R^2	0.828	0.960
Group-Frontier Results	Pre-intervention Trend	0.0185***	0.020***
	Level Change	0.0964***	0.082
	Trend Change	0.0070***	0.002
	Seasonal Healthcare-seeking Behavior	0.030	-0.025
	Pandemic Peak Period	0.001	0.074
	Constant	0.0845***	-40.611***
	R^2	0.904	0.951
TGR Results	Pre-intervention Trend	0.0250*	0.036***
	Level Change	0.120	0.015
	Trend Change	-0.017	-0.038
	Seasonal Healthcare-seeking Behavior	0.100	0.041
	Pandemic Peak Period	-0.011	0.007
	Constant	0.455***	-72.909***
	R^2	0.904	0.839

*, **, ***TGR = Technology Gap Ratio. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

4. Conclusions and Recommendations

4.1 Research Conclusions

4.1.1 DIP Reform Effectively Promotes the Improvement of Healthcare Service Efficiency in H City

Empirical analysis indicates that the DIP reform has significantly enhanced the level of healthcare service efficiency among medical institutions in H City. Specifically, the DIP policy has effectively increased both the meta-frontier efficiency and the group-frontier efficiency of these institutions. While there was an improvement in the Technology Gap Ratio (TGR), it was not statistically significant. Detailed evidence is provided in Table 6 and Figures 2, 3, and 4. The results in Table 3 further reveal efficiency disparities among different tiers of medical institutions: within tertiary hospitals, general hospitals consistently maintained their position at the technological frontier, whereas the efficiency improvement in specialized hospitals was relatively slower; among secondary institutions, three specialized hospitals reached the technological frontier, while the efficiency values of the remaining institutions remained at relatively low levels; at the primary care level, a few institutions achieved breakthrough development.

This study posits that these achievements are primarily attributable to the dual-drive mechanism established by the reform. On one hand, from the cost-control perspective, the DIP payment method, by setting caps on per-case expenses and implementing a cost-overrun responsibility mechanism, compels hospitals to optimize resource allocation. This incentivizes medical institutions to proactively refine their case-mix cost structures and the utilization rates of medical equipment, reduce redundant resource inputs, and enhance resource utilization efficiency, thereby effectively controlling costs (Wang et al., 2025). On the other hand, following the implementation of the DIP reform, both outpatient and inpatient service volumes in H City's medical institutions showed significant growth. This phenomenon can be explained from the service optimization perspective. The DIP reform further standardized patient care pathways, shifting the payment focus from "treatment process" to "treatment outcome," which improved treatment efficacy and patient experience while alleviating the financial burden on patients (Yang, Luo, & Guo, 2024). However, currently, only a few institutions have achieved optimal TGR values (Table 3), indicating substantial potential remains for improving overall medical service efficiency. This situation mainly stems from the fact that the DIP reform is still in a phase of policy adaptation and exploration, where supporting management mechanisms and detailed implementation rules are not yet fully mature.

4.1.2 Medical Costs in H City Exhibit a "U-shaped Rebound" Pattern under the DIP Policy

Interrupted time series analysis of medical expenditures reveals a significant decrease in medical costs in H City following the DIP reform, which aligns with findings from previous studies (Deng et al., 2023). This indicates that medical institutions have achieved substantive results in cost control, consistent with the reform objectives of strengthening internal cost management and enhancing the technical value of medical services outlined in the Three-Year Action Plan for DRG/DIP Payment Method Reform (National Healthcare Security Administration, 2021). However, Table 5 and Figure 1 reveal a noteworthy phenomenon: medical costs began to rise again in the later stage of the reform. If the current trend continues, costs are projected to return to pre-reform levels within 12 quarters. This highlights challenges in sustaining cost control in H City. This pattern of significant initial success followed by later rebound reflects a "conformist behavior" phenomenon (Shang & Huang, 2020) that may suggest weakening implementation efforts or insufficient oversight during the policy execution process. This is likely associated with the yet-to-be-mature and fully-developed relevant regulatory and assessment mechanisms (Peng et al., 2025). It warrants high attention from the relevant functional departments and calls for targeted corrective measures.

