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Original Article

Bridging care hierarchies through regional global budget payment: evidence from county medical communities in Zhejiang Province, China

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Abstract

A hierarchical medical system anchored in primary healthcare is a critical mechanism for global healthcare systems to alleviate financing pressures and enhance health outcomes. Leveraging panel data from Zhejiang Province (2017–2022), this study evaluates how regional global budget payment reforms, implemented within county medical communities, influence the progression of the hierarchical medical system. The reforms were associated with a 3.0% (90% CI: −6.3 to 0.3, $P < 0.1$) reduction in patient volumes at county-level hospitals and a 30.2% (95% CI: 3.1–57.4, $P < 0.05$) surge in downward referrals to primary institutions. Concurrently, primary facilities saw an 8.3% (95% CI: 0.56–16.0, $P < 0.05$) increase in outpatient visits and 6.9% (95% CI: 0.15–13.7, $P < 0.05$) revenue growth. From the perspective of health performance, there was a 1.33% (95% CI: −2.57 to −0.09, $P < 0.05$) reduction in premature mortality from major chronic diseases. Mechanism analysis reveals that the regional global budget payment reshapes the incentives for both county-level hospitals and primary healthcare institutions. Under cost-containment pressures, county-level hospitals strategically redirect non-critical patients to primary healthcare institutions through formal referral protocols, while the latter are financially incentivized to provide healthcare services. These findings demonstrate how payment reforms can recalibrate provider behavior in vertically integrated systems, offering an explorable pathway for building people-centered, integrated healthcare systems through health insurance leverage.

Keywords: regional global budget payment; hierarchical medical system; county medical communities; cost constraints

Key messages

- The hierarchical medical system with primary healthcare at its core is a key measure for global healthcare systems to address financing and health risks.
- Although China has implemented numerous reforms to steer patients toward primary healthcare and boost its service quality and efficiency, these efforts have been unsuccessful because specialized hospitals and primary care clinics fiercely compete for the patients and the funding that follows them.
- The global budget payment reform introduced cost-control pressures on healthcare providers and established incentives for sharing savings or covering deficits. These measures compelled county-level hospitals to proactively refer patients downward to primary institutions, strengthened service continuity between grassroots providers and patients, and advanced the hierarchical medical system.
- The downward referral of patients from county-level hospitals to primary institutions not only avoided compromising health benefits but also reduced the premature mortality rate from major noncommunicable diseases.

Introduction

The hierarchical medical system anchored in primary healthcare is widely recognized as a critical system to ensure equitable and cost-effective health service delivery (Zhou *et al*. 2021). China had ambitiously planned to increase the proportion of primary-level outpatient utilization rate to 65%; however, between 2015 and 2022, this share declined from 56.44% to 50.71%. The total number of patient visits to primary healthcare institutions (PHIs) grew by only 12%, from 3.81 billion to 4.25 billion, whereas visits to tertiary hospitals soared by 148%, from 900 million to 2.23 billion. The reason lies in the inverted pyramid structure of China's healthcare resource allocation, where high-level hospitals monopolize high-quality medical resources, while the quality of primary healthcare services is poor, leading to a lack of patient trust (Lu *et al*. 2019, Li *et al*. 2020). Simultaneously, the absence of compulsory gatekeeping permits direct access to tertiary hospitals, with public insurance maintaining coverage for such unreferred visits (Zhang *et al*. 2020). Furthermore, in recent years, with the rise in per-capita income in China, patients' demand for high-quality medical resources has continuously increased, which has also accelerated the expansion of outpatient service demand at high-level hospitals.

The County Medical Communities (CMCs) have been recognized as China's flagship policy initiative for strengthening primary healthcare since their inception. CMCs refer to county-wide networks of healthcare providers led by county-level hospitals, which integrate the resources of county-level hospitals, township health centers (community health centers), and community health stations (village clinics) under unified legal, staffing, and financial management. This organizationally vertical integration emphasizes collaboration among different tiers of medical institutions to deliver continuous, people-centered care within an integrated healthcare system, ultimately forming a community of service, a community of responsibility, and a community of shared benefits. The CMCs model, first piloted in Tianchang City, Anhui Province, and inspired by the integrated healthcare system of Kaiser Permanente in the United States, emphasized the integration of insurers (purchasers) with healthcare providers (operators), as well as the coordination of multi-tiered diagnostic services across different levels of medical institutions. The model was soon adopted and promoted nationwide. China's county-level healthcare provision system consists of three tiers: the first tier comprises county-level hospitals (typically one–two per county), tasked with standardized diagnosis and treatment of common diseases, inpatient care for acute and critical illnesses, and upward referrals; the second tier includes township health centers and community health centers, specializing in ambulatory care for prevalent diseases, basic rehabilitative services, and downward referral coordination; the third tier encompasses community health stations and village clinics, dedicated to disease prevention, infectious disease control, chronic disease management, and primary care for common conditions (Li *et al.* 2017). Collectively, the latter two tiers form the operational backbone of China's primary healthcare infrastructure. Through vertical integration of these tiers, CMCs institutionalize a unified legal entity structure with centralized governance and equitable human resource allocation mechanisms, thereby enabling cross-tier resource optimization (Wu *et al.* 2021). Nevertheless, systemic barriers persist: the absence of aligned economic incentives has impeded genuine interest convergence between county-level hospitals and PHIs, fostering superficial collaboration. The county-level hospitals still depend heavily on treating more patients to secure greater revenue from medical insurance funds and out-of-pocket payments from patients. Concurrently, in China, PHIs exhibit limited financial impetus for service quality improvement, perpetuating structural care delivery imbalances (Li *et al.* 2017).

