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ORIGINAL RESEARCH

Does the Diagnosis-Intervention Packet Payment Reform Impact Medical Costs, Quality, and Medical Service Capacity in Secondary and Tertiary Hospitals? A Difference-in-Differences Analysis Based on a Province in Northwest China

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Purpose: To control medical costs and regulate the behavior of providers, China has formed an original widely piloted case-based payment under the regional global budget, called the Diagnosis-Intervention Packet (DIP). This study aimed to evaluated the impact of the DIP payment reform on medical costs, quality of care, and medical service capacity in a less-developed pilot city in Northwest China.

Patients and Methods: We used the de-identified case-level discharge data of hospitalized patients from January 2021 to June 2022 in pilot and control cities located in the same province. We performed difference-in-differences (DID) analysis to examine the differential impact of the DIP reform for the entire sample and between secondary and tertiary hospitals.

Results: The DIP payment reform resulted in a significant decrease of total expenditure per case in the entire sample (5.5%, $P < 0.01$) and tertiary hospitals (9.3%, $P < 0.01$). In-hospital mortality rate decreased significantly in tertiary hospitals (negligible in size, $P < 0.05$), as did all-cause readmission rate within 30 days in the entire sample (1.1 percentage points, $P < 0.01$) and secondary hospitals (1.4 percentage points, $P < 0.01$). Proportion of severe patients increased significantly in the entire sample (1.2 percentage points, $P < 0.05$) and tertiary hospitals (2.5 percentage points, $P < 0.01$). We did not find the DIP reform was associated with a significant change in relative weight per case.

Conclusion: The DIP payment reform in the less-developed pilot city achieved short-term success in controlling medical costs without sacrificing the quality of care for the entire sample. Compared with secondary hospitals, tertiary hospitals experienced a greater decline in medical costs and received more severe patients. These findings hold lessons for less developed countries or areas to implement case-based payments and remind them of the variations between different levels of hospitals.

Keywords: DIP payment, medical costs, quality of care, medical service capacity, less developed city, case-based payment

Introduction

Medical insurance payments are an important lever for regulating medical service behaviors and guiding the allocation of medical resources. To control the continuous growth in medical expenses, reform of health insurance payments in many countries has shifted from a retrospective payment system to a prospective payment system.[1–4] As a type of case-based payment, Diagnosis-related groups (DRG) payment has been widely adopted worldwide, and many countries, particularly low- and middle-income countries (LMICs), are increasingly using DRG payment to compensate health-service providers.[5] DRG payment divides patients into diverse diagnostic groups according to diagnosis, treatment, and patient

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characteristics and sets payment standards according to the group rather than the actual cost. China has long explored DRG payments, but owing to the high requirements regarding the quality of medical data, management, and technical capabilities of medical insurance personnel and hospitals, and the need to substantially reform the health information system, its application and implementation has been slow, especially in less developed areas.[6]

To control medical costs, regulate the behavior of providers, and make it easier to implement, China has developed an original case-based payment method under the regional global budget based on the advantages of big data in several cities (eg, Guangzhou), called the Diagnosis-Intervention Packet (DIP). The main differences between the DIP and DRG payments are in the classification system and payment standard. The DRG classification system is based on the selection of clinical pathways and the subjective judgment of physicians, and the absolute reimbursements for each group in the general practice of DRG payment are fixed in advance.[7,8] Generally, the number of DRG groups does not exceed 1000. However, the DIP classification system emphasizes statistical analysis of clinical objective real data. The DIP group exhaustively matches the combinations of principal diagnosis ICD-10 codes and procedure ICD-9-CM codes from the historical data of hospitalized cases,[9] and the number of DIP groups generally exceeds 3,000. The payment standard of the DIP group is determined by the fixed related weight (RW) and floating monetary value for each RW. The RW is calculated according to the average medical cost of cases in the entire sample data, which is the relative value reflecting the degree of resource consumption among the different DIP groups. As the monetary value for each RW of the DIP payment is equal to the sum of the annual total regional global budget divided by the sum of the RW for all hospitalized cases in the region, the monetary value for each RW is floating. In other words, hospitals in the same region allocate the total regional global budget according to the sum of the RW of their respective annual healthcare services. Therefore, hospitals in the same area have a mutual influence: the medical services provided by a hospital in a certain area affect not only the interests of the hospital and patients' health benefits but also the interests of other hospitals in the same area. Due to the lower requirements for the patient classification rules and information systems, the number of cities piloting the DIP payment across China far exceeded that of the DRG payment in November 2020, especially in less developed cities.[10]

The expected goal of medical insurance payment reform is to achieve a win-win situation among medical insurance departments, hospitals, and patients, while the key to success lies in the balance between controlling medical costs and ensuring the quality of medical care.[11] According to the relevant theoretical literature,[6,12] on the one hand, DIP payment has the characteristics of a prospective payment system wherein RW for each DIP group is predetermined, thus potentially incentivizing providers to minimize medical costs and reduce the provision of services in the same DIP group so as to achieve the purpose of controlling medical expenditures. On the other hand, to a certain extent, DIP payment introduces a competition mechanism among hospitals because of the uncertainty of the monetary value of each RW. This may encourage providers to increase their RW to obtain more medical insurance compensation, thus potentially altering providers' medical service capacity. However, the impact of the DIP payment on medical quality is unknown and needs to be further analyzed through empirical results.