4.1.3 Responses of H City's Medical Institutions to the DIP Policy Show Hierarchical Heterogeneity

The empirical results from the efficiency and multiple-group interrupted time series analyses show that the operational efficiency of healthcare institutions at all levels in H City significantly improved after the DIP reform, but with distinct hierarchical differences. Specific evidence is provided in Table 7 and Figures 6-8. This differential effect primarily stems from variations in the organizational resilience of institutions at different levels. Specifically, tertiary medical institutions, leveraging their robust financial support systems, specialized human resource allocation, and standardized operational management processes, demonstrated strong policy responsiveness and the most optimal efficiency growth trend. They were able to effectively mitigate the shocks brought by the payment reform while rapidly capitalizing on the policy dividends(Cheng, Zhang, & Jiang,2020). Secondary hospitals exhibited the strongest capacity for continuous improvement during the reform, showcasing the adaptive advantages of mid-level institutions. In contrast, primary care institutions showed a lagged response to the DIP policy. Nevertheless, as the reform progressed, their service volumes increased significantly, and their initiative in admitting patients improved, demonstrating a positive trend of gradually unleashing service vitality.

4.2 Policy Recommendations

4.2.1 Improve the Construction of Supporting Mechanisms for DIP to Comprehensively Enhance Medical Service Efficiency

To address the insufficient convergence towards the efficiency frontier among medical institutions during DIP policy implementation and the challenges in overall policy adaptation, and to comprehensively enhance medical service efficiency, it is recommended to advance the reform from the following four aspects:

First, regarding foundational supporting mechanisms**, i**t is crucial to improve the dynamic adjustment mechanism for the DIP diagnosis database and enhance the scientific basis for setting disease groups, weights, and coefficients (Wu et al., 2023). Medical insurance and relevant departments should collect and compare historical and real-time data, dynamically analyze the differences and underlying reasons in medical insurance payment standards and disease costs before and after DIP implementation. This will promote the alignment of the diagnosis database with clinical realities, ensure that payment standards match actual clinical medical costs, and thereby guide medical institutions to standardize their diagnosis and treatment practices.

Second, regarding payment and settlement mechanisms**,** medical institutions should focus on budget management and cost control, thoroughly implementing the budget management mechanism of "global budget control, surplus retention, and reasonable overrun sharing" to motivate staff to strictly adhere to budgets. Medical insurance departments should dynamically adjust settlement cycles and clearly define the proportion of shared responsibility for cost overruns.

Third, regarding supervision and assessment mechanisms, it is recommended to formulate supporting assessment and evaluation methods. Establish a performance evaluation system incorporating expert reviews. Provide preferential support in medical insurance fund allocation and financial subsidies to institutions demonstrating significant improvement in medical services, thereby fully leveraging the positive incentives of the DIP reform (Deng & Zhou, 2022).

4.2.2 Deepen Internal Refined Management to Drive Behavioral Transformation

Given the significant disparities in efficiency performance and evident internal differentiation among different levels of medical institutions, a "one-size-fits-all" management approach should be avoided. Development paths and management strategies tailored to institutional capacities should be formulated.

First, tertiary medical institutions should be promoted to play a technological leadership role in constructing a regional standardized diagnosis and treatment system. Tertiary hospitals can take the lead in establishing regional DIP disease consortiums, developing standardized treatment protocols and cost-control pathways for common and frequently occurring diseases, and promoting these to lower-level hospitals.

Second, secondary medical institutions should establish a cost accounting and performance evaluation system based on disease categories, strengthen the standardization of diagnosis and treatment behaviors, and avoid declines in service quality due to excessive cost control.

Third, to address the uneven efficiency among primary medical institutions, it is recommended that health and medical insurance departments jointly establish a "Tiered Performance Management System for DIP in Primary Healthcare Institutions." Provide preferential treatment in total medical insurance funds to institutions showing continuous efficiency improvement and include them as key targets for technical assistance within regional medical consortia.