To address these systemic challenges, an initiative termed the Regional Global Budgets Payment (GBP) within CMCs was launched in China, beginning in 2018 in Deqing County, Zhejiang Province. The GBP refers to a financing mechanism in which the health insurance authority estimates the annual regional insurance fund budget by integrating key indicators—namely, the total number of insured beneficiaries, their age distribution and health status, the three-year averages of outpatient, emergency and inpatient visits and expenditures, and the local GDP average growth rate over the same period. Based on this estimate, the total prepayment for each CMC is calculated by multiplying the number of insured individuals served by the CMC's member institutions by the per-capita pooled contribution, and the resulting sum is disbursed to the CMC—either as a lump sum or in installments—for its autonomous management and use of the fund. At the end of the insurance year, a final reconciliation is conducted according to performance-based quality assessments. Under this scheme, the prepayment amount constitutes the upper payment limit regardless of actual medical expenses incurred by insured individuals within the CMC, and a surplus retention and deficit sharing mechanism ensures that any budget surplus is retained by the CMC following quality evaluation, while any overspend is apportioned among member institutions in proportion to their service volume. The county-level hospitals prioritize care pathway efficiency through inter-institutional collaboration with PHIs, strategically allocating chronic disease management and post-acute rehabilitation services to grassroots facilities. The mechanism generates dual incentives—maximizing insurance fund surpluses via per-case efficiency gains while achieving strategic patient redistribution across care tiers. Some scholars have begun to explore the impact of cost-control measures on hospital behavior (Ellis and McGuire 1993, Trottmann *et al.* 2012, Chan and Zeng 2018). Empirical validation comes from Ding and Zhou's (2024), which demonstrates that implementing a health insurance package payment for CMCs significantly increased outpatient rates at the primary level. However, they did not investigate the impact of medical insurance payment methods within an integrated healthcare delivery system, focusing only on the effects of cost-containment pressures on hospital behavior while neglecting their influence on PHIs and the promotion of the hierarchical medical system. Moreover, previous studies on China's insurance payment methods within CMCs have lacked rigorous empirical evidence, with particularly few studies utilizing healthcare and insurance data from a single province. Finally, few of these studies have examined the broader impact of medical insurance payment within CMCs on patients' health outcomes and overall welfare.

Over the past two decades, China has prioritized the refinement of its hierarchical medical system through sustained policy interventions. The fundamental reason for the difficulty in advancing hierarchical medical care in China lies in the distorted incentive structures within the healthcare delivery system, where specialized hospitals and PHIs engage in competition for patients and revenue. This paper argues that global budget payment mechanisms within vertically integrated delivery systems effectively align interests between county-level hospitals and PHIs. The GBP model constitutes a holistic purchasing mechanism oriented toward health outcomes, resonating with the World Health Organization's vision for people-centered integrated healthcare system. This approach operationalizes the axiom that integrated financing necessitates integrated delivery—global budgets inherently reward system-wide efficiency gains rather than fragmented service provision, thereby structurally reinforcing tiered care pathways.

Materials and methods

Study setting

Zhejiang, located on the eastern coast of China, has 11 cities and 72 counties (Fig. 1). It is regarded as one of the most densely populated and developed regions in China. But Zhejiang has more mountains, islands, and fewer plains, which is not conducive to constructing a primary healthcare system. Zhejiang Province began implementing the CMCs reform in 2017, and by 2018, it had established CMCs in all 72

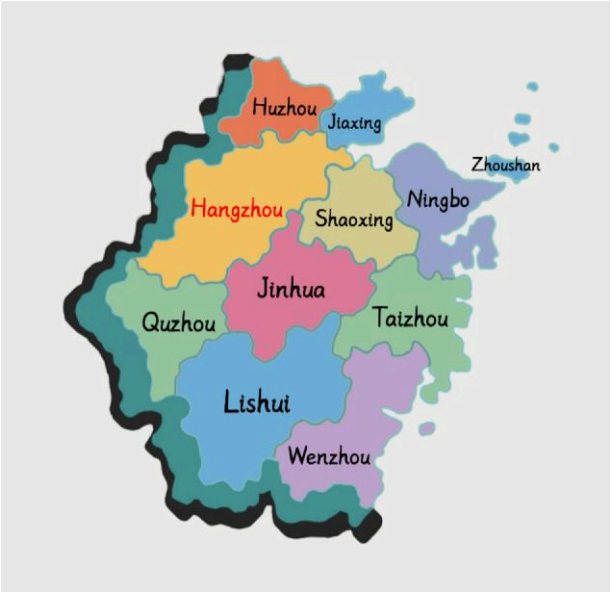

Figure 1. Map of Zhejiang Province, China.

counties across the province following a unified model. On average, each CMC includes 2–3 county-level hospitals and almost 10 PHIs with a single legal entity, integrated financial and information systems, and a unified employee compensation system. In 2018, a subset of counties in Zhejiang Province began implementing GBP within CMCs. In October 2023, we administered paper-based questionnaires and telephone interviews with key administrators from all 72 CMCs or their respective Healthcare Security Administrations across Zhejiang, successfully investigating implemented health insurance payment models in the county, achieving a 100% response rate (72/72 questionnaires returned). Between 2017 and 2022, eight counties—Deqing, Cixi, Changxing, Anji, Xiangshan, Kaihua, Jiangshan, and Yuhuan—implemented the GBP within CMCs.[1] Non-GBP counties predominantly employ five alternative payment mechanisms: (i) inpatient Diagnosis-Related Groups (DRG) with points-based pricing coupled with outpatient capitation; (ii) DRG points systems for inpatient care alongside fee-for-service (FFS) reimbursement for outpatient services; (iii) global budgets on single institution covering either inpatient, outpatient; (iv) single-disease paying or disease-group payments as the inpatient reimbursement model; and (v) comprehensive FFS arrangements encompassing both inpatient and outpatient services.

The mechanisms for sharing savings and covering deficits of the medical insurance fund are implemented within CMCs, involving all member institutions. These arrangements operate both vertically—between county-level hospitals and primary healthcare institutions—and horizontally—among different primary care facilities such as township health centers or community health service centers. In practice, CMCs adhere to a 'total-budget, surplus retention, and reasonable overspend sharing' rule. At fiscal year-end, any unspent medical insurance funds are distributed, with 70% automatically retained by the CMCs and the remaining 30% released after performance evaluation. The retained portion is primarily allocated to system-wide investments in specialty development, digital transformation, and personnel compensation, while the discretionary 30% is directly transferred to PHIs for autonomous expenditure, predominantly financing family physician salaries. The horizontal distribution among PHIs—including township health centers (community health centers) and village clinics (community health stations)—follows proportional service volume weighting. Should deficits occur, 85% of overexpenditures are collectively shared across all CMC-affiliated institutions, with individual burden apportioned according to each facility's service contribution ratio and performance assessment results. Since implementing the reform in 2018, Deqing's medical insurance fund has transitioned from a \$0.96 million deficit to a \$14.71 million surplus[2]. Concurrently, the payable duration of the Urban Employee Basic Medical Insurance Fund (EMBI) and Residence Basic Medical Insurance Fund (RBI) increased from 1.48 months and 0.72 months to 5.63 months and 5.54 months, respectively, demonstrating enhanced fiscal sustainability (Fig. 2).

