How Does Medical Consortium Affect Public Hospital Performance? Evidence from China

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Abstract

The medical consortium represents a potential solution to the fragmentation and hospital-centered nature of China's health system. This paper utilizes hospital-level data from Beijing, spanning 2010 to 2018, to assess the impact of medical consortia on public hospital performance at different levels, with a focus on institutional isomorphism theory. The analysis was conducted using the Generalized Method of Moments (GMM) method, with the findings summarized as follows: (1) The establishment of medical consortia positively influenced outpatient and inpatient services, though it negatively impacted hospital revenue across the entire sample. (2) Further analysis demonstrated that the formation of medical consortia significantly improved outpatient services, inpatient services, and revenue in secondary public hospitals. (3) In contrast, for tertiary public hospitals, the establishment of medical consortia did not affect outpatient performance but negatively impacted both inpatient performance and hospital revenue. The results of this study offer the latest evidence on the impact of integrated care on public hospital performance. In light of these findings, it can be concluded that promoting medical consortia is an effective strategy for improving the performance of public hospitals. This approach has been recognized by the government as a crucial policy direction for advancing integrated care. However, it is essential to implement measures aimed at mitigating the negative effects of medical consortia on the performance of tertiary public hospitals.

Keywords: Medical Consortium; Public Hospital Performance; Integrated Care; China; Global Markets

1. Regional Healthcare Models in China

In 2009, the Chinese government initiated a national healthcare reform aimed at providing affordable and equitable medical care (Yip and Hsiao, 2014). China has

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since established a universal insurance system that now covers over 95% of its population (He and Meng, 2015). Despite this achievement, healthcare institutions still grapple with a fragmented and hospital-centric care model (Wu et al., 2015). Patients in China tend to favor hospitals over primary health care (PHC) services, even though the government has invested in improving PHC quality. As a result, hospitals frequently experience overcrowding, and patients face extremely long waiting times for care (Qian et al., 2017). Additionally, with over 190 million adults aged 65 and older – a figure expected to double by 2050 (China National Bureau of Statistics, 2021; United Nations, 2019) - the fragmented and hospital-centric model is increasingly ill-equipped to handle the aging population. This challenge also hampers care continuity and drives up healthcare costs (Shi et al., 2015).

Integrated care has been widely implemented in developing countries to address the fragmentation of health services (Stokes et al., 2016). According to the World Health Organization (2016), integrated health service refers to a coordinated continuum of care across various levels and settings, delivering a range of health services tailored to individuals' needs throughout their lifetimes. Previous research has explored the impact of integrated care on various outcomes, such as patient satisfaction (Baxter et al., 2018), healthcare utilization (Mason et al., 2015; Stephenson et al., 2019), medical costs (Humphries, 2015), mortality (Lijas et al., 2019), and quality of care (Bender et al., 2016). From a global perspective, "systemic thinking" has emerged as a cornerstone of public policy formation, particularly in healthcare reforms designed to improve medical efficiency and address rising healthcare expenditures (Rogate, 2017). Several countries have improved healthcare management efficiency through technological innovation while fostering horizontal and vertical collaboration among medical institutions (Franco and Tursunbayeva, 2014). Additionally, mirroring China's medical consortium practices, other nations have implemented public-private hospital partnership models to strengthen integrated care and enhance the resilience of national healthcare systems (Mariani et al., 2014). Amado et al. (2022), in a review of 64 studies, found that vertical integration reduced care costs while improving technical efficiency and quality. Similarly, Rocks et al. (2020) conducted a systematic review and meta-analysis and concluded that integrated care led to lower costs and better health outcomes.

In 2010, the Chinese government introduced integrated care to address the fragmentation of the healthcare system by organizing medical institutions at various levels into collaborative teams, known as regional medical consortia, with clearly defined roles. A medical consortium is formed by integrating different levels of healthcare providers, such as tertiary hospitals, secondary hospitals, and community health centers within a specific region, or through horizontal collaboration among providers of the same level across similar or diverse specialties (Cai et al., 2018). There are currently four types of regional healthcare models in China: urban consortia, rural consortia, specialty alliances, and telemedicine collaborative networks (Liang et al., 2019).

As the capital, Beijing is home to the most extensive high-quality medical resources, attracting numerous patients to its tertiary hospitals from across the country. By the end of 2012, the number of patients visiting tertiary hospitals in Beijing had reached 80.7 million, marking a 94.83% increase compared to 2008 (Beijing National Health and Family Planning Commission, 2012). In 2012, the Beijing government initiated a pilot program to establish a regional medical consortium involving three hospitals. With subsequent government support, medical consortia gradually expanded to other public hospitals. For example, in 2014, Peking University established the largest urban medical consortium, comprising 18 hospitals and 7 primary care centers. By 2016, Beijing had established 53 medical consortia (Mao, 2017).