4.2.3 Optimize Differentiated Reform Pathways and Build Collaborative Promotion Mechanisms

Regarding the differentiated implementation and collaborative mechanism construction for the DIP payment method reform, this paper proposes countermeasures and suggestions from two dimensions: vertical governance and horizontal coordination. In terms of optimizing vertical governance: First, establish a tiered and classified management system. Municipal medical insurance departments should guide district and county-level authorities to establish special DIP working groups, focusing on the differentiated configuration of the disease point value system, institutional tier coefficients, and budget allocation mechanisms. Drawing on practical experience from various regions—such as the "case-by-case special deliberation" tiered management in Dongying City, Shandong Province (Chen et al., 2025), the dynamic adjustment mechanism for coefficients in Xiamen City Xiamen Medical Security Center., 2024), and the "same-price-for-same-basic-diseases within the city" mechanism in Lianyungang City (Lianyungang Medical Security Bureau, 2025)—policies should be tailored to regional and institutional realities to further optimize medical insurance management. Second, consolidate the foundation of primary-level service capacity. By promoting the extension of medical services to the grassroots level and establishing a "three priorities" investment mechanism—prioritizing funding, equipment, and talent for primary healthcare institutions—more basic medical services can be shifted to these facilities. The practical experience of implementing the Diagnosis-Intervention Packet (DIP) within the medical consortium of Huadu District, Guangzhou, can serve as a valuable reference (Fu et al., 2022). This approach will tangibly enhance primary-level service capacity and advance the hierarchical diagnosis and treatment system (Cai et al., 2023).

In terms of horizontal coordination mechanisms: First, establish a multi-department collaborative governance mechanism**.** Form a DIP Reform Office composed of departments such as medical insurance, health, and finance. This office would collaboratively discuss crucial matters including policy alignment, budget management, and information system development. Specialized subgroups should be established to ensure concerted policy efforts throughout the DIP reform process. Second, improve the support system for coordinated development**.** Achieve data sharing and synergy by constructing a unified healthcare big data platform that covers medical insurance, medical services, and pharmaceuticals. Valuable insights can be drawn from integrated reform models such as Zhejiang Province's "tripartite coordination among healthcare, medical insurance, and medicine" and "integrated planning for six healthcare areas"(Wu, 2024), aiming to create a unified resource and information model.

5. Research Outlook

This study still has certain limitations. First, regarding data timeliness**,** the five-year interrupted time series analysis includes only 20 observation points, which may affect the robustness of trend judgments. Second, in terms of research methodology, due to data acquisition constraints, the study design lacks a control group, and the DEA method does not account for the influence of random errors. Finally, concerning sample representativeness, the sample covers only a portion of medical institutions and lacks data on patient clinical characteristics, staff interviews, and information from primary care institutions. Future research will aim to enhance the depth of the study by extending the observation period, expanding the indicator system, refining research methods, incorporating control regions, and broadening the sample scope.

References

Cai, Q. M., Ke, X. T., Du, F., et al. (2023). Research on the Collaboration Level of County Medical Alliance Among County-Township-Village Three-Tier Medical Institutions. *Chinese Health Service Management*, *40*(9), 641-646, 687.

Chen, L., Song, Q., Zhang, J., et al. (2025). Practical Exploration of the DIP Special Case Deliberation Mechanism: A Case Study of Dongying City. *China Medical Insurance*, (2), 84-90. https://doi.org/10.19546/j.issn.1674-3830.2025.2.011

Cheng, Y., Zhang, Y., & Jiang, C. H. (2020). Cognitive Evaluation of County Residents in Central China on the Three-Tier County-Level Medical Institutions. *Medicine and Society*, *33*(3), 20-24. https://doi.org/10.13723/j.yxysh.2020.03.005

Deng, Q., Wang, C., Jin, J. H., et al. (2023). An Empirical Study on the Operational Effects of DIP Pilot Cities Based on the Difference-in-Differences Method. *Chinese Hospital Management*, *43*(6), 6-9.

Deng, Q., Wang, C., Jin, J. H., et al. (2023). An Empirical Study on the Operational Effects of DIP Pilot Cities Based on the Difference-in-Differences Method. *Chinese Hospital Management*, *43*(6), 6-9. (Duplicate of [4], retained as per user's list)

Deng, X. N., & Zhou, Z. P. (2022). Challenges and Countermeasures for Public Hospitals Under the DRG/DIP Payment Reform. *Straits Science and Industry*, *35*(9), 33-36, 40.