The main data used in this analysis comprise three integral components, which are merged. These include the Zhejiang Provincial Health Statistical Annual Report (HSAR), the Health Financial Annual Report (HFAR), and DRG Performance Data (DPD). These components, originating from the Health Commission of Zhejiang Province for the years 2017–2022, are employed to generate a six-year panel data. First, the HSAR database summarizes the performance indicator data of county-level hospitals and PHIs, including the number of patient visits, two-way referrals, medical staff, and beds. Next, the HFAR database collects the financial indicators of county-level hospitals and PHIs, including outpatient

[1] Geographically distributed across northern, eastern, western, and southern Zhejiang, these pilot sites represent diverse socioeconomic development levels (per capita GDP range: \$9314–\$20 540 in 2022, with the province's average at \$16 928) and distinct geographical characteristics (coastal/inland/mountainous).

[2] Chinese renminbi (CNY) values are converted to US dollar equivalents using the 30 December 2022 exchange rate (1 USD = 6.96 RMB).

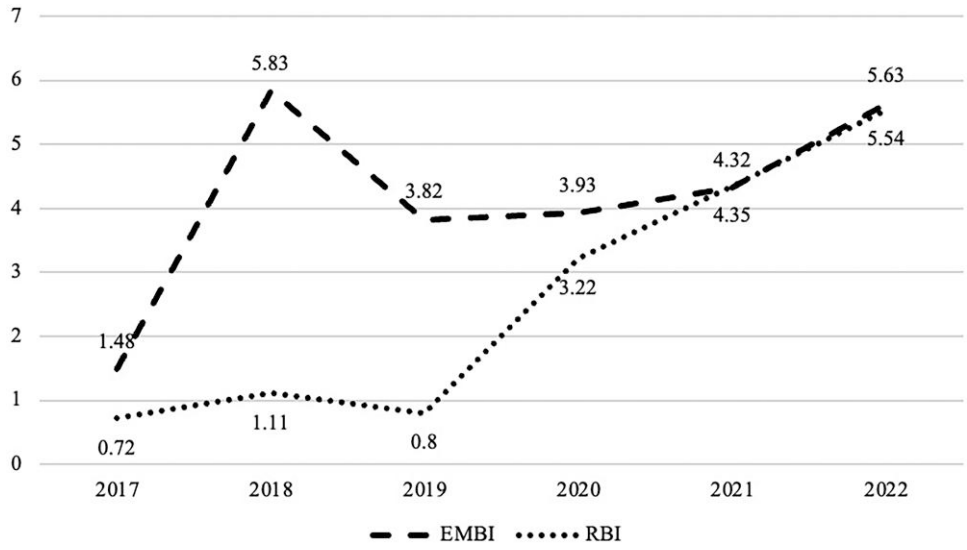

Figure 2. The number of months the medical insurance fund can cover from 2017 to 2022.

and inpatient income, drug income, expenditures, and other information. Third, the DPD database provides information on county-level hospitals' medication costs per hospitalization. Given Zhejiang's universal public healthcare system, the database captures health service information from all 72 counties in Zhejiang, including 167 county-level hospitals and 1160 PHIs. Among the 1160 PHIs, due to incomplete information registration and collection in some institutions, the data on the number of beds and doctors were missing for 97 PHIs, resulting in incomplete sample information. As a result, these samples were excluded, leaving data from 167 county-level hospitals and 1063 PHIs.

Variables

To evaluate the impact of the GBP within CMCs on promoting a hierarchical medical system, we examined measures in four domains. The first domain is county-level hospitals' total visits (HTV), which reflects the reduction in the siphoning effect of patients by county-level hospitals. The second domain includes three variables: PHIs' total visits (PTV), PHIs' outpatient income (POI), and the number of referrals from county-level hospitals to PHIs (NRP). These variables indicate that PHIs are treating more referred patients, thereby verifying the implementation effect of the hierarchical medical system from the perspective of PHIs. Due to missing data collection and registration, the total number of observations for the dependent variable NRP is 4,044, with 2334 missing values. The reason is that the referral data is not mandated for reporting by health authorities, resulting in a high number of missing values. To address this, we employed multiple imputation by chained equations (MICE), generating 20 imputed datasets that incorporated individual fixed effects, temporal trends, and relevant covariates. We then pooled the regression results according to Rubin's rules, yielding a final sample of 6378 observations for models involving NRP. In parallel, because 390 observations lacked complete bed-number data, our final analytical sample for primary healthcare institutions included 5988 observations with full information on NRP, PTV, and POI. The third indicator is related to public health outcome, the premature mortality rate from major noncommunicable diseases (NCDs). NCDs are defined as the ratio of deaths among individuals aged 30 to 70 caused by four major noncommunicable diseases: cardiovascular and cerebrovascular diseases, cancer, chronic respiratory diseases, and diabetes. This indicator has been incorporated by the National Health Commission of China as a key metric for evaluating the health performance of local governments. Since only the statistical results of NCDs for the years 2021 and 2022 were obtained, the total sample size is 144. The forth domain consists of mechanism variables, including county-level hospitals' outpatient drug income (HDO), drug costs per hospitalization (HDC), and per insured person medical expenditure (HPE), which are income and cost-related indicators. These mechanism variables help assess the impact of the GBP within CMCs on the effectiveness of the hierarchical medical system.

The key independent variable in this paper is the following dummy variable: 'has the GBP been implemented in the CMCs?' (GBP). This variable is assigned the value 1 if the GBP is implemented in CMCs and 0 otherwise.

The control variables included the sample counties' economic status, population and health resources, specifically the number of permanent residents; the population of elderly individuals over 60; the number of medical beds, practicing physicians, and nurses in the county; and per-capita GDP. To satisfy the normal distribution of the sample, the article applies a logarithmic transformation to all variables except medical expenditure per insured person. Since such expenditure is already an average value with relatively small differences, it is not subject to logarithmic transformation. We list the definitions and descriptions of all the variables of interest (Table 1). Counties that implemented the GBP within CMCs outperform counties with other payment methods in the five indicators: HTV, PTV, POI, NRP, and NCD (Table 2). Regarding cost-control indicators, there is no significant difference in outpatient drug income or per-insured person medical expenditure between counties with global budget control for CMCs and those without it.

It is generally agreed that social policies are closely related to regional factors such as economic and population structure. Therefore, a description of the basic information regarding a region strengthens scientific rigor. We detail the differences

Table 1. Definitions and description of variables.