Many scholars have assessed the impact of medical consortia in China from two main perspectives: disease-based and primary care-based studies. Disease-based research has shown that medical consortia positively influence the prognosis of cancer patients and help bridge the gap between higher-level hospitals and primary care providers (Cai et al., 2018). In addition, an integrated care model can alter patients' health-seeking behaviors and mitigate health inequities and disparities among senior patients with chronic diseases (Shi et al., 2015). In primary care-based studies, researchers have evaluated the effects of vertical integration between hospitals and primary healthcare facilities on the perceived quality of primary care. They compared three typical integration models: private hospital-township health centers (THCs), public hospital-THC integration, and loose collaboration. The findings indicated that only private hospital-THC integration significantly improved the quality of care (Yuan et al., 2020). However, little attention has been paid to how medical consortia affect public hospital performance across different tiers of China's hierarchical system, particularly the divergent impacts on tertiary and secondary hospitals. This study addresses this gap by applying institutional isomorphism theory to analyze how consortia-driven pressures reshape performance outcomes at varying hospital levels, offering critical insights for tier-specific policy design.

Institutional isomorphism theory posits that organizations adopt homogenized structures and practices in response to three institutional pressures: coercive, normative, and mimetic (DiMaggio and Powell, 1983; Flood and Fennell, 1995; Scott, 2014). Coercive isomorphism arises from formal mandates imposed by regulatory bodies. In China, the government has mandated that all hospitals join the medical partnership system by 2020, forcing compliance even when such policies conflict with hospitals' operational interests. Normative isomorphism emerges from professionalization processes and shared expectations among actors within a field (Flood and Fennell, 1995). For example, regional variations in political and cultural values or community resources can affect the decisions of peer organizations to adopt innovations or industry norms (Scott, 2014). In healthcare, normative isomorphism has been evident in case management, public data sharing, and hospital partnerships (Ellis Hilts et al., 2022; Casey et al., 2016). Mimetic isomorphism occurs under conditions of uncertainty, where organizations imitate perceived successful peers to reduce risks (Flood and Fennell, 1995; Teodoro, 2014). For example, secondary hospitals may replicate tertiary hospitals' technologies or management practices to enhance competitiveness in facing resource constraints. The above mechanisms collectively explain how consortia reshape hospital behavior: coercive mandates enforce structural compliance, normative alignment fosters quality improvements, and mimetic imitation drives efficiency in lower-tier hospitals.

Institutional isomorphism theory can effectively explain medical consortia's impact on public hospital performance in China's hierarchical system. Firstly, coercive pressures align with China's top-down governance, where state mandates override institutional autonomy. Secondly, normative isomorphism reflects professional networks in consortia, where secondary hospitals adopt tertiary peers' protocols to meet quality benchmarks. Thirdly, mimetic pressures can explain why secondary hospitals imitate tertiary strategies while tertiary institutions stagnate due to leader roles discouraging adaptation. By framing consortia as conformity-inducing environments, the theory bridges gaps in integrated care literature, which often neglects state power's role in reform outcomes. This approach contextualizes China's reforms and offers a framework for hierarchical and policy-driven systems globally.

Thus, this study hypothesizes that lower-level public hospitals are likely to emulate higher-level ones in management and technology. This leads to the hypothesis:

H1: Public hospitals that participate in the medical consortia are expected to exhibit higher performance compared to hospitals that do not participate in the medical consortia.

The positioning of organizations within the local hierarchy affects their tendency to imitation. Industry leaders, aiming to differentiate themselves, are generally less inclined to follow the practices of others (Han, 1994). In the context of forming a medical consortium, tertiary hospitals, being at higher organizational levels, are less motivated to emulate lower-level participants. Therefore, it is hypothesized that the medical consortium does not significantly impact the performance of tertiary hospitals.

H2: The positive impact of the medical consortium is significant for lower-level hospitals but negligible for tertiary hospitals.

2. Materials and Methods

2.1 Data and Variables

This study used data from the 2010-2018 Beijing Health Statistical Yearbooks to examine the impact of healthcare consortia on public hospitals in Beijing. Given that empirical research indicates institutional isomorphism in hospital referral systems primarily occurs between secondary and tertiary hospitals (Jung and Choi, 2010), community hospitals are excluded from this analysis.