Previous empirical studies provided less empirical pieces of evidence on the impacts of case-based payment systems in low-and middle-income countries. They mainly focused on medical costs and efficiency, but few studies on medical quality and medical service capacity, especially in less developed areas in China, for DIP payment reform.[13,14] Previous empirical studies on the DIP payment were all aimed at regions with high economic development in China, such as Guangzhou and Shenzhen. However, the impact of DIP payment reform in the less developed areas of China, which may determine whether the DIP payment can be widely adopted in China or even in less developed countries, has yet to be studied. According to the existing literature, there may be differences in the reform effect of DRG or DIP payments at different hospital levels;[15,16] however, few studies have examined this issue. Most empirical studies have adopted statistical descriptions or univariate analysis methods that cannot eliminate the influence of time and mixed factors.[17] Therefore, the authenticity of the results must be considered. To enhance the scientific evaluation of this effect, some scholars have employed difference-in-differences (DID) analysis or the interrupted time series (ITS) method.[18,19] However, the results are inconsistent, and further research is required.

This study aimed to understand the impact of the DIP payment reform on medical costs, quality of care, and medical service capacity in a less developed city in China and the heterogeneity between secondary and tertiary hospitals. Specifically, we used DID analysis to estimate changes before and after the reform in a DIP pilot city compared to

a control city with similar levels of economic development and population size in the same province, thus providing empirical evidence for less developed countries or areas to carry out case-based payments and reminding them of the variations between different levels of hospitals.

Material and Methods

Settings and Institutional Background

We selected a prefecture-level city (W City) in Northwest China as the intervention group, which was one of the 71 national pilot cities selected for the DIP payment reform. In 2022, W City's gross domestic product was 66.3 billion yuan, and its population was 1.4 million. Before the DIP payment reform, W City utilized a fee-for-service (FFS) system for inpatient medical services under the hospital-level global budget. In January 2022, the DIP payment system under the city-level regional global budget was implemented in 19 hospitals (five tertiary and 14 secondary) in W City, which covers local health insurance inpatients, including the urban employee basic medical insurance scheme (UEBMI) and the urban and rural resident basic medical insurance scheme (URRBMI) inpatients. W City identified approximately 2,000 local DIP groups based on the collection and cleanliness of historical data from the previous three years.

We selected Z City, which is located in the same province as W City, as the control group. Both cities are similar in terms of their economic development level, population size, medical resources, and social health insurance schemes. During the study period, Z City's payment method for inpatient medical services to the provider was the FFS under the hospital-level global budget.

Data

Our data source included de-identified case-level discharges from January 2021 to June 2022, collected from the Healthcare Security Administration in the study province and all hospitals in the study cities. During this period, neither city implemented any other major health reform policies. The Corona Virus Disease 2019 (COVID-19) pandemic broke out in China in 2020. Therefore, we attempted to select a study period that was less affected by the pandemic, with almost no new cases in either city, to analyze the effect of the DIP payment reform. Each record included information on the hospital name, hospital level, diagnosis and procedure codes, medical costs, admission and discharge dates, and patient characteristics (age at admission, sex, and insurance type). We restricted our sample to local inpatients with the UEBMI and URRBMI in both cities because the DIP payment reform in W City only covers insured local inpatients, whereas non-local inpatients are still under FFS. Finally, we obtained a sample of 423,631 observations from the two cities at the case level. The sample size in W City was 1.2 times that in Z City. Hospitalized cases were included in 19 hospitals in W City (five tertiary hospitals and 14 secondary hospitals) and 23 hospitals in Z City (three tertiary hospitals and 20 secondary hospitals).

Study Variables

We used the log form of the total expenditure per case as the outcome variable. We also included two quality outcome variables: in-hospital mortality (the variable "discharge status" in the dataset as "death") and all-cause readmission within 30 days (interval between admission and the last discharge less than 30 days). Additionally, we included two outcome variables that reflect medical service capacity: severe patients (the age-adjusted Charlson Comorbidity Index equals one or above) and RW per case.[20,21] We assigned each case a DIP group and its corresponding RW using the DIP classification system in W City in 2022, which made the RW comparable across different years and cities.

The control variables included indicators for age groups (minor group: patients younger than 17 years; young people group: patients aged 18–64 years; older adult group: patients over 65 years), sex (male or female), health insurance type (UEBMI or URRBMI), dummies for disease categories (principal diagnosis according to the ICD-10 coding system), and dummies for the Charlson Comorbidity Index (CCI).

