



How to Make Diagnosis Related Groups Payment More Feasible in Developing Countries- A Case Study in Shanghai, China

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(Received 10 Dec 2013; accepted 14 Apr 2014)

Abstract

Background: Given limited health sources, how to make DRGs (Diagnosis Related Groups) more feasible is a big question in developing countries. This study contributes to the debate on how to bridge the pay-for-service and DRGs during the transitional period of payment reform.

Methods: From 2008 to 2012, 20740 patients with cirrhosis or duodenal ulcer disease were chosen as sample. Using multiple linear regression analysis, the interrelationships between the total medical expenses of the inpatients, and age, gender of the inpatients, length of stay (LOS), region and economic level of the hospitals were examined.

Results: The main findings were 1) length of stay (LOS) and the economic level of treatment location had a statistically significant impact on patients with cirrhosis or duodenal ulcer disease. Meanwhile gender is not a significant factor for both of them. 2) Under the premise of limited resources, developing countries should first narrow down to screen for common and frequently occurring diseases, then study the key factors which affect the treatment cost of the diseases.

Conclusion: Based on picking out common diseases and their key factors, Simplification of the DRGs setting process will greatly increase the efficiency of implementing DRGs in the developing world.

Keywords: Diagnosis related groups, Payment, Hospitals, China

Introduction

Diagnosis Related Groups (DRGs) are one of the most striking prospective payment systems around the world in recent years (1-2). As a classification system that groups patients according to (a) principal diagnosis, (b) type of treatment, (c) age, (d) surgery, and (e) discharge status (3), prospective payment system have gradually become the principal means of reimbursing hospitals in most developed countries, such as US, Germany and Australia (4). Under the prospective payment system, hospitals are paid a set fee for treating patients in

a single DRG category, regardless of the actual cost of care accrued for the individual, as to create incentives for hospitals to control cost, to reduce the LOS of patients and to increase number of inpatient admissions (2, 4-5). Successful experiences of DRGs in developed countries have encouraged developing countries to adopt the system. Since 2000, countries such as Brazil, Mexico and Iran have introduced DRGs reform in order to control cost and to increase hospital efficiency (6). However, those countries met varying degrees

of difficulties during the implementation of the policy. For example, Iran developed an interest in casemix funding of hospital as part of a major health financing reform in 2003 (7). But the usefulness of DRG information for either management or funding arrangement is still under question due to the poor quality of hospital data (8).

In fact, DRGs is not a new term to China (9). As early as the beginning of the century, some of China's relatively economically developed provinces have started the exploration of DRGs (10). For example, Shanghai has experimented with a prospective payment system whereby a reimbursement cap is imposed on each Diagnosis-Related Group (DRG) in 2004. This experimentation includes fifteen types of different diseases (11). However, the DRG mentioned above is greatly different from the foreign DRGs (12): a) it adopts survey results on hospitalization costs for corresponding diseases, b) it bases on the average medical insurance cost of the past few years, c) it formulates insurance payment standard for a single disease. In a word, the payment standard merely sets a maximum payment limit for a particular disease.

China's new medical reform was launched in 2009, which had four important parts (13): public health, medical services, basic drugs and medical insurance. Payment innovations have become the most prospective direction for medical insurance reform in these years (14). Currently in Shanghai, the level of health information technology has been gradually improved. Also, medical record keeping and diagnosis coding have been more standardized, which provided a foundation for the formal practice/ implementation of DRGs (15). However, due to China's complex social and economic background, and uneven development across regions, the time was not yet ripe for the formulation of a national payment standard (16). The 10 year experience of payment reform in Shanghai has told researchers (12, 17): a) 10-20 diseases diagnosis groups couldn't fulfill demands of health services of the whole city; b) but too many diseases diagnosis groups are not realistic under the limited sources. Hence a step by step realization approach is required. That means a bridge

between pay for service and DRGs is needed. The study will construct a theory model to show how to make DRGs more feasible in the context of limited resources, and use a case to prove it.