Performance was measured using three indicators as dependent variables: outpatient visits per physician, hospitalizations per physician, and annual revenue per physician, which reflect the hospital's operational efficiency and capacity utilization. These indicators were selected based on various performance measurement approaches (Coeling and Wilcox, 1988; Platonova et al., 2006; Williams et al., 2007; Zazzali et al., 2007) and adapted to the context of Chinese public hospitals (Zhou et al., 2011). The independent variable, medical consortium participation, was derived from a comprehensive review of consortium policies in Beijing. Hospitals participating in the consortium are coded as 1, while non-participants were coded as 0. Several covariates were included in the analysis. First, the number of physicians and beds per hospital were considered, as these indicators reflected service quality (Fu et al., 2017). Second, the analysis differentiated between types and hierarchies of public hospitals using dummy variables: general hospitals were coded as 1, while other types were coded as 0. Tertiary hospitals were coded as 1, and specialized and traditional Chinese medicine hospitals were coded as 0 (Lin et al., 2014). According to the Chinese government's classification, hospitals are categorized into three levels: primary hospitals (fewer than 100 beds) provide basic care, secondary hospitals (100 to 500 beds) serve specific communities, and tertiary hospitals (more than 500 beds) offer interregional services (Lin et al., 2014). Therefore, tertiary hospitals were recoded as 1 and secondary hospitals were recoded as 0. Third, the size of the medical consortium and the extent of its multi-membership were considered. Research on hospital alliances highlights the significance of alliance size in affecting cost efficiency (Granderson, 2011), so consortium size was included. Additionally, multiple memberships in medical consortia may affect the performance of public hospitals (Durand and Paolella, 2013), so participation in more than one medical consortium was coded as 1, with single or no membership coded as 0. Lastly, the age of the hospital, representing the number of years since its establishment, was also factored into the analysis (Rahman and Capitman, 2012). Definitions and descriptive statistics for these variables are provided in Table 1.

Table 1. *Descriptive Statistics Results*

Variables	Definition	Mean	Std.
Dependent variable			
Outpatient	The number of outpatient visits per physician	18.86	28.43
Inpatient	The number of hospitalizations per physician	49.60	128.89
Revenue	The annual revenue per physician	1984609	1739371
Independent variable			
Medical consortium	1=Participate in Medical consortium; 0=no participation	0.3889	0.48774
Control variable			
Beds	Number of beds	0.5850	0.4783
Personnel	Number of personnel	1.1681	1.0306
Tertiary hospitals	1=Tertiary hospitals; 0=Secondary hospitals	0.5159	0.5000
General hospitals	1=General hospitals;0=other service type	0.5040	0.5002
Age	The age of public hospitals	52.64	25.32
Size	The number of hospitals in each medical consortium	6.6290	9.9033
Multi-membership	1=participation in more than one medical consortium	0.1260	0.3320

2.2 Method

To avoid the endogeneity and dynamic panel bias, this study applied the System Generalized Method of Moments (GMM) estimator, developed by Arellano and

Bond (1991) and Blundell and Bond (1998). The method offers several advantages. First, Ordinary Least Squares (OLS) levels and within-group estimators often produce biased and inconsistent estimates in dynamic settings (Nickell, 1981). Specifically, OLS estimates tend to be biased due to the exclusion of unobserved time-invariant country effects, while the coefficient of the lagged dependent variable introduces bias because it is associated with permanent effects in dynamic panel regressions. The within-groups estimate of the coefficient on the lagged dependent variable is more likely to be biased downward. The system GMM estimator corrects these biases. Second, the system GMM estimator addresses both fixed effects and endogeneity issues of the regression variables (Omri and Nguyen, 2014) by instrumenting the lagged dependent variable and other endogenous variables with instruments uncorrelated with fixed effects. Third, the system GMM method enhances the accuracy of dynamic panel estimation (Lu and Wooldridge, 2019). Fourth, compared to the difference GMM estimator, the system GMM allows for more instruments by assuming that the first differences of the instruments are uncorrelated with the fixed effects, thus providing a more robust estimation.

The following dynamic panel equation was used in the system GMM analysis:

$$\ln(Per_{it}) = \gamma Per_{it-1} + \beta_1 Consortium_{it} + X_{i,t} + \mu_i + \varphi_i + \varepsilon_{i,t}$$

The dynamic panel equation is structured for i=1, …, 120 and t=2010,…, 2018, where the dependent variable, representing public hospital performance, is explained by its lagged value, membership of medical consortium, and other relevant control variables. These controls included the number of physicians and beds per hospital, the type of public hospital, the age of public hospitals, as well as the size and multi-membership of the medical consortium. The term $\boldsymbol{\mu_i}$ represents fixed hospital effects, $\boldsymbol{\varphi_i}$ denotes time effects, and $\boldsymbol{\varepsilon_{i,t}}$ is an error term with zero.