Statistical Analysis

We employed a DID model to identify the impact of introducing the DIP payment on medical costs, quality, and medical service capacity. For i admitted to hospital h at time t, the DID model is as follows:

$$Y_{iht} = \alpha + \beta DIP_{iht} + \theta X_{iht} + z_t + v_h + \varepsilon_{iht} \quad (1)$$

DIP_{iht} is a dummy variable, and the value of local health insurance patients discharged after January 2022 in W City is one; otherwise, it is zero. β reflects the main effects of the DIP payment reform and Y_{iht} denotes a series of dependent variables. X_{iht} is a set of covariables that measures demographic characteristics, including age group, sex, health insurance type, disease category, and CCI. However, when we used severe patients as the dependent variable, sex and CCI were excluded from covariables. z_t and v_h were used to control for year–month and hospital fixed effects, respectively. ε_{iht} is a robust error term that is clustered at the monthly hospital level.

The model settings for the DID method must satisfy the parallel trend assumption. Parallel trend tests were performed using the event study method to validate the results. Figures 1–3 show the parallel trend test results for the entire sample

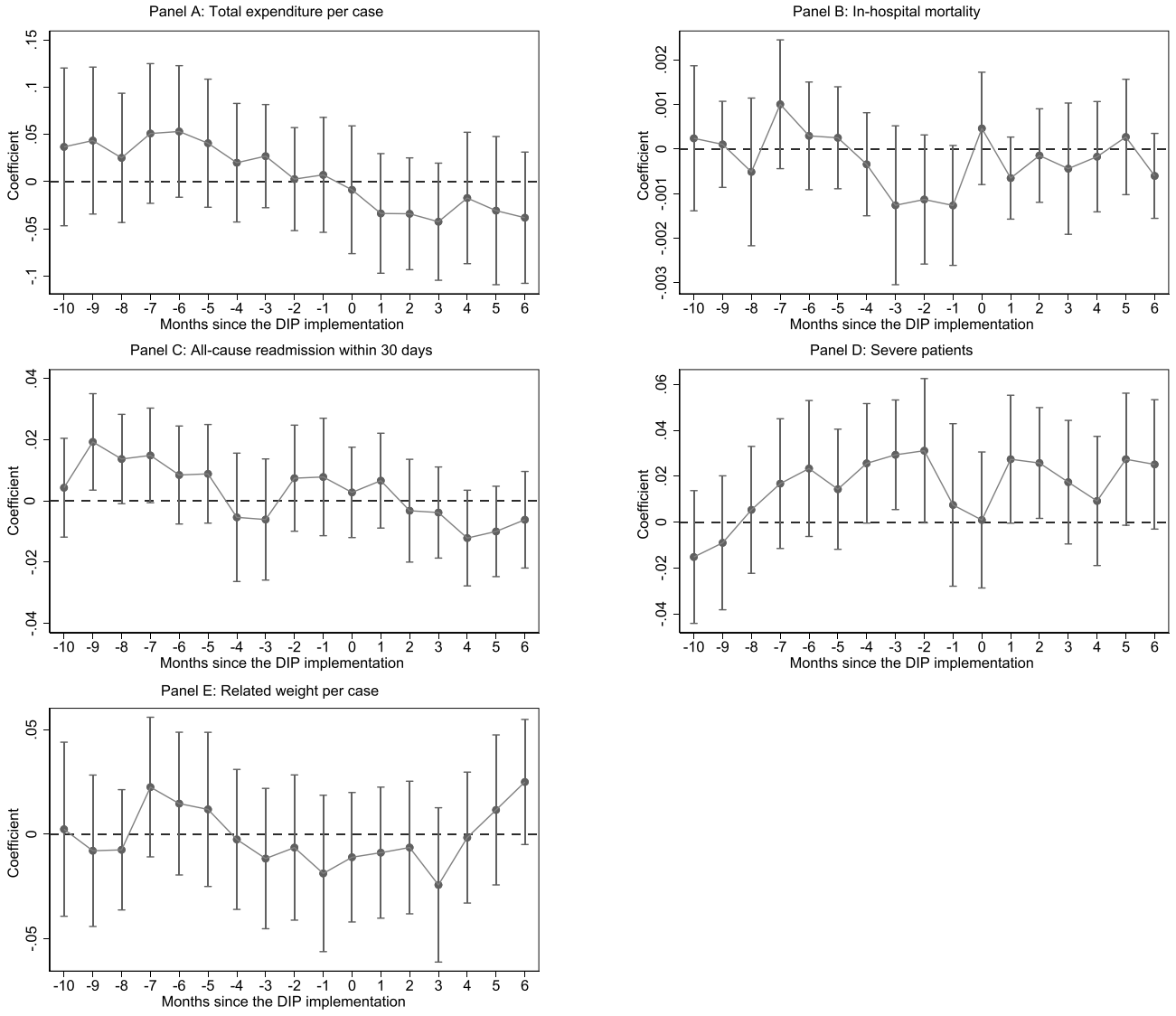