Materials & Methods

Sites and Sampling

This research was a retrospective examination of data from 32,000 hospital stays at 60 regional general hospitals from 2008 to 2012 in Shanghai. We divided the 60 hospitals into three groups by economic level, and then picked one hospital from each group randomly. All discharges from the sampled hospitals were included in the database. We chose to start with the data of 2008 because it was the earliest year that cost data was available and sufficient, and 2012 because it contained the most recent data when we performed our analysis. Shanghai has been promoting information technology gradually since 2007. This study selected 32,113 discharged cases from the department of digestive surgery as sample for analysis from 2008 to 2012. Among the types of diseases, duodenal ulcer and cirrhosis have the highest prevalence rates, the number of cases being 13,428 (41.8%) and 7,312 (22.8%) respectively. As the proportion of the remaining cases occurred less than 10%, 20,740 discharged patient cases from 2008 to 2010 are finalized as the total sample for this study.

This study did not use blood sample or questionnaires, so Ethics Committee from Tongji University considered the research didn't have to apply for ethical review.

Participants

Patients in our study were admitted to hospitals from 2008 to 2012 and were discharged with a principal diagnosis of cirrhosis or duodenal ulcer disease. All these diagnoses were the top three diseases on the spectrum of disease in five years.

Data and Statistical Analysis

At first, we used descriptive statistics to get the summary of the outpatients and sample hospitals. Secondly, for each patient, we included the factors

of age, gender, length of stay, principal and secondary diagnoses, and the total medical expenses. Hospitals were categorized by region and economic level. In our primary analysis, we used multiple regression model to find correlations between the total medical expenses and traits of inpatients and hospitals during 2008 to 2012 for each of the two principal diagnosis at sampled hospitals. We held covariates constant at their overall sample means. The model included patient factors—age, gender, length of stay, principal and secondary diagnosis, the total medical expenses—as well as hospital factors—region and economic level. In order to analyze whether the expenses for medical treatment is related to the economic environment of the healthcare provider hospital, the study also divided the hospitals into three groups of high, medium and low according to each hospital's level of economic environment.

All analysis were carried out using SPSS 17.0. All *P* values less than 0.05 were considered significant.

Results

Theory of Simplified process of DRGs

Based on lots of practice and theoretical experience, the research finds a way to achieve DRGs

gradually for developing countries (Figure 1). The most important steps: first of all, it is necessary to analyze the common and frequently occurring diseases of a region within a period of time. Secondly, target the first few high incidence diseases ranking on top of the disease spectrum, and then analyze the factors associated with the medical expenses of these diseases (such as demographic characteristics of patients, disease diagnosis, treatment, and other relevant factors). This can provide a good prediction on the feasibility of formulating payment standards for each disease group. This approach can also provide developing countries with relatively low level of healthcare technology a theoretical framework to implement DRGs during the transition from the past payment system.

Case study on two key steps

The data for age and gender of the 20,740 cirrhosis or duodenal ulcer disease discharge cases were derived from case records. Among the discharged cases, there were less than 50% of male cases. By dividing the cases into five groups using 10 years as an interval, there was no specific trend of increasing or decreasing (Table 1).

Table 1: Descriptive statistics of patients' regional general hospitals from 2008 to 2012 in Shanghai

Characteristics	2008		2009		2010		2011		2012	
	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)
Total	2480	100	3762	100	6218	100	3771	100	4509	100
Age(year)										
under 50	871	35.1	1082	28.7	1911	30.7	1551	44.3	940	20.8
51-60	720	29.0	1181	31.4	1139	18.3	860	24.6	1255	27.8
61-70	392	15.7	670	17.8	1148	18.5	343	9.7	1240	27.5
71-80	289	11.7	607	16.2	1140	18.3	527	15.1	666	14.7
above 81	207	8.5	222	5.9	880	14.1	220	6.3	408	9.1
Male	901	36.3	1420	37.8	2261	36.3	1030	29.4	1765	39.1
Economic level of environment a										
low	789	31.9	1050	27.9	2161	34.7	970	27.7	1366	30.3
mid	990	39.9	1478	39.4	2229	35.9	1253	35.7	1229	27.3
high	701	28.2	1234	32.7	1827	29.4	1228	36.6	1904	42.4