Types of variables	Variables	Definitions	Description
Dependent variables	HTV	County-level hospitals' total visits	Total number of visits to CMC county-level hospitals for treatment
	PTV	PHIs' total visits	Total number of visits to CMCs PHIs for treatment
	POI	PHIs' outpatient income	PHI total outpatient revenue in a financing year
	NRP	The number of referrals from county-level hospitals to PHIs	Number of patient referrals from county-level hospitals to PHIs
	NCD	The premature mortality rate from major noncommunicable diseases	The ratio of deaths among individuals aged 30–70 caused by four major noncommunicable diseases
	HDO	County-level hospitals' outpatient drug income	Total pharmaceutical revenue from outpatient services received by the county-level hospitals
	HDC	County-level hospitals' drug costs per hospitalization	Pharmaceutical costs from inpatient services received by county-level hospitals
	HPE	Per insured person's medical expenditure	Per capita medical expenditure of insured persons managed by the CMCs
Independent variables	GBP	Whether GBP was implemented for the CMCs	Implemented GBP in CMCs = 1; Not implemented GBP in CMCs = 0
Control variables	HTW	Health technician workers	Number of technicians in county-level hospitals or PHIs
	DOC	Doctors	Number of doctors in county-level hospitals or PHIs
	NUR	Nurses	Number of nurses in county-level hospitals or PHIs
	BED	Beds	Number of beds in county-level hospitals or PHIs
	Population	Permanent residents	Permanent population at the end of the year
	Aging	Aging rate	Population proportion of the aged over 60
	GDPPC	GDP per capita	GDP/permanent residents

PHIs, primary healthcare institutions; CMCs, county medical communities; GBP, global budget payment.

Table 2. The medical cost performance characteristics concerning whether the regional global budget payment within CMCs was implemented.

Variables	Implemented	Not implemented	*P*-Value
HTV (Person-time)	637 770	630 794	0.800
PTV (Person-time)	125 834	118 160	0.018
POI (Thousand CNY)	16 688	13 036	0.000
NRP (Person-time)	320	288	0.445
NCD (%)	94	50	0.091
HDO (Thousand CNY)	73 607	76 522	0.424
HDC (CNY)	2122	2331	0.023
HPE (CNY)	1843	1803	0.283

CMC, county medical communities; HTV, county-level hospitals' total visits; PTV, primary healthcare institutions' total visits; POI, primary healthcare institutions' outpatient income; NRP, the number of referrals from county-level hospitals to primary healthcare institutions; NCD, the premature mortality rate from major noncommunicable diseases; HDO, county-level hospitals' outpatient drug income; HDC, county-level hospitals' drug costs per hospitalization; HPE, per insured person medical expenditure.

among the characteristics of the areas that have implemented the GBP within CMCs and those that have not (Fig. 3).

Empirical strategy

According to the analyses above, we specify an empirical relationship linking the hierarchical medical system to whether the GBP within CMCs has been implemented. In this paper, the two-way fixed effects model is used to estimate the above relationship because doing so can eliminate interfering factors that do not change with time or an individual, to better examine the net effect of payment methods in CMCs.

$$Y_{it} = \beta_1 D_{it} + \theta X_{it} + \lambda_t + \alpha_i + \varepsilon_{it}$$

where Y_{it} is the core dependent variable, representing the effectiveness of the hierarchical medical system performance of county-level hospitals or PHIs i at time t. X_{it} are control variables, including the number of health technicians, beds, doctors, and nurses at both the PHIs and county-level hospital, as well as counties' per-capita GDP, population, and aging. λ_t is a time-fixed effect; α_i represents the individual fixed effects of both county-level hospitals and PHIs. And ε_{it} are random disturbance terms. D_{it} is the independent variable, namely, the interaction item between the group dummy variable and the time dummy variable. If the CMCs adopted the regional global budget in the current year, the value of D_{it} is 1; otherwise, the value is 0. β is the regression coefficient, which is this paper's main concern.

Hypothese and analysis framework

Public hospitals in China rely on themselves to generate income, with fiscal subsidies accounting for only 8% of their total revenue. As a result, they must compete with PHIs to attract patients. There is a lack of effective incentive mechanisms to guide hospitals in referring patients downward and providing integrated and continuous health services. Implementing GBP within CMCs, which is the total amount of insurance funds, is limited and has been allocated to the CMCs in advance.

CMCs are responsible for covering the excess of medical insurance funds and sharing the surpluses of the insurance fund. Under the mechanism, providers must reduce unreasonable costs and enhance efficiency, which county-level hospitals have to leverage their comparative advantages in treating severe, complex, and acute illnesses while directing patients with chronic and common diseases to PHIs. This approach not only improves service efficiency but also optimizes revenue generation.

> Hypothesis 1: By implementing the GBP within CMCs, the number of patient visits at the county-level hospital decreases.

China's primary healthcare system remains imperfect, largely due to county-level hospitals siphoning patients from

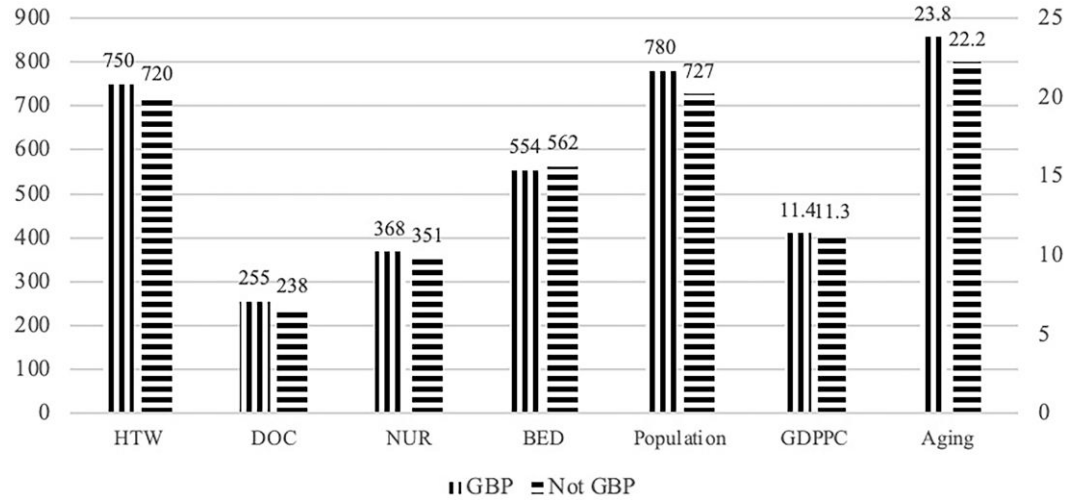

Figure 3. Regional characteristics information concerning whether the GBP within CMCs has been implemented. HTW, health technician workers; DOC, doctors; NUR, nurses; GDPPC, GDP per capita.