Figure 1 Tests on the validity of parallel assumptions for the whole sample. We replaced the DIP dummy in equation (1), with the interaction terms of a series of year–month dummies and the treatment group dummy. The DIP payment reform was implemented in January 2022, and the horizontal axis represented months since the DIP implementation. We selected the first study month (January 2021) as the reference period. **A**–**E** depict changes in differences of the outcomes (total expenditure per case, in-hospital mortality, all-cause readmission within 30 days, severe patients, and RW per case) relative to the reference period for the entire sample between the W and Z cities.

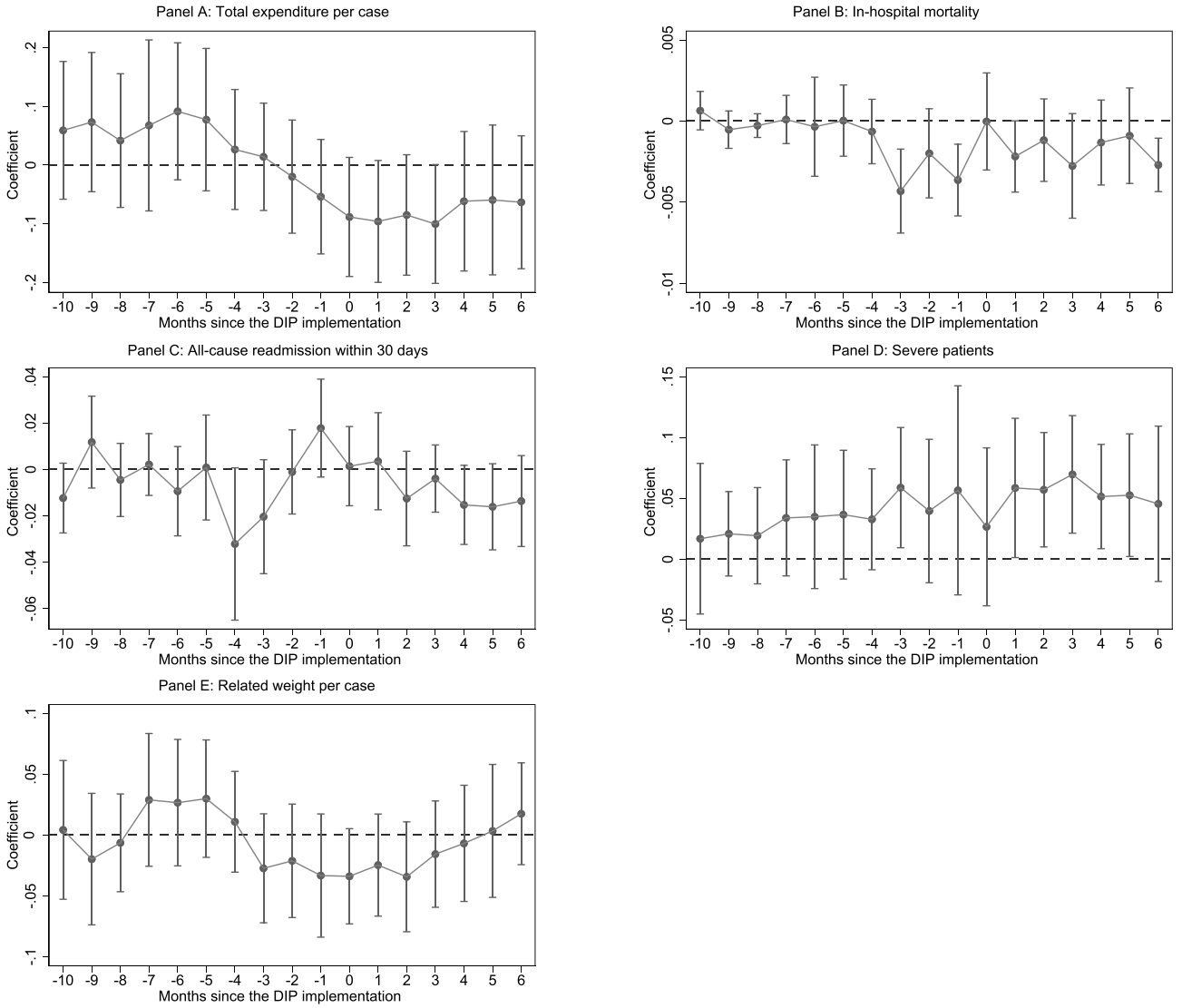

Figure 2 Tests on the validity of parallel assumptions for inpatients from tertiary hospitals. We replaced the DIP dummy in equation (1), with the interaction terms of a series of year–month dummies and the treatment group dummy. The DIP payment reform was implemented in January 2022, and the horizontal axis represented months since the DIP implementation. We selected the first study month (January 2021) as the reference period. **A**–**E** depict changes in differences of the outcomes (total expenditure per case, in-hospital mortality, all-cause readmission within 30 days, severe patients, and RW per case) relative to the reference period for inpatients from tertiary hospitals between the W and Z cities.

and for inpatients from tertiary and secondary hospitals, respectively. We found that, compared with the first month of the study period, there were no pre-existing differences between the locally insured inpatients in W and Z cities before the DIP reform, indicating that our results are valid.

