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The Effect of Hospital Vertical Integration on Health Care Quality in China

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Abstract

The rapid growth of hospital integration activities in China has made it critical to understand whether integration in health care markets enhanced or damaged quality. The purpose of this study is to analyze the effect of hospital integration on health care quality in Shanghai. Using difference-in-difference analysis, the authors analyze cure rate and length of stay for gastric ulcer patients. The data indicates that hospital integration has positive impact on cure rate 4 years after integration at the 10% significant, but has no significant impact on length of stay. The authors also discuss the implications of these findings and offer directions for future research.

Keywords: Integration; Health care; Quality; Length of stay; Hospital

1. Introduction

In the past 20 years, it emerges a lot of consolidation activities in the America health care industry [8]. In 1992, 42 percent of all hospitals were owned by a multi-hospital system, by 1997, hospitals owned by a multi-hospital system grew to 50 percent [4]. In 2000, Chinese government issued a series of policies to instruct the consolidation, transfer, shutdown, and take-over of public hospitals. Since then, it emerges a lot of consolidation activities in the China health care industry.

Studies of industry consolidation typically assume that the specific form of integration under consideration can be neatly categorized as either horizontal or vertical [10]. Kongstvedt defines 'horizontal integration' as the integration of resources along clinical healthcare delivery lines, 'vertical integration' as the integration of various levels of the healthcare delivery system [13]. There are two forms of vertical integration: classical integration and virtual integration. The classical form is a structure in which a single organization has ownership of all component organizations; in virtual integration, relationships are maintained between organizations with long-term, exclusive contracts, affiliations, and operating agreements rather than through ownership [5]. The current multi-hospital systems and continuums built from public hospitals through vertical integration in China are mostly virtually integrated, for example, Shanghai Sixth People's Hospital System and Nanjing Gulou Hospital System. Vertical integration of hospitals in China mainly undergoes between tertiary hospitals, secondary hospitals and community hospitals, which are to some extent similar with foreign hospital systems and integrated delivery systems, but there is also great difference. This paper defines vertical integration of public hospitals in China as follows: it is to form a business operation continuum and a collaboration system linked by asset, management, technique or service, with tertiary hospital as the center and the inclusion of some independent secondary hospitals and community hospitals, so as to realize efficient allocation of hygienic resource and provide patients with collaborative and continuous services.

One can imagine several reasons for the pursuit of consolidations. These include increased volume or market share [10], higher prices [7] [11] [14], synergies unrelated to quantity [10] and reputation benefits [7]. Barro and Cutler speculate that large "downtown" hospitals may buy small "suburban" hospitals to increase the share of patients traveling from the suburbs to the downtown facility [2]. The corporate strategy literature pointes that firms integrate to compensate for incomplete markets for resources, such as brand names, management expertise or referrals [18] [6] [16] [3]. Through integration, the acquirer might gain access to the target's resource of a close attachment to local patients and physicians; the target might gain access to specialized technology, the quality reputation of the acquirer and potentially valuable contracts with managed care payers [10].

The flurry of hospital consolidation has generated interest in determining its impact on prices, costs, and quality of care [9]. But a small numbers of studies have considered the impact of consolidation on explicit quality in health care settings [1] [9] [12]. This paper mainly use difference-in-difference analysis to study the impact of integration on the health care quality of integrated secondary hospital from two aspects: one is cure rate; another is patients' length of stay. An examination of the impact of hospital integration on patient outcomes will provide a more complete picture of market consolidation and social welfare.

2. Methodology

2. 1 Sample and Data

For this study Shanghai sixth people's hospital system is selected. In August 2000, Shanghai sixth people's hospital (a 1600-bed hospital located in the southern-west part of Shanghai, affiliated to Shanghai Jiaotong University), constructed a hospital system with 4 secondary hospitals. This paper selected 406 gastric ulcer patients' data of 5 years (one year before integration, namely 1999, and 4 years after integration, namely 2001 to 2004) of two secondary hospitals involved in integration, and 93 gastric ulcer patients' data of one secondary hospital with same scale not undergoing integration as control group. The paper selected these three hospitals because they all implemented electronic management before 1996 and the patients' data is available. Moreover, gastric ulcer instead of heart disease was selected because gastric ulcer has large volume in secondary hospitals in China.