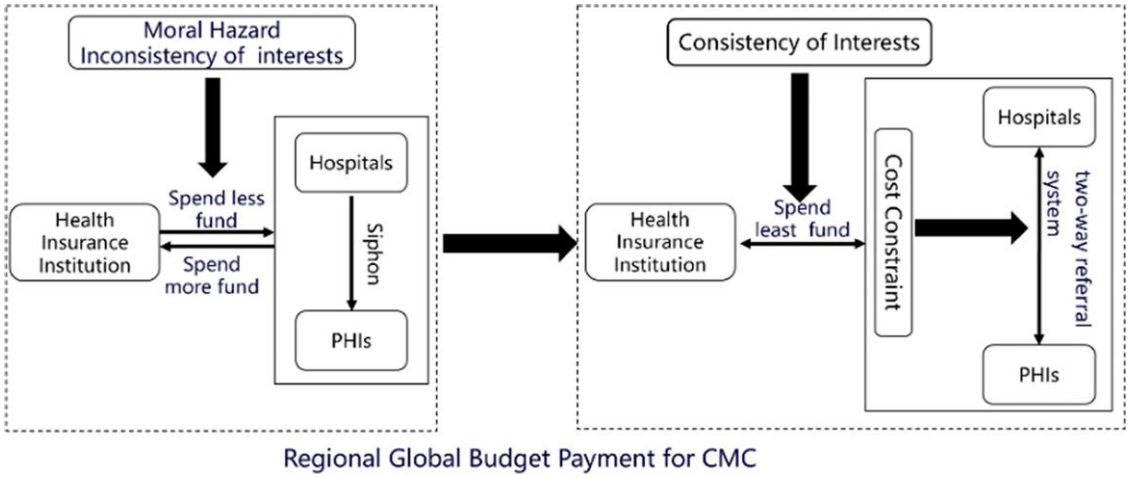

Figure 4. The theoretical framework; CMCs, county medical communities.

PHIs. This undermines service continuity and fosters a trust deficit between patients and PHIs. By implementing the GBP within CMCs, county-level hospitals are compelled to actively transfer patients with common diseases, those in recovery, and those in stable condition to PHIs. These practices result in reducing visits to county-level hospitals and increasing patient referrals to PHIs. Because the number of patients at PHIs continues to grow, they have been driven to continuously enhance their service capabilities. Meanwhile, county-level hospitals will also assist in enhancing their diagnostic and treatment abilities through technical assistance, expert training, and adding equipment. These measures ultimately strengthen the trust and service stickiness between PHIs and patients, leading to an increase in outpatient visits and business revenue at PHIs.

Hypothesis 2: Implementing the GBP within CMCs increases patient referrals to PHIs, as well as outpatient visits and income.

By pre-allocating the total health insurance fund to CMCs, county-level hospitals, and PHIs, the allocation, utilization, and supervision of these funds are jointly managed. As a result, the responsibility for overseeing fund security, previously handled by insurance institutions, is now managed internally by service providers. This shift addresses the interest misalignment between insurance institutions and healthcare providers under the traditional principal-agent model. It also redirects service providers' revenue incentives from increasing income to reducing costs. In summary, the implementation of the GBP within CMCs fosters a close-knit community of interests between county-level hospitals and PHIs. Combined with an incentive mechanism that allows for retaining fund surpluses and sharing excess expenses, this system encourages medical service providers to collaborate more effectively in delivering integrated and continuous care, thereby facilitating the realization of a truly hierarchical medical system. We display a diagram of the article's analytical frame (Fig. 4).

Hypothesis 3: By implementing the GBPwithin CMCs, the strong cost-control pressure encourages county-level hospitals to reduce patient siphoning and proactively transfer patients to PHIs, ultimately contributing to the realization of a hierarchical medical system.

Table 3. The impact that the GBP within CMCs has on reducing the siphon effect of the county-level hospital on patients, coefficients.

	HTV
GBP	−0.030*
	(0.017)
HTW	0.000
	(0.000)
DOC	−0.000
	(0.000)
NUR	0.362
	(0.229)
BED	0.233**
	(0.095)
Population	−0.147*
	(0.079)
Aging	−0.001
	(0.117)
GDPPC	0.012
	(0.059)
Cons	9.992***
	(1.633)
Time-fix Effects	Yes
Individual-fix Effects	Yes
Observations	983

Robust standard errors in parentheses.
***, **, and * mark significance at the 1%, 5%, and 10% levels, respectively.
GPB, whether GBP was implemented for the CMCs; CMCs, county medical communities; HTV, county-level hospitals' total visits; HTW, health technician workers; DOC, doctors; NUR, nurses; BED, Beds; Population, permanent residents; Aging, aging rate; GDPPC, GDP per capita.

Table 4. The impact that the GBP within CMCs has on the PHI performance, coefficients.

	(1) NRP	(2) PTV	(3) POI
GBP	0.219**	0.083**	0.069**
	(0.091)	(0.039)	(0.039)
HTW	0.103	1.207***	1.075***
	(0.087)	(0.169)	(0.152)
DOC	−0.003	−0.026	−0.023
	(0.048)	(0.019)	(0.016)
NUR	0.103***	0.014	0.007
	(0.037)	(0.033)	(0.029)
BED	−0.030***	0.003	0.004
	(0.011)	(0.004)	(0.003)
Population	0.539	−0.048	0.157**
	(0.359)	(0.075)	(0.078)
Aging	1.070	−0.198	−0.285
	(0.981)	(0.210)	(0.177)
GDPPC	1.301***	0.055	0.051
	(0.355)	(0.088)	(0.087)
Cons	−17.162***	6.812***	4.341***
	(5.083)	(1.101)	(1.133)
Time-fix Effects	Yes	Yes	Yes
Individual-fix Effects	Yes	Yes	Yes
Observations	5988	5988	5988

Robust standard errors in parentheses.
***, **, and * mark significance at the 1%, 5%, and 10% levels, respectively.
CMCs, county medical communities; GBP, whether GBP was implemented for the CMCs; PHIs, primary healthcare institutions; NRP, the number of referrals from county-level hospitals to primary healthcare institutions; PTV, primary healthcare institutions' total visits; POI, primary healthcare institutions' outpatient income; HTW, health technician workers; DOC, doctors; NUR, nurses; BED, Beds; Population, permanent residents; Aging, aging rate; GDPPC, GDP per capita.