We also examined the robustness of the DID estimation results by performing a series of placebo tests.

Results

Descriptive Statistics

For the convenience of comparison, Table 1 shows the descriptive statistical results for W and Z cities before (January–June 2021) and after (January–June 2022) the DIP reform. After the DIP payment reform, the proportion of discharged cases in tertiary hospitals and the average age of inpatients in W City increased, whereas those in Z City decreased slightly. Conversely, after the DIP payment reform, the proportion of inpatients with UEBMI in W City increased, whereas that in Z City showed only a slightly increasing trend. We observed that the total expenditure per case, all-cause

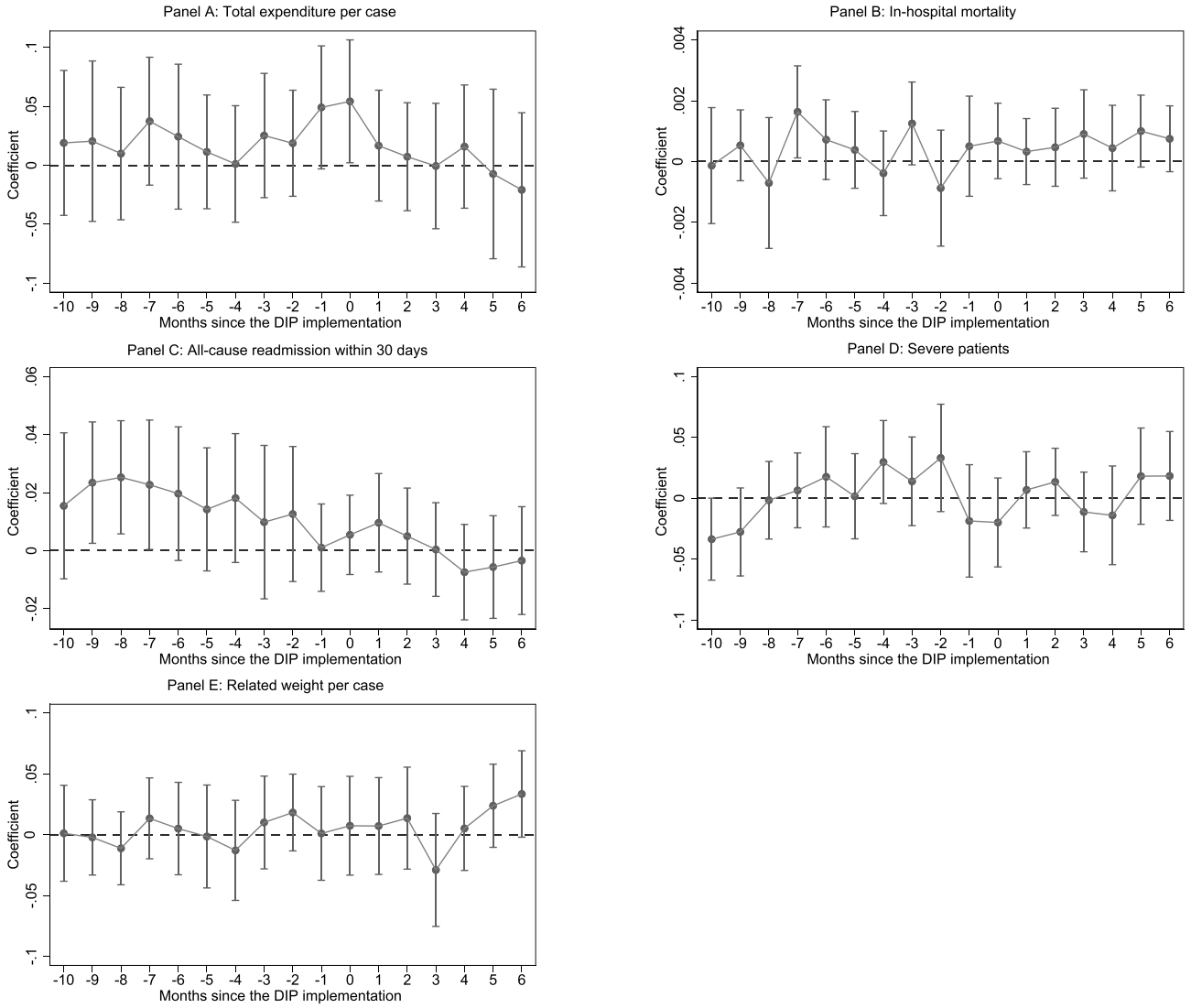

Figure 3 Tests on the validity of parallel assumptions for inpatients from secondary hospitals. We replaced the DIP dummy in equation (1), with the interaction terms of a series of year–month dummies and the treatment group dummy. The DIP payment reform was implemented in January 2022, and the horizontal axis represented months since the DIP implementation. We selected the first study month (January 2021) as the reference period. **A**–**E** depict changes in differences of the outcomes (total expenditure per case, in-hospital mortality, all-cause readmission within 30 days, severe patients, and RW per case) relative to the reference period for inpatients from secondary hospitals between the W and Z cities.

readmission within 30 days, and RW per case in W City decreased after the DIP reform, whereas those in Z City increased. However, compared with the three indicators mentioned above, the trends in the proportion of severe patients in the two cities were opposite. After the reform, the in-hospital mortality rate in both cities decreased. Tables S1 and S2 of the Supplementary Appendix shows the results of statistical analyses at the hospital level.

Total Expenditure per Case

Table 2 presents the DID estimates of the impact of the DIP payment reform for the entire sample (Column (2)) and for subgroups by hospital level (Columns (3) and (4)). Column (1) presents the unadjusted estimates for the entire sample. The estimations are based on equation (1), where we used case-level discharge data from cities W and Z. Compared to Z City, the total expenditure per case in W City decreased by 5.5% ($P < 0.01$) after the DIP payment reform.