^a Low, high or mid: Economic level of areas

Cirrhosis and duodenal ulcer diseases have been the most frequently occurring diseases in the district hospital departments of Shanghai since 2008. In order to analyze whether the primary diagnosis impacts the differences in medical expenses, the study first depicts the change in expense for cirrhosis and duodenal ulcer disease in five years. The maximum and minimum medical expenses for the two diseases fluctuated yearly, as a pyramid trend. The mean expense for cirrhosis had increased from RMB 11531.75 to RMB 12085.92 and back to RMB 10361.85 in five years. Meanwhile, the changes of mean expense for duodenal ulcer had been fluctuating during 2008-2012. To further analyze whether the medical expenses of the two diseases are different, the study applies t-test for Equality of Means and found $P < 0.05$. The difference was statistically significant, showing that the primary diagnosis had a significant impact

on the medical cost of discharged patients (Table 2, 3).

For Table 4 with the inpatients medical expenses as the dependent variable, the inpatients' age, gender and length of hospital stay as independent variables, and the economic level of treatment location as dummy variable (regions with higher economic level set at high, with moderate economic level set as mid, with lower economic level set as constant), results from multiple linear regression were as follows: targeting on the regression model of patients with cirrhosis, overall the model had a high goodness of fit, with R Square= 0.809. Despite that the Unstandardized Coefficients of age were not statistically significant; the impact of duodenal ulcer disease patients' ages on medical expenses was statistically significant, with P value less than 0.05. The Unstandardized Coefficients of genders of both diseases were not statistically significant.

Table 2: Independent Samples Test of cirrhosis and duodenal ulcer

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Total charge	Equal variances assumed	47.983	.000	7.125	2496	.000	1830.81810	256.95130
	Equal variances not assumed			6.889	1591.602	.000	1830.81810	265.77405

Table 3: The results of regression model of cirrhosis and impact factors

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	896.319	809.196		1.108	.268
age	4.682	10.682	.009	.438	.661
LOS ^a	555.299	28.367	.493	19.575	.000
gender	436.259	277.259	.033	1.573	.116
high ^b	5804.809	382.515	.444	15.175	.000
mid	1119.848	378.438	.071	2.959	.003

^a LOS: length of stay

^b High or mid: Economic level of areas

R Square=0.809, Adjusted R Square=0.655

Table 4: The results of regression model of duodenal ulcer and impact factors

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	103.977	393.898		.264	.792
age	18.111	5.811	.056	3.116	.002
LOS	707.280	31.481	.467	22.467	.000
gender	27.185	216.667	.002	.125	.900
high	4871.254	321.125	.374	15.169	.000
mid	784.044	236.796	.065	3.311	.001

^a LOS: length of stay/ ^b High or mid: Economic level of areas/ R Square=0.755, Adjusted R Square=0.569

Discussion

Based on systematic reviews of DRGs in China, the “incomplete” DRGs referred in introduction section was still the most popular payment around the mainland (18-19). Nevertheless, the “incomplete” DRGs could just be called “pay for single disease” (12) not “pay for real Diagnosis Related Groups”. To perfect this simple model of “one disease one price”, Beijing launched its Beijing Diagnosis Related Groups (BJ-DRGs) after 5 years research, including 108 groups (19). However, the pilot of BJ-DRGs was not so successful in practice due to the level of medical standards and economic constraints, and there were lots of obstructions to pull it back to “pay for single disease” (20-21). The experiences from China reveals a truth that underdeveloped countries need a payment more mature than “pay for single disease” and less complex than DRGs from developed countries (22), and unfortunately we can get very limited experience from developed countries. In this paper, we used database from digestive department as an example to confirm that simplification of the DRGs process will make it more feasible for practice. This idea may promote the development of DRGs around developing countries.