2.2 Empirical Framework

The issue of how to measure quality in health care is both long standing and contentious. Various potential proxies for quality have been put forward, including length of stay and mortality rates [17]. Because the mortality rate of gastric ulcer is very low in China, the paper use cure rate and length of stay to measure health care quality.

In the previous studies, many variables are used to test health care quality, such as patient characteristics including age, gender and race, clinical controls, patient volume [9] [10]. Based on the studies of prior research, this paper uses patient characteristics including age, gender, clinical controls, and patient volume as independent variables. To better understand the effect of integration, this paper applies difference-in-difference analysis which allows for time-invariant unobserved differences between integrated hospitals and control hospital, in particular it removes differences in unobserved characteristics that are constant over time.

To determine the effect of vertical integration on cure rate, this paper estimates the following specification:

$$CUR_{iht} = \alpha_h + \beta_1 Age_{it} + \beta_2 Gender_i + \beta_3 VOL_{ht} + \beta_4 S_{iht} + \beta_5 B_{iht} + \beta_6 I_h + \gamma Y + \delta I * Y + \varepsilon_{iht} \quad (1)$$

Where CUR_{iht} denotes the quality measure of interest for patient i admitted to hospital h in year t. If the patient was cured after discharge, then CUR_{iht} is 1, otherwise is 0. α_h denote hospital-specific intercept, all characteristics that do not change over the sample period will be captured. Age_{it} and $Gender_i$ are demographic characters for each patient. VOL_{ht} is the volume of gastric ulcer patients of hospital h in year t. S_{iht} and B_{iht} are two dummy variables, represents clinical controls for each patient. If the patient undergo surgery, then S_{iht} is 1, otherwise is 0; If the patient undergo blood transfusion, then B_{iht} is 1, otherwise is 0. I is a dummy variable, represent whether hospital h undergo integration in 2000. Y is year dummy vector to show the fixed effects of every year. $I*Y$ is multiple of I and Y, the parameter δ represents the effect of integration on cure rate. ε_{iht} are unobserved disturbance.

We next consider the effect of vertical consolidations on patients' length of stay. The specification is as following:

$$LOS_{iht} = \alpha_h + \beta_1 Age_{it} + \beta_2 Gender_i + \beta_3 VOL_{ht} + \beta_4 S_{iht} + \beta_5 B_{iht} + \beta_6 I_{ht} + \gamma Y + \delta I * Y + \varepsilon_{iht} \quad (2)$$

Where LOS_{iht} denotes the length of stay for patient i admitted to hospital h in year t. In this study, length of stay is

defined as the total number of days between admission and discharge dates for each patient. Other variables are the same as in equation (1).

3. Results

3.1 Descriptive Analysis

Table 1 provides descriptive statistics of two integrated hospitals and one control hospital.

Table 1. Descriptive statistics for integrations and controls in sample

		1999	2001	2002	2003	2004
Integrated hospitals (n=2)	Average length of stay	15.37	17.52	16.40	15.40	15.64
	Cure Rate	70.93%	70.49%	66.67%	58.62%	56.47%
	Sample size	86	61	87	87	85
Control hospital (n=1)	Average length of stay	21.52	31.82	24.14	20.67	22.80
	Cure Rate	39.13%	35.90%	28.57%	25.00%	20.33%
	Sample size	23	17	14	24	15

Table 1 show that average length of stay of integrated hospitals is shorter than that of control hospital, and cure rate of the former is higher. In addition, cure rates are all declined during the sample period.