Considering hospital levels, we found that the DIP payment reform was associated with a 9.3% ($P < 0.01$) decline in total expenditure per case in W City for tertiary hospitals. The effect in tertiary hospitals was approximately 4.4 times greater than that in secondary hospitals (2.1%, $P < 0.1$), which may be related to the different changes in treatment intensity of inpatients at different hospital levels. We further found that the proportion of inpatients receiving procedures

Table 1 Descriptive Statistics Before and After DIP Payment Reform Among Inpatients in W and Z Cities

	Before DIP Reform (January–June 2021)		After DIP Reform (January–June 2022)	
	W City	Z City	W City	Z City
	(1)	(2)	(3)	(4)
Outcome variables				
Total expenditure per case, mean (SD), RMB	5,398.51 (6,857.89)	6,137.59 (8,903.13)	5,262.17 (5,978.83)	6,298.58 (8,880.15)
In-hospital mortality rate (%)	0.14	0.17	0.09	0.13
All-cause readmission rate within 30 days after discharge (%)	6.03	5.44	5.66	6.81
Proportion of severe patients (%)	48.18	51.89	50.59	50.00
Related weight per case, mean (SD)	0.96 (0.80)	0.99 (0.88)	0.94 (0.70)	1.01 (0.94)
Patient characteristics				
Age, mean (SD), years	50.81 (22.53)	50.64 (23.63)	52.03 (21.71)	50.61 (23.38)
Female (%)	53.17	51.69	52.24	52.18
UEBMI (%)	11.85	13.16	16.02	13.29
Charlson Comorbidity Index, mean (SD)	0.43 (0.76)	0.53 (0.94)	0.53 (0.92)	0.56 (0.96)
Hospital level (%)				
Tertiary (N_W = 5, N_Z = 3)	40.47	39.84	52.12	38.74
Secondary (N_W = 14, N_Z = 20)	59.53	60.16	47.88	61.26
Sample size	71,297	58,455	92,139	74,421

Notes: DIP denoted the diagnosis-intervention packet payment reform. The UEBMI was a basic medical insurance scheme for urban employees. N_W and N_Z denoted the number of hospitals in cities W and Z, respectively.

Table 2 Impact of DIP Payment Adoption Across the Entire Sample and When Subdivided into Tertiary and Secondary Hospitals: Difference-in-Differences Estimates

	Whole Sample		Tertiary Hospitals	Secondary Hospitals
	Unadjusted	Adjusted	Adjusted	Adjusted
	(1)	(2)	(3)	(4)
ln (total expenditure per case)				
DIP Payment	−0.056***	−0.057***	−0.098***	−0.021*
	(0.013)	(0.012)	(0.020)	(0.011)
Sample size	423,631	423,631	189,086	234,545
In-hospital mortality				
DIP Payment (*100)	−0.014	−0.019	−0.097**	0.032
	(0.026)	(0.026)	(0.047)	(0.026)
Sample size	423,631	423,631	189,086	234,545
All-cause readmission within 30 days				
DIP Payment	−0.011***	−0.011***	−0.005	−0.014***
	(0.003)	(0.003)	(0.005)	(0.003)
Sample size	423,631	423,631	189,086	234,545
Severe patients				
DIP Payment	0.017***	0.012**	0.025***	0.006
	(0.006)	(0.005)	(0.006)	(0.008)
Sample size	423,631	423,631	189,086	234,545

(*Continued*)

Table 2 (Continued).