Results

The impact that the GBP within CMCs has on county-level hospitals' behavior

We demonstrate the significance of implementing the GBP within CMCs regarding promoting hierarchical medical. The regression results confirm the inference, showing that the number of patient visits at county-level hospitals implementing the GBP within CMCs has significantly decreased by approximately 3.0% (90% CI: −6.3 to 0.3, $P < 0.1$) on average. This result is significant at 10%, after controlling for the time and individual fixed effects (Table 3).

Overall, we confirmed Hypothesis 1, which states that by implementing the GBP within CMCs, the number of patient visits at the county-level hospital decreases.

The impact that the GBP within CMCs has on PHIs' behavior

Model (1) in Table 4 demonstrates that implementing the GBP within CMCs significantly increased the number of referrals from county-level hospitals to PHIs by 21.9% (95% CI: 3.6%–40.2, $P < 0.05$). The regression results of Model (2) show that, after implementing the GBP within CMCs, there was a significantly larger number of outpatient visits at PHIs, with an average increase of around 8.3% (95% CI: 0.56–16.0, $P < 0.05$). Meanwhile, Model (3)'s regression results reveal PHIs outpatient revenue. One can observe that PHIs in regions with the budget payment system have also seen an increase in outpatient income, by approximately 6.9% (95% CI: 0.15–13.7, $P < 0.05$). By incentivizing county-level hospitals to refer appropriate patients to PHIs, this approach not only improves the quality of primary medical services but also strengthens patients' trust in these facilities (Table 4).

Overall, we confirmed Hypothesis 2: Implementing the GBP within CMCs increases patient referrals to PHIs, as well as outpatient visits and income.

Mechanism analysis

By implementing the GBP within CMCs, the issue of inconsistent interests between insurance institutions and medical service providers in the traditional principal–agent relationship is addressed. The insurance institution allocates the funds to the CMCs on a total prepaid basis, directly linking the CMCs' economic interests to the efficiency of fund utilization. By establishing an incentive mechanism, namely, retaining fund surpluses and sharing excess expenses, the CMCs have a stronger motivation to control medical expenditure, improve medical service efficiency, and ensure fund surpluses whenever possible. This method of interest alignment effectively mitigates the conflict of interests bound in the principal–agent relationship, transforming the CMCs' provision of medical services into a scenario where it is essentially spending its own money to manage its own affairs. Table 5 outlines the changes in cost performance regarding county-level hospitals operating under the pressure of the regional global budget.

The results of Model (1) in Table 5 indicate that implementing the GBP within CMCs led to a significant 4.1% (95% CI: −7.9 to −0.4, $P < 0.05$) reduction in outpatient medication revenue. This suggests that after reform, county-level hospitals further strengthened drug use management and delegated

Table 5. The impact that the GBP within CMCs has on county-level hospitals' cost performance, coefficients.

	(1) HDO	(2) HDC	(3) HPE
GBP	−0.041**	−0.026*	−31.286*
	(0.019)	(0.015)	(18.716)
HTW	0.655***	−0.031	−115.013
	(0.222)	(0.292)	(184.392)
DOC	−0.030	0.029	37.800
	(0.093)	(0.081)	(103.676)
BED	0.060	−0.021	185.953***
	(0.065)	(0.056)	(65.828)
NUR	−0.003	−0.015	105.200
	(0.085)	(0.205)	(84.821)
GDPPC	0.081	0.057	−454.976***
	(0.080)	(0.063)	(147.117)
Aging	0.042	0.138	−146.796
	(0.137)	(0.113)	(328.065)
Population	−0.145	0.036	−824.455***
	(0.113)	(0.057)	(129.768)
Cons	6.185***	6.814***	9227.516***
	(1.499)	(1.222)	(2214.055)
Time-fix Effects	Yes	Yes	Yes
Individual-fix Effects	Yes	Yes	Yes
Observations	983	913	808

Robust standard errors in parentheses.
***, **, and * mark significance at the 1%, 5%, and 10% levels, respectively.
CMCs, county medical communities; GBP, whether GBP was implemented for the CMCs; HDO, county-level hospitals' outpatient drug income; HDC, county-level hospitals' drug costs per hospitalization; HPE, per insured person medical expenditure; HTW, health technician workers; DOC, doctors; NUR, nurses; BED, beds; Population, permanent residents; Aging, aging rate; GDPPC, GDP per capita.

more medication treatment for patients with minor illnesses, relatively stable conditions, and those in recovery to PHIs, thereby reducing outpatient drug revenue. Model (2)'s regression outcomes indicate that implementing the GBP within CMCs significantly reduced 2.6% (90% CI:5.6 to 0.4, $P < 0.1$) county-level hospitals' average hospitalization drug costs, at the 10% level, after controlling for time and individual fixed effects. Model (3) shows that implementing the GBP within CMCs leads to a significant relative reduction of approximately 31.29 yuan (90% CI:-68.29 to 5.71, $P < 0.1$) in the average medical cost per insured person, at the 10% level. The incentive mechanism of the GBP within CMCs motivates county-level hospitals to reduce unreasonable medical expenses. Therefore, it is a rational choice for them to reduce service fees in outpatient and inpatient departments, which translates into decreased average medical expenditure per insured individual.

Ultimately, this article confirms Hypothesis 3, which posits that by implementing the GBP within CMCs, the strong cost-control pressure encourages county-level hospitals to reduce patient siphoning and proactively transfer patients to PHIs, ultimately contributing to the realization of a hierarchical medical system.

The impact that the GBP within CMCs has on public health welfare

While cost-containment measures targeting healthcare providers have raised scholarly concerns about potential compromises to public health performance (Wagenschieber and Blunck 2024), this study employs the NCDs to assess the population health implications of implementing the GBP within CMCs. We indicate that counties implementing the GBP demonstrated 1.33% (95% CI: −2.57 to −0.09, $P < 0.05$) lower NCDs compared to non-implementing counties, remaining statistically significant after controlling for time and regional fixed effects. Although the GBP strengthens cost control for healthcare providers, it promotes a hierarchical medical system, improves primary healthcare, and enhances prevention, treatment, and management of major chronic diseases at PHIs. By establishing an incentive mechanism for retaining medical insurance fund surpluses and reducing chronic disease complications such as strokes and myocardial infarctions, it ultimately saves medical insurance expenditures. Consequently, PHIs are motivated to improve public health outcomes (Table 6).