3. Results

To avoid the downward bias that can occur with two-stage GMM estimators in finite samples, this study used one-step system GMM estimators. For consistency, the system GMM approach must meet the assumption that the error term has no serial correlation and is correlated with the instruments. The Arellano-Bond test and the Sargan J test were employed to verify these assumptions. The results, shown in the bottom rows of all tables, indicate that the Sargan J test did not reject the null hypothesis of instrument validity in any of the models, and the AR2 test confirmed no second-order autocorrelation in the differenced residuals. Estimates for the full sample, as well as for different hospital levels, including tertiary and secondary hospitals, are provided in columns (1) to (3) respectively. Across all regressions, the lagged dependent variable was controlled for, and the number of physicians and beds per hospital, the type of public hospitals, the age of public hospitals, as well as the size and multi-membership of the medical consortium, were treated as exogenous variables. Time dummies were included in all regressions.

3.1 The Relationship between Medical Consortium and Outpatient Performance

Table 2 represents the effects of the medical consortium on outpatient performance. Analyzing the relationship between outpatient performance in the previous and current periods for the entire sample, tertiary hospitals, and secondary hospitals supports the assumption that previous outpatient performance contributes to current outpatient performance. Moreover, the impact was most pronounced for tertiary hospitals, where a 1% increase in lagged outpatient performance led to a 20.3% improvement in the current period.

For the entire sample, participation in the medical consortium had a positive and statistically significant effect on outpatient performance, with consortium members seeing a 19.67% increase. As expected, this positive effect was observed specifically among secondary hospitals.

Table 2. *The Impact of medical consortium on outpatient performance*

	Entire sample	Tertiary hospitals	Secondary hospitals
	(1)	(2)	(3)
Lagged dependent variable	0.1063^{***}	0.2030^{***}	0.0781^{***}
	(0.0239)	(0.0178)	(0.0139)
Medical consortium	0.1967^{***}	0.0266	0.4740^{***}
	(0.0355)	(0.0198)	(0.0272)
Control variable	YES	YES	YES
AR (1)	0.0012	0.0393	0.0303
AR (2)	0.5196	0.2349	0.7703
Sargan J test	0.1067	0.3648	0.2684
N	1008	520	488

*Note: Standard errors are reported in parentheses, ***, **, and * representing significance at the 1%, 5%, and 10% levels, respectively. AR1 and AR2 represent the Arellano-Bond tests for first- and second-order autocorrelation in the idiosyncratic errors of the first-differenced equation.*

3.2 The Relationship between Medical Consortium and Inpatient Performance

Table 3 presents the impact of the medical consortium on inpatient performance. As with outpatient service, lagged inpatient performance positively influenced current performance.

In Model 1, which includes all public hospitals, participation in the medical consortium significantly increased inpatient performance by 14.08%. While the full sample suggested a generally expected positive effect of the consortium on inpatient performance, this effect varied notably by the levels of public hospitals. For tertiary hospitals, the consortium's impact was significantly negative, reducing inpatient performance by 4.22%. In contrast, secondary hospitals showed a substantial increase in inpatient performance, with consortium participation boosting it by 51.96% compared to other secondary hospitals.

Table 3. *The impact of medical consortium on inpatient performance*

	Entire sample	Tertiary hospitals	Secondary hospitals
	Model 1	Model 2	Model 3
Lagged dependent variable	0.3548***	0.1944***	0.4077***
	(0.0244)	(0.0108)	(0.0122)
Medical consortium	0.1408***	-0.0422***	0.5196***
	(0.0336)	(0.0125)	(0.0209)
Control variable	YES	YES	YES
AR (1)	0.0004	0.0495	0.0051
AR (2)	0.1201	0.5481	0.1000
Sargan	0.1445	0.2902	0.2597
N	1008	520	488

*Note: Standard errors are reported in parentheses, ***, **, and * representing significance at the 1%, 5%, and 10% levels, respectively. AR1 and AR2 represent the Arellano-Bond tests for first- and second-order autocorrelation in the idiosyncratic errors of the first-differenced equation.*

3.3 The Relationship Between Medical Consortium and Revenue

Table 4 illustrates the effect of the medical consortium on hospital revenues. The analysis of lagged revenues in the sample supports the assumption that higher hospital revenues per physician in the previous period positively influence current revenues. For the full sample, the results show that participation in a medical consortium reduced hospital revenue by 5.59%. This negative relationship was particularly evident among tertiary hospitals, where participation in the medical consortium led to a 15.13% reduction in hospital revenue. In contrast, secondary hospitals experienced a positive impact, with the consortium increasing their revenue by 6.78%.