Analyze the factors that affect the medical expenses of specific diseases. Simplify the DRGs standard- setting process

In 2001, the feasibility research of introducing Australian refined DRGs had been launched in Chengdu city (Chongqing province) (23). A total of 161,478 inpatient episodes from three Chengdu

hospitals with demographic, diagnosis, procedure and billing data for the year 1998-2001 were grouped using the Australian refined-diagnosis related groups (AR-DRGs) (version 4.0) grouper (23). 553 groups were classified based on 16 key factors, but finally no further practice (18). To enhance feasibility, Beijing shrank the 553 groups into 108 groups, and the key factors influencing price making declined from 16 to 13 (21). But they could not avoid the same dilemma and just 8 hospitals took part in DRGs (24). As a result, our study confirms that screening common diseases from each clinical department and simplification of the DRGs setting process should be the most important elements for the payment reform.

For example, the research has first confirmed that cirrhosis or duodenal ulcer diseases are the most common inpatients of digestive diseases in Shanghai. Then through the sample analysis, age is found to be an unimportant factor for cirrhosis medical expense, but affects the medical expenses of duodenal ulcer patients. Therefore, age should be included in formulating payment standard for cirrhosis, but not for duodenal ulcer. Using the above as an example, targeted disease group pricing is possible through considering the inclusion or exclusion of related factors.

DRGs will become an important direction for China's medical reform

A number of studies have shown that, two current medical dilemmas in developing countries include high medical expenses and bed turnover inefficiency (25-26). These two dilemmas have also caused the headache of expensive and diffi-

cult medical treatment in China (27). The BJ-DRGs produced the best CV and RIV results for expenditure control. In our study, for cirrhosis and duodenal ulcer, which are the two highest incidence digestive system diseases, in particular, length of stay was positively correlated with the expense of medical treatment, which brings hope to resolving the very two issues. Hence DRGs would be a major direction for China's medical reform.

Limitations of the study and directions for future development

There are two limitations in this study. On one hand, the sample size is limited thus cannot represent the distribution of disease cost in the whole population. If a larger sample is available, the analysis of impact factors for specific diseases would be more accurate. Also, data mining techniques can be introduced for the cost of disease clustering based on key factors, thereby to develop more accurate pricing standards for each disease group. On the other hand, Shanghai, as one of China's most developed cities, has the highest economic and medical technological level in the nation, thus the results of this study cannot be generalized. This study mainly provides fellow colleagues research an idea on the way to introducing prospective payment system during transition from past payment system. For future studies, the direct application of research results has to be improved.

Conclusion

Conditions in developing countries are not up to the management requirements to fully realize DRGs. However, in the context of limited resources, starting with screening for common and frequently occurring diseases, studying the limited diseases within each disease group and the key factors influencing medical expenses of these diseases, as well the simplification of DRGs standard-setting process based on standardized clinical pathways and accurate costing, will greatly in-

crease the efficiency of implementing DRGs in developing countries.

Ethical considerations

Ethical issues (Including plagiarism, Informed Consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

Acknowledgements

The authors thank all members of the DRGs project team and cooperative hospitals in Shanghai and, particularly, Tabitha Mui, Jun Lv, Li Luo for their advice and guidance. They are also grateful to the journal's referees for their constructive comments.

This work was supported by the Fundamental Research Funds for the Central Universities (2012KJ017), Research Funding from the Health bureau of Shanghai (20124y182), Shanghai Postdoctoral Scientific Program (13R21416600) and China Postdoctoral Science foundation (2013M531223). The authors declare that there is no conflict of interests.

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