Table 6. The impact of the GBP within CMCs on public health.

	NCDs
GBP	−1.33**
	(0.632)
GDPPC	0.000
	(0.000)
Aging	0.027
	(0.035)
Number of insured individuals	0.013
	(0.017)
Per-capita disposable income	−0.000
	(0.000)
Fiscal revenue	−0.004
	(0.003)
Cons	4.630
	(4.913)
Time-fix Effects	Yes
Individual-fix Effects	Yes
Observations	144

Robust standard errors in parentheses.
***, **, and * mark significance at the 1%, 5%, and 10% levels, respectively.
CMCs, county medical communities; GBP, whether GBP was implemented for the CMCs; NCDs, the premature mortality rate from major noncommunicable diseases; Aging, aging rate; GDPPC, GDP per capita.

Heterogeneity analysis

Age is a key factor affecting individuals' utilization of medical services and their health expenditures. As age increases, physical functionality declines, one's stock of health capital decreases, and the depreciation rate of one's health capital accelerates (Grossman 1972). Therefore, controlling the rapid growth of health expenditures has become a common challenge facing aging countries. This article divides the sample counties into two categories based on the degree of aging. The first 50% of regions, sorted from low to high based on the elderly population, are considered regions with a relatively low degree of aging. The remaining 50% are considered regions with a relatively high degree of aging. As shown in Table 7, at the level of county-level hospitals in regions with a relatively high degree of aging, implementing the regional global budget payment within CMCs significantly decreased visits to county-level hospitals. The explanation for this reduction is that patient flow in the region shifted from the county-level hospital to PHIs, due to the CMCs' cooperation mechanism and the regional global budget's cost-control mechanism, which prompts them to transfer patients downward.

Table 7. Comparison of medical cost performance under different degrees of aging, coefficients.

Variables	Lower GDPPC			Higher GDPPC		
	HTV	PTV	NRP	HTV	PTV	NRP
GBP	−0.036	0.019	−0.023	−0.038*	0.081	0.372***
	(0.024)	(0.019)	(0.146)	(0.020)	(0.056)	(0.079)
Contral Variables	Yes	Yes	Yes	Yes	Yes	Yes
Cons	6.000***	8.341***	−25.815***	10.002***	9.258***	−10.876***
	(0.819)	(1.613)	(7.889)	(0.865)	(1.711)	(1.956)
Time-fix Effects	Yes	Yes	Yes	Yes	Yes	Yes
Individual-fix Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	494	2952	2952	489	3036	3036

Robust standard errors in parentheses.
***, **, and * mark significance at the 1%, 5% and 10% levels, respectively.
GBP, whether GBP was implemented for the CMCs; HTV, county-level hospitals' total visits; PTV, primary healthcare institutions' total visits; NRP, the number of referrals from county-level hospitals to primary healthcare institutions; GDPPC, GDP per capita.

Table 8. Comparison of medical cost performance under different degrees of GDPPC, coefficients.

Variables	Lower GDPPC			Higher GDPPC		
	HTV	PTV	NRP	HTV	PTV	NRP
GBP	−0.031	0.023	0.622***	−0.008	0.032	0.235*
	(0.034)	(0.022)	(0.111)	(0.015)	(0.051)	(0.128)
Contral Variables	Yes	Yes	Yes	Yes	Yes	Yes
Cons	9.706**	7.074***	7.068**	10.345***	9.446***	−10.876***
	(4.527)	(2.088)	(3.158)	(1.102)	(1.151)	(1.956)
Time-fix Effects	Yes	Yes	Yes	Yes	Yes	Yes
Individual-fix Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	366	2818	2818	617	3170	3170

Robust standard errors in parentheses.
***, **, and * mark significance at the 1%, 5%, and 10% levels, respectively.
GBP, whether GBP was implemented for the CMCs; HTV, county-level hospitals' total visits; PTV, primary healthcare institutions' total visits; NRP, the number of referrals from county-level hospitals to primary healthcare institutions; GDPPC, GDP per capita.

Especially in areas with a high degree of aging, the incidence of chronic diseases among the elderly is high. For such ailments, more emphasis should be placed on the primary healthcare system's health management; this makes the regression results significant. However, in areas with a relatively low degree of aging, the budget payment system for CMCs' cost-control effect is relatively weak. Thus, the results in promoting hierarchical diagnosis and treatment are not significant (Table 7).

Discussion of varying economic development levels is of practical significance for elucidating the impact of implementing the regional global budget payment within CMCs on the hierarchical medical system. In particular, given the importance of generalizing our findings to other less affluent provinces in China and to developing countries worldwide with underdeveloped primary healthcare systems, we performed a heterogeneity analysis based on per-capita GDP. Using the 2020 China per-capita GDP of RMB 72 447 as the threshold, we divided our sample regions into developed and less developed areas. We present the results by economic status. The findings indicate that, in less developed areas, implementing the regional global budget payment within CMCs significantly increased the likelihood that county-level hospitals would refer patients downward to PHIs by approximately 62%, significant at the 1% level, whereas this effect was not evident in more economically developed regions. By introducing the regional global budget payment within CMCs, county-level hospitals, under cost-containment pressures and incentives to retain fund surpluses, are motivated to down-refer patients requiring post-acute care and chronic disease management, thereby enhancing the efficiency of medical service delivery. (Table 8, Supplementary S1).

Discussion

From a global perspective, three predominant strategies have been implemented to advance hierarchical medical system and improve primary-level first-contact rates: (i) compulsory gatekeeping through primary healthcare mandates requiring initial family physician consultations with referral authority (Sripa *et al.* 2019, Bi and Liu 2023); (ii) reimbursement gradient policies that amplify financial disincentives for bypassing PHIs through tiered insurance coverage differentials (Lu *et al.* 2019, Zhou *et al.* 2021, Switzer *et al.* 2021, Wang *et al.* 2023); and (iii) geographically enforced utilization driven by physical barriers in remote regions (e.g. mountainous/island terrains) that functionally restrict care alternatives (Wakerman *et al.* 2008). However, these three approaches have proven to be either ineffective or impractical in China, nowadays. First, the 1998 foundational design of China's basic medical insurance system explicitly rejected gatekeeping mechanisms to ensure rapid population coverage. Reintroducing mandatory primary care gatekeepers now would destabilize entrenched care-seeking behaviors, potentially triggering public discontent and systemic risks—a politically untenable proposition for policymakers. Second, as income levels have risen and health awareness has increased among the Chinese population, the use of insurance as an

economic lever to guide individuals to primary care has gradually weakened; moreover, excessively large differences in reimbursement ratios could trigger debates on fairness. Third, due to nearly 30 years of extensive investment in road infrastructure, particularly with the expansion of high-speed rail, the natural geographic constraints that once strongly influenced healthcare choices have progressively diminished[3].