	Whole Sample		Tertiary Hospitals	Secondary Hospitals
	Unadjusted	Adjusted	Adjusted	Adjusted
	(1)	(2)	(3)	(4)
ln (Related weight per case)				
DIP Payment	−0.005	0.000	−0.005	0.005
	(0.008)	(0.006)	(0.008)	(0.008)
Sample size	423,631	423,631	189,086	234,545

Notes: ***, **, and *Denoted significance at the 1%, 5%, and 10% levels, respectively. This table reported the estimators of the outcome variables based on equation (1) using case-level discharge data from cities W and Z. Each panel represented a separate regression analysis. The estimated coefficients were reported for the entire sample (Columns (1) and (2)), patients from tertiary hospitals (Column (3)), and patients from secondary hospitals (Column(4)). Column(1) reported the unadjusted results when no control variables were included. In Columns (2)–(4), all specifications included the full set of control variables (ie, indicators for age group, sex, insurance type, disease category, and CCI), except when we used severe patients as outcome variable (ie, indicators for sex, insurance type, and disease category). We also controlled for hospital and year–month fixed effects. Standard errors clustered at the hospital month level were shown in parentheses.

in W City increased by 6.8 percentage points, and the increase in treatment intensity in secondary hospitals was greater than that in tertiary hospitals (Table S3 of the Supplementary Appendix).

Quality of Care

According to Table 2, regardless of the overall level or tertiary and secondary hospitals, the estimated effect on the in-hospital mortality rate was small in W City after the DIP payment reform, compared with the sample mean of this measure. However, this estimate was statistically significant only for the tertiary hospitals.

Compared with Z City, the all-cause readmission rate within 30 days in W City decreased by 1.1 percentage points ($P < 0.01$) after the DIP payment reform. For tertiary hospitals, the difference was also negative but not statistically significant. For secondary hospitals, we found that the DIP payment reform was associated with a decline of 1.4 percentage points ($P < 0.01$) in the all-cause readmission rate within 30 days.

Medical Service Capacity

Compared with Z City, DIP payment adoption was associated with an increase of 1.2 percentage points ($P < 0.05$) in the proportion of severe patients in W City (Table 2). For tertiary hospitals, DIP payment adoption was associated with an increase of 2.5 percentage points ($P < 0.01$) in the proportion of severe patients. The estimate for secondary hospitals was also positive but not statistically significant.

Across the entire sample and when subdivided into secondary and tertiary hospitals, we found no significant change in RW per case in response to policy reform.

Robustness Checks

To analyze whether our results were affected by omitted variables and random factors, we employed placebo tests by randomly selecting pilot hospitals for the DIP payment reform and generating the reform time respectively.[22,23] Furthermore, we repeated the DID estimation 500 times according to equation (1). Finally, we plotted the density distributions of the estimated coefficients on the pseudo-DIP dummy in equation (1) (Figures S1-S3, of the Supplementary Appendix). We found that the coefficients estimated by random processing were distributed around zero, indicating that important influencing factors were not omitted in the model setting and that the core conclusions were still robust.

We also conducted a series of robustness checks to verify the validity of the results (Tables S4-S6, of the Supplementary Appendix). Table S4 presents the results of excluding inpatients discharged between September 2021 and December 2021 to eliminate the influence of the preparatory phase of the DIP payment. Table S5 reports the results

of excluding inpatients with tumors and mental diseases since these cases may be compensated by other payment systems such as per diem. We also excluded observations from October 2021 to exclude the influence of the COVID-19 pandemic; Table S6 presents the results. Therefore, our results were unaffected by these factors and remained essentially unchanged.

Discussion

To the best of our knowledge, this is the first empirical study to analyze the impact of the DIP payment reform on medical costs, quality, and medical service capacity in a less developed city in China. In January 2022, W City in northwest China changed from the FFS scheme under the hospital-level global budget to the DIP payment system under the city-level regional global budget. Our results showed that the DIP payment reform in W City achieved short-term success in controlling expenses without sacrificing the quality of care for the entire sample. Consistent with the theoretical analysis literature, the DID estimate showed an average of 5.5% ($P < 0.01$) decrease in total expenditures per case associated with the DIP payment reform. This finding is consistent with previous results indicating that the DIP payment was associated with a decline in medical costs,[18] contrary to other results.[19] The inconsistencies in the results may be related to the different reform backgrounds of the pilot cities and differences in control group selection during the DID analysis.

Due to concerns about the deterioration of medical service quality in previous case-based payment reforms,[24,25] we analyzed the impact of the DIP payment reform on the quality of care. We found a 1.1 percentage point drop ($P < 0.01$) in all-cause readmission within 30 days for the entire sample. We found no statistically significant effects on in-hospital mortality. Overall, there was no statistically significant decline in the quality of care after the DIP reform, consistent with previous findings,[19] which is a prerequisite for policymakers and other stakeholders to ensure the continuation of the DIP payment reform in the pilot city.