3.2 The Impact of Integration on Cure Rate

Table2.Logistic regression results

Variable	Coefficient	S.E.	Wald	df	P	OR
Age	-0.020	0.009	5.423	1	0.020	0.980
Gender	0.714	0.314	5.172	1	0.023	2.042
VOL	-0.030	0.024	1.470	1	0.225	0.971
S	3.526	0.556	40.261	1	0.000	33.973
B	0.546	0.368	2.200	1	0.138	1.727
I	3.908	1.024	14.556	1	0.000	49.812
Y01	-21.900	11073.299	0.000	1	0.998	0.000
Y02	-1.535	0.910	2.842	1	0.092	0.216
Y03	-1.225	0.842	2.212	1	0.137	0.294
Y04	-2.349	1.028	5.224	1	0.022	0.095
I*Y01	21.633	11073.299	0.000	1	0.998	2E+009
I*Y02	1.194	0.974	1.502	1	0.220	3.299
I*Y03	0.335	0.937	0.128	1	0.721	1.398
I*Y04	2.200	1.219	3.258	1	0.071	9.024
Constant	-1.706	1.107	2.372	1	0.124	0.182

Logistic regression analysis (SPSS13.0) is used to estimate model (1). The regression results are presented in Table 2. The -2 log likelihood of the model is 393.212, Cox & Snell R^2 is 0.366, Nagelkerke R^2 is 0.493. The data in Table 2 shows that the regression coefficient for Age, *Gender, S*, *I, Y02, Y04* and *I*Y04* are all statistically significant at 0.1 significant level, which indicates that hospital integration has positive impact on cure rate from 4 years after integration. Thus, when cure rate is used as a quality measure, integrations do have a positive impact on health care quality.

3.3 The Impact of Integration on Length of Stay

Then, multiple regression analysis (SPSS13.0) is used to estimate model (2) to test the effect of each variable on length of stay. The regression results are presented in Table 3(R^2 is 0.166).

Table3.Multiple regression results

Variables	Standard coefficient	S.E.	t-value	p- value
Age	0.180	0.035	3.670	0.000
Gender	-0.026	1.255	-0.570	0.569
VOL	0.052	0.090	0.408	0.683
S	0.060	1.190	1.132	0.258
B	0.129	1.278	2.625	0.009

I	-0.302	3.368	-2.490	0.013
Y01	0.283	3.846	2.179	0.030
Y02	0.007	3.620	0.048	0.962
Y03	-0.164	3.188	-1.495	0.136
Y04	-0.081	3.566	-0.649	0.517
I*Y01	-0.185	4.196	-1.402	0.162
I*Y02	0.046	3.940	0.322	0.748
I*Y03	0.111	3.604	1.052	0.293
I*Y04	0.061	4.436	0.428	0.669

The data in Table 3 shows that the regression coefficient for *Age, B, I, Y01* are statistically significant at 0.05 significant level, while *Gender, VOL, S, I, Y02, Y03, Y04, I*Y01, I*Y02, I*Y03* and *I*Y04* have no effect on length of stay. The data indicates that hospital integration has no significant impact on length of stay even 4 years after integration.

An examination of excessive multicollinearity and autocorrelation is performed. First, the value of Durbin-Watson is 2.023. Second, the variance inflation factors (VIF) are scrutinized and all are found to be within the range of 1.047 to 8.559. Myers indicates that only if the VIF is above 10 is there cause for concern about multicollinearity [15]. Therefore, multicollinearity and autocorrelation are well within acceptable limits and not unduly influencing the regression estimates.

4. Discussion and Implications

This paper provides an initial look at the impact of hospital integrations on patient outcomes for patients admitted to two secondary hospitals affiliated to one hospital system in Shanghai in 2000, a location and period that has seen a substantial amount of hospital integration activity in China. The data indicates that hospital integration has positive impact on cure rate 4 years after integration, but has no significant impact on length of stay. The main reason may be as following: on the one hand, through integration, the core hospital might gain access to the target's resource of a close attachment to local patients; the target might gain access to specialized technology. The technology diffusion between core hospital and target hospital may improve the target's cure rate. On the other hand, because of the absence of referrals system between higher level hospitals and community hospitals, patients needing long-term care and short-term rehabilitation care can not be transferred to community hospitals effectively. Consequently, hospital integration between tertiary hospitals and secondary hospitals in China has no impact on the reduction of length of stay. From this point, hospital consolidation should develop closer ties with community hospitals.

The limitation of this analysis is that it only studied one hospital system in Shanghai. To generalize the findings, more samples should be included, and this may be the future research.

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