Precisely because of these challenges, China has chosen a fourth path—using the cost-containment pressures inherent in insurance to compel healthcare providers to refer patients downward. This model mitigates conflicting interests by assigning financial responsibility to providers, thereby granting them greater autonomy in fund management and ensuring the security of these funds. In so doing, it addresses the misalignment of interests that typically characterizes the traditional principal–agent relationship between insurance institutions and healthcare providers, thereby deepening the practical application of principal-agent theory. By imposing cost pressures on healthcare providers to compel them to reduce the siphoning of patients from PHIs and to increase the downward referral of patients, this approach offers valuable insights for many countries with underdeveloped primary healthcare systems.

Over the past three decades, many countries around the world have focused on promoting integrated healthcare to combat fragmentation (e.g. 1993 Health Security Act, 2010 Affordable Care Act) (Bhat *et al.* 2022, Burns *et al.* 2022). Despite increased efforts to better integrate care, outcomes remain varied (Wodchis *et al.* 2015). While topics such as the number of medical institutions, service volume, and public health benefits have drawn significant research attention, empirical studies on these areas remain scarce. Additionally, healthcare systems are likely too complex for a universal, one-size-fits-all integration approach (Armitage *et al.* 2009, Baldo *et al.* 2015, Burns *et al.* 2022). In China's Zhejiang Province, the implementation of a prospective payment system reform within its integrated healthcare delivery system has established positive incentives for primary healthcare. This reform has stimulated an increase in service volume at grassroots medical institutions and enhanced health benefits for residents. This model provides an explorable pathway for building people-centered, integrated healthcare systems globally.

Moving forward, future research should address three critical dimensions: First, the potent cost-containment incentives inherent in this model may trigger unintended provider behaviors—including quality erosion or 'cherry-picking' of patients—necessitating rigorous empirical scrutiny through rich provider-level data to quantify impacts on service quality, case-mix selection, and patient satisfaction. Second, investigations should prioritize vulnerable populations, particularly chronic disease cohorts, to elucidate how GBP reshape care utilization and health trajectories, thereby defining reform effectiveness boundaries while guiding tailored policy adaptations for broader implementation. Third, extending analyses to Western China's underdeveloped regions using provincial data would assess the GBP implementation in resource-constrained settings, enhancing findings' generalizability and offering actionable insights for similar health systems globally seeking primary care strengthening. Health resource shortages alongside underdeveloped primary healthcare systems mirror the challenges faced by public insurers in many developing countries. More generally, our study offers a rare opportunity to assess how implementing health insurance payment reforms within integrated healthcare delivery systems can deliver maximal health benefits at minimal cost.

[3] Source: China's Ministry of Transport: By 2024, China's high-speed rail operating mileage has exceeded 48 000 kilometers. In Zhejiang Province, the high-speed rail mileage surpassed 2000 kilometers, achieving the goal of providing high-speed rail access to all cities within the province.

Conclusion

This article analyzes the impact that the GBP within CMCs has on promoting a hierarchical medical system, as well as the underlying mechanisms. At county-level hospitals, the payment scheme reduces patient visits by 3%. The reason for this decrease is that more patients are referred downward. At PHIs, it has significantly increased the number of outpatient visits by 8.3% and outpatient income by 6.9%. From a mechanistic perspective, the cost-control pressure exerted by the GBP system compels county-level hospitals to reduce patient siphoning, promoting patient referrals to PHIs and ultimately contributing to the achievement of a hierarchical medical system. Moreover, regarding public health welfare, the study finds that the GBP within CMCs has reduced NCDs by 1.33%. Finally, the heterogeneity analysis further suggests that the mechanism's design is better suited for the era of aging populations.

This paper makes three key contributions to the body of academic literature. First, this study advances scholarly understanding by examining how prospective payment system reforms within integrated healthcare delivery systems influence the promotion of tiered care—broadening prior discussions limited to hospital-level behaviors to encompass system-wide coordination mechanisms. Second, utilizing 6-year (2017–2022) panel data from a Chinese province with 66 million residents, our provincial-scale analysis enhances the robustness and generalizability of findings compared to conventional single/multi-hospital studies. Third, the research theoretically extends principal-agent theory by demonstrating that implementing the GBP within CMCs mitigates interest misalignment between insurers and providers, establishing an incentive-compatible framework.

Nevertheless, there is still room for improvement regarding the research conducted in this paper. First, although a fixed effects model and a shortened temporal window were used to minimize other reforms' influence on the results, their impact cannot be entirely eliminated. Fortunately, since the establishment of the National Healthcare Security Administration in 2018, local governments have had increasingly limited flexibility to adjust health insurance policies, resulting in a lack of heterogeneity in policy changes across different cities in Zhejiang Province. Thus, most other reforms have been implemented broadly, affecting both the treatment and control groups simultaneously, which helps mitigate the endogeneity issue. Second, reforms often have a lagging effect. While the sample period spans 6 years, a longer observation period would be necessary to fully assess the reform's impact. Finally, given data limitations, the indicators used to evaluate the effectiveness of a hierarchical medical system have certain shortcomings, such as a lack of specific disease information for patients referred to PHIs.

Supplementary data

Supplementary data is available at *Health Policy and Planning* online.

Author contributions

Xiaoting Liu; Hao Lyu (conception or design of the work), Hao Lyu (data collection), Hao Lyu (data analysis and interpretation), Xiaoting Liu; Hao Lyu; Haiyu Jin (drafting the article), Haiyu Jin (critical revision of the article), Xiaoting Liu; Hao Lyu; Haiyu Jin (final approval of the version to be submitted)

Reflexivity statement

The authors include two females and one male and span multiple levels of seniority. Moreover, two authors are China-based and one author is UK-based. The authors include PhD candidates, junior researchers, and professors. The authors also have diverse methodological backgrounds, including social science and medical/clinical training. The authors have made a conscious effort to consider how their differing backgrounds may have shaped their approach to the research question and to critically reflect on the findings in this light.

Ethical approval

Ethical approval for this type of study is not required by our institute.

Conflict of interest

None declared.

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Data availability

The data underlying this article are available in DOI:10.5281/zenodo.13777030

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