Table 4. *The impact of medical consortium on hospital revenue*

	Entire sample	Tertiary hospitals	Secondary hospitals
	Model 1	Model 2	Model 3
Lagged dependent variable	0.2276***	0.1630***	0.3932***
	(0.0161)	(0.0113)	(0.0151)
Medical consortium	-0.0559**	-0.1513***	0.0678***
	(0.0235)	(0.0219)	(0.0104)
Control variable	YES	YES	YES
AR (1)	0.0194	0.0009	0.0443
AR (2)	0.1157	0.1244	0.1101
Sargan	0.2747	0.2275	0.3963
N	1008	520	488

*Note: Standard errors are reported in parentheses, ***, **, and * representing significance at the 1%, 5%, and 10% levels, respectively. AR1 and AR2 represent the Arellano-Bond tests for first- and second-order autocorrelation in the idiosyncratic errors of the first-differenced equation.*

4. Conclusion and Discussion

China has actively pursued healthcare reform to address the challenges posed by its fragmented, hospital-centric system, with a focus on establishing a hierarchical diagnosis and treatment system. In 2010, the government launched a significant health reform to integrate medical institutions of various levels into regional medical consortia, aiming to improve healthcare delivery. Using hospital-level data from 2010 to 2018, this study applied the system GMM method to assess the impact of medical consortia on public hospital performance in Beijing. The study reveals several significant conclusions.

First, the study demonstrates that participation in medical consortia positively impacts outpatient and inpatient performance across the entire sample. Hospitals involved in consortia showed superior performance in both outpatient and inpatient services compared to those that did not participate. These results are consistent with previous research in China, which found that integrated care improves healthcare utilization, perceived quality of care, and disease prognosis.

Second, a negative association between medical consortium participation and public hospital revenue was observed, particularly among tertiary hospitals. The enhancement of technology and facilities at lower-level hospitals, driven by consortia, may attract more patients to these institutions. This shift can reduce the patient volume and revenue for tertiary hospitals. Additionally, the engagement of doctors from tertiary hospitals in primary community institutions may further decrease their availability and productivity in tertiary settings, contributing to a reduction in revenue.

Third, the medical consortium's impact varied across hospital levels due to two factors. Institutional isomorphism explains how coercive government mandates reduced tertiary hospitals' revenue, while normative adoption of protocols and mimetic imitation of successful strategies improved secondary hospitals' outpatient and inpatient performance, consistent with existing findings (Amado et al., 2022). However, patients still prefer tertiary hospitals for initial care. Creating excessive workloads that offset potential benefits for these institutions (Tang et al., 2013). This combination of isomorphic pressures and patient behavior patterns created divergent outcomes as secondary hospitals gained from knowledge transfer while tertiary hospitals faced financial strain. These findings extend existing findings of disease-specific studies by showing how institutional theory explains system-wide integration effects, suggesting policy adjustments are needed to address tertiary hospitals' challenges while maintaining consortium benefits.

Fourth, given the positive effects of medical consortia, further expansion of this policy is expected to significantly enhance the performance of public hospitals in China. Implementing performance evaluations for hospitals within medical consortia could help monitor and improve outcomes for both higher-level and lower-level institutions. However, measures should be taken to address the adverse effects of consortia on tertiary hospitals. In China, challenges such as burdensome workloads, low salaries, and the zero-markup policy on drug sales have already reduced hospital revenues and affected physician incomes

(Zhou et al., 2018). This has led to a shortage of physicians and a decrease in the proportion of young doctors by 10% over the past decade (Lien et al., 2016). The additional reduction in revenue caused by medical consortia may exacerbate these issues.

This study has several limitations. First, due to the constraint of available data, the analysis is limited to the impact of the medical consortia on the performance of public hospitals in Beijing. Consequently, the results may not be nationally representative. Beijing, being one of the largest cities with advanced medical technologies and abundant resources in China, may not reflect the experiences of public hospitals in lower-tier cities with different institutional environments. Second, hospital performance was evaluated using only three indicators. Due to data limitations, other important indicators such as quality performance, provider job satisfaction, and patient satisfaction could not be assessed. The analysis also included a limited set of covariates, such as technological capacity, which may introduce omitted variable bias. These limitations highlight areas for future research. Third, there are various types of medical consortia in China, including those tailored for specific patient groups or established for certain groups of doctors. Future empirical studies should explore these different types to provide a more comprehensive understanding of their impact.

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