Feng, F. L., Hu, X. J., Ye, X. M., et al. (2021). Policy Implications and Reform Practice of DRG and DIP in Promoting High-Quality Development of Public Hospitals: A Summary of the 'Seminar on DRG and High-Quality Development of Public Hospitals'. *Health Economics Research*, *38*(8), 35-38. https://doi.org/10.14055/j.cnki.33-1056/f.2021.08.026

Fu, M. R., Chang, J. H., Cai, Q. M., et al. (2022). Construction of an Integrated Medical and Health Service System in Huadu District, Guangzhou City. *Chinese Health Resources*, *25*(2), 223-229. https://doi.org/10.13688/j.cnki.chr.2022.210425

Fu, W., Jiang, Q., Yu, L. H., et al. (2020). Comparison Between DRG and DIP and Analysis of Their Impact on Medical Institutions. *Chinese Health Economics*, *39*(12), 13-16.

Li, L. L., & Li, Y. X. (2022). An Analysis of the Governance Pathway of Medical Insurance Payment Reform in China: A Mechanism Comparison Based on DRG and DIP. *Health Economics Research*, *39*(9), 43-48. https://doi.org/10.14055/j.cnki.33-1056/f.2022.09.016

Li, L. L., & Wang, R. F. (2024). The Impact and Mechanism of DRG/DIP Payment Reform on Physicians' Welfare. *Chinese Journal of Health Policy*, *17*(4), 23-29.

Li, S. Q., & Chu, F. L. (2021). Does the Reform of Global Budget Management in Medical Insurance Payment Improve Medical Service Efficiency? Evidence from a Provincial Employee Medical Insurance Program. *Journal of University of Jinan* (Social Science Edition), *31*(3), 140-150, 160.

Lianyungang Medical Security Bureau. (2025, April 21). *Notice on Publishing the 'Lianyungang Diagnosis-Intervention Packet (DIP) Disease Catalog, Points, and Related Coefficients (2025 Edition)'*. Retrieved from https://www.lyg.gov.cn/zglygzfmhwz/zcwj_ylws/content/f128e533-4e0f-4ef2-8717-9f96975f1842.html

Lu, Z. H., Sun, J. J., Li, Y. W., et al. (2024). The Impact of DIP Payment Reform on Inpatient Services in County-Level Traditional Chinese Medicine Hospitals in Shandong Province: An Empirical Study Based on DID. *Chinese Health Economics*, *43*(4), 64-67.

Muselli, M., Cofini, V., Mammarella, L., et al. (2022). The Impact of COVID-19 Pandemic on Emergency Services. *Annali di Igiene: Medicina Preventiva e di Comunità*, *34*(3), 248-258. https://doi.org/10.7416/ai.2021.2480

National Healthcare Security Administration. (2021). *Three-Year Action Plan for DRG/DIP Payment Reform*. Retrieved March 31, 2025, from https://www.gov.cn/zhengce/zhengceku/2021-11/28/content_5653858.htm

O'Kelly, B., Conway, A., McNally, C., et al. (2020). Rapid Diagnosis of Seasonal Influenza Virus and Cohorting of Hospitalized Patients on an Influenza Ward: A Prospective Analysis of Outcomes. *Journal of Hospital Infection*, *105*(3), 509-517. https://doi.org/10.1016/j.jhin.2020.03.023

Peng, X. Y., Jiao, X. Y., Xiang, L., et al. (2025). Research on the Impact Mechanism of DIP Payment's Primary Care Disease Policy on Patient Flow. *Chinese Health Economics*, *44*(2), 50-53, 108.

Peng, X. Y., Tan, H. W., Yang, Q. J., et al. (2024). Analysis of the Impact of Diagnosis-Intervention Packet Payment on Inpatient Visits and Costs in Primary Healthcare Institutions. *Health Development and Policy Research*, *27*(2), 142-147, 156.

Rao, D. P., O'Donnell, C. J., & Battese, G. E. (2003). *Metafrontier Functions for the Study of Inter-regional Productivity Differences* (CEPA Working Paper). Centre for Efficiency and Productivity Analysis.

Shang, H. P., & Huang, L. Z. (2020). A Study on the Change of Participation Rate in the New China's Rural Cooperative Medical Scheme: A Quantitative Exploration Based on 316 Central-Level Policy Documents. *Chinese Rural Economy*, (7), 99-121.

Sun, J. Q., Huang, J. Y., Liu, H. Z., et al. (2024). The Impact of DRG Payment Reform on the Structure of Average Inpatient Costs in County-Level Public Hospitals. *Chinese Hospital Management*, *44*(12), 38-41.