The effects of the DIP reform on secondary and tertiary hospitals differed: while the decrease in medical costs associated with the DIP reform was mainly driven by tertiary hospitals, the decrease in secondary hospitals was not significant. This may be because the increase in treatment intensity in secondary hospitals was greater than that in the tertiary hospitals.

Additionally, we found that in terms of medical quality, the in-hospital mortality rate in tertiary hospitals in W City decreased significantly after the DIP reform, as did the all-cause readmission rate within 30 days in secondary hospitals. In the short term, DIP reform has not resulted in a decline in the quality of care; however, it is still necessary to monitor changes in the quality of care in the long term because this is the key to ensuring the continuous implementation of DIP reform. It should be noted that after discussion with stakeholders, policymakers should consider the practice of local DIP reform, expect the possible behavioral changes of medical service providers and the negative impact on medical quality, and establish regulatory tools in line with local characteristics.[26]

We found that the proportion of severe patients admitted to tertiary hospitals in W City significantly increased after the DIP reform in tertiary hospitals. This may mean that DIP reform encourages high-level hospitals to treat patients with higher disease severity. Moreover, it would be helpful for tertiary hospitals to match their functional positioning in providing diagnostic and treatment services for acute critical, difficult, and complex diseases, which is conducive to promoting the construction of China's hierarchical medical system.[27] In addition, the reason may be that receiving patients with higher severity of disease often means more RW and reimbursement; compared with secondary hospitals, tertiary hospitals have higher professional, technical, and management abilities; thus, they are more inclined to receive patients with more complex and difficult diseases.[16]

Looking at the full sample or differentiating between secondary and tertiary hospitals, the DIP payment reform did not bring about significant changes in the RW per case, which is inconsistent with the results reported in the previous theoretical and empirical literature that DIP payment may motivate providers to increase RW.[16,18,28] However, the reason for this may be that the DIP implementation time of W City was only half a year, and liquidation would only be carried out at the end of the year; thus, the medical service provider was unable to fully understand the incentive mechanism of DIP payment. Another possible reason may be that W City took certain preventive supervision measures to avoid such behavior when implementing the DIP reform.

This study had several limitations. First, due to the availability of data, we only measured the short-term effect of the DIP payment reform on medical costs, quality, and medical service capacity, and could not exclude the effect of the increase in the number of people covered by UEBMI of W City in 2022 compared to 2021, particularly the increase in the proportion of UEBMI inpatients in secondary hospitals. Therefore, longer monitoring is needed to observe the long-term impact of the DIP payment reform. Second, the cities selected in this study were less developed, and the policy background of DIP payments differed among cities in China. Therefore, caution should be exercised when extrapolating the results of this study to other cities. Third, the effects of the DIP payment reform may differ for different disease types. Future research can further analyze the change in disease structure under DIP payment reform and the influence mechanism of DIP reform on provider behavior so that policymakers can improve the DIP payment policy.

Conclusion

In conclusion, our research indicates that DIP reform has achieved short-term success in a less developed city in China, which is mainly reflected in the control of medical costs and the lack of deterioration in medical quality. In terms of medical service capacity, the DIP reform encouraged hospitals to receive more severe patients and patients with higher treatment intensities; however, no significant change in RW per case was found. These findings are somewhat different from those reported in the literature on developed cities, which may be related to differences in the institutional background, disease structure, and informatization levels of cities with different economic development levels. In addition, there were some differences in the effects of the DIP payment reform between secondary and tertiary hospitals. Compared with secondary hospitals, tertiary hospitals exhibited a greater decline in medical costs and received more severe patients. These findings may be related to the stronger implementation of tertiary hospitals in terms of cost control and their ability to upgrade their expertise in managing patients with complex and difficult disease conditions. Our study reminds policymakers that, when extending DIP payments to other regions, they must be aware that the impact of the DIP reform may vary between cities with different levels of economic development and between different levels of hospitals.

Abbreviations

DIP, Diagnosis-Intervention Packet; DID, difference-in-differences; DRG, Diagnosis-related groups; LMICs, low- and middle-income countries; RW, related weight; ITS, interrupted time series; FFS, fee-for-service; UEBMI, urban employee basic medical insurance scheme; URRBMI, urban and rural resident basic medical insurance scheme; COVID-19, Corona Virus Disease 2019; CCI, Charlson Comorbidity Index.

Ethics Approval and Informed Consent

The study was approved by the Ethics Committee of Capital Medical University (Z2022SY085). The study was performed by the Declaration of Helsinki. Patient written consent was waived by the Ethics Committee of Capital Medical University (Z2022SY085) because no contact with patients was conducted and patient anonymity was assured.

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Disclosure

The authors declare that they have no competing interests in this work.

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