Wang, Q. Q., Xie, Y. L., Qin, Y. H., et al. (2025). An Empirical Study on the Impact of the Diagnosis-Intervention Packet Payment System on Hospital Performance Management. *West China Medical Journal*. Advance online publication. Retrieved November 1, 2025, from https://kns.cnki.net/KCMS/detail/detail.aspx?dbcode=CAPJ&dbname=CAPJLAST&filename=HXYX20251027007

Wu, L. (2024). The Effectiveness of the 'Tripartite Medical System Linkage' and 'Six-Medical Coordination' Reform: A Case Study of a Tertiary Hospital in Zhejiang Province. *Economist*, (6), 240-241.

Wu, Y. P., Li, H. J., Zhang, L., et al. (2023). Ethical Reflections on Medical Insurance DIP Reform and Medical Service Provision: Conflicts and Countermeasures. *Medicine and Philosophy*, *44*(19), 17-19.

Xi, J. P. (2022). *Hold High the Great Banner of Socialism with Chinese Characteristics and Strive in Unity to Build a Modern Socialist Country in All Respects: Report to the 20th National Congress of the Communist Party of China*. Retrieved January 20, 2025, from https://www.gov.cn/xinwen/2022-10/25/content_5721685.htm

Xiamen Medical Security Center. (2024, May 28). *Notice on Further Improving the Dynamic Adjustment Mechanism for DIP Coefficients*. Retrieved October 31, 2025, from https://www.jimei.gov.cn/ztfw/yljk/bzgf/202405/t20240528_1056008.htm

Yan, Y. B., Zheng, X. P., & Xu, H. (2023). A Comparative Study on the Cost-Control Effects of C-DRG and DIP in Public Hospitals. *Chinese Hospital Management*, *43*(3), 30-33.

Yang, H., & Lyu, C. C. (2023). Ten Years of the 'New Healthcare Reform': Research on Regional Disparities, Dynamic Evolution, and Influencing Factors of China's Healthcare Service Efficiency. *Chinese Journal of Management Science*, *31*(2), 162-172. https://doi.org/10.16381/j.cnki.issn1003-207x.2021.0539

Yang, R., Luo, Y. R., & Guo, J. (2024). A Study on the Impact of DIP on the Operational Performance of Stomatology Hospitals Based on Interrupted Time Series Model. *Chinese Hospital Management*, *44*(12), 42-45.

Ying, Y. Z. (2021). DIP and DRG: Similarities and Differences. *China Medical Insurance*, (1), 39-42. https://doi.org/10.19546/j.issn.1674-3830.2021.1.009

Yu, B. R. (2021). Reform Practice and Developmental Implications of DRG and DIP. *Health Economics Research*, *38*(1), 4-9. https://doi.org/10.14055/j.cnki.33-1056/f.2021.01.021

Zhang, A. L., & Tan, H. W. (2024). The Impact of DIP Payment on the Intensity of Diagnosis and Treatment of Medical Service Items. *Health Economics Research*, *41*(7), 41-43, 48. https://doi.org/10.14055/j.cnki.33-1056/f.2024.07.007

Zhang, D. (2021). Practice and Discussion on Performance Management of Public Hospitals Under DRG/DIP Payment. *Accounting Learning*, (8), 160-161.

Zhao, T. (2017). Service Efficiency of Rural Medical Institutions in China Incorporating Demand-Side Factors: Based on Data from Medical Institutions and Household Surveys in 18 Counties Across Three Provinces. *Nankai Economic Studies*, (3), 34-49. https://doi.org/10.14116/j.nkes.2017.03.003

Zhao, Y. (2014). Evaluation of the Relative Efficiency of Medical Services in Healthcare Institutions Across Chinese Provinces: An Empirical Analysis Based on DEA-BCC Model and Malmquist Index. *Review of Economy and Management*, *30*(2), 151-156. https://doi.org/10.13962/j.cnki.37-1486/f.2014.02.005

Zheng, C. (2022). Hospital Cost Management Under DRG/DIP Payment. *Health Economics Research*, *39*(3), 88-90. https://doi.org/10.14055/j.cnki.33-1056/f.2022.03.022