

Exploring the transition to DRGs in Developing Countries: A case study in Shanghai, China

Zhaoxin Wang¹, Rui Liu², Ping Li³, Chenghua Jiang⁴

ABSTRACT

Objective: With the success of DRGs (Diagnosis Related Groups) in developing countries, this prospective payment system has been imported into China from the early 21st century. However, DRGs has been struggling and has made little progress since (its adoption in) 2004. This study contributes to the debate on how to bridge the pay-for-service (system/scheme) and DRGs (Diagnosis Related Groups) during the transitional period of payment reform in China.

Methods: From 2008 to 2012, sixty regional general hospitals in Shanghai were divided into three groups according to their economic level, and one hospital was picked from each group randomly. After ranking of morbidity, 22130 patients with hypertension or coronary heart disease were chosen as sample. Using multiple linear regression analysis, the inter relationships between the total medical expenses of the inpatients, and age, gender of the inpatients, length of stay, region and economic level of the hospitals were examined.

Results: The main findings were (1) Age, LOS and the economic level of treatment location had a statistically significant impact on patients with hypertension or coronary heart disease. However, gender is only a significant factor to patients with coronary heart disease. The results suggested that age, LOS and the economic level of treatment location should be considered in formulating pricing standards for the hypertension patient group. Besides the above mentioned factors, gender should also be considered in formulating pricing standards for the coronary heart disease patient group. (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.

Conclusions: Simplification of the DRGs standard- setting process based on standardized clinical pathways and accurate costing will greatly increase the efficiency of implementing DRGs in the developing world.

KEY WORDS: Diagnosis Related Groups, Payment, Hospitals, China, Hypertension, Coronary Heart Disease.

doi: <http://dx.doi.org/10.12669/pjms.302.4452>

How to cite this:

Wang Z, Liu R, Li P, Jiang C. Exploring the transition to DRGs in Developing Countries: A case study in Shanghai, China. *Pak J Med Sci* 2014;30(2):250-255. doi: <http://dx.doi.org/10.12669/pjms.302.4452>

This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/3.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

1. Zhaoxin Wang
2. Rui Liu
Shanghai Tenth People's Hospital,
1-2: Tongji University School of Medicine, China.
3. Ping Li
Zhou Pu Hospital, Shanghai, China.
4. Chenghua Jiang
Tongji University School of Medicine, China.

Correspondence:

Chenghua Jiang,
Tongji University School of Medicine, 1239 SiPing Road,
Tongji University, Shanghai, 200092, China.
E-mail: supercell001@sina.com
supercell002@sina.com

- * Received for Publication: October 11, 2013
- * Revision Received: December 30, 2013
- * Revision Accepted: January 3, 2014

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,^{3,4} prospective payment system have gradually become the principal means of reimbursing hospitals in most developed countries, such as US, Germany and Australia.⁵ 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.^{6,7}

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.^{8,9} 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 2003.¹⁰ But the usefulness of DRG information for either management or funding arrangement is still under question due to the poor quality of hospital data.¹¹

In fact, DRGs is not a new term to China.¹² As early as the beginning of the century, some of China's relatively economically developed provinces have started the exploration of DRGs.^{13,14} 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.¹⁵ However, the DRG mentioned above is greatly different from the foreign DRGs:¹⁶ 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. The reason why China's reform attempt did not fully introduce foreign experience was because during 2004, objective conditions for the implementation of DRGs were not mature yet in the following three aspects even in China's most developed city, Shanghai: 1) hospitals had low information technology. Daily practice mostly relied on manual records with poor normality and comparability; 2) medical recording was not standardized, leading to limitation in the collection of patient related information and incomplete recording of paper materials; 3) the payment for services was deeply ingrained and many doctors feared that it may impact their revenue, thus there was resistance to reform.

China's new medical reform was launched in 2009, which had four important parts:¹⁷ public health, medical services, basic drugs and medical insurance. Payment innovations have become the most prospective direction for medical insurance

reform in these years.¹⁸ 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.¹⁹ 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.²⁰ Since DRGs cannot be achieved overnight in developing countries, a step by step realization approach is required.

In the context of limited resources, the reasonable grouping of cases is difficult to cover all diseases. Hence 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, 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.

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 selected 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. While the development on medical recording and other important foundation for the implementation of DRGs in the district general hospitals is uneven, in general the circulatory diseases clinical department has the fastest growth on the degree of standardization in clinical pathways and medical recording. Therefore, this study selected 40,019 circulatory system discharged cases as sample for analysis from 2008 to 2012. Among the types of

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

Characteristics	2008		2009		2010		2011		2012	
	N	Percent(%)	N	Percent(%)	N	Percent(%)	N	Percent(%)	N	Percent(%)
Total	4090	100	4961	100	4729	100	3770	100	4580	100
Age (year)										
under 50	240	6	181	4	201	4	130	3	90	2
51-60	533	13	371	7	432	9	280	7	32	7
61-70	487	12	799	16	566	12	480	13	638	14
71-80	1210	30	1710	35	1680	36	1324	35	1440	31
above 81	1621	40	1900	38	1850	39	1556	41	2110	46
Male	1609	39	2001	40	1880	40	1461	39	2120	46
Economic level of environment ^a										
low	1089	27	1691	34	1929	41	850	23	410	9
mid	1731	42	2402	48	1644	35	2110	56	1720	38
high	1270	31	868	18	1156	25	810	21	2450	53

^aLow, high or mid: Economic level of areas.

diseases, coronary heart disease and hypertension have the highest incidence rates, the number of cases being 16,235 (40.4%) and 5,895 (14.7%) respectively. As the proportion of the remaining cases occurred less than 10%. 22,130 discharged patient cases from 2008 to 2010 are finalized as the total sample for this study.

Because the sample did not contain identifiable private information, the Institutional Review Board at Tongji University did not consider this analysis to be human subjects research.

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

Data and Statistical Analysis: 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 five 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. All analysis were carried out using SPSS version 17.0. All *p* values less than 0.05 were considered significant.

RESULTS

Patient and Hospital Characteristics: The data for age and gender of the 22,130 hypertension or coronary heart 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 a yearly decrease in proportion of cases for patients age 50 below, and a trend of yearly increased for patients age 81 above, which was associated with improvements in the level of chronic disease prevention and health standards of Shanghai residents. To analyze whether the

Table-II: The total medical expenses of inpatients with hypertension or coronary heart disease from 2008 to 2012.

	2008	2009	2010	2011	2012						
	H ^a	CHD ^b	H	CHD	H	CHD	H	CHD	H	CHD	
Total charge											
N	1309	2781	1459	3502	1039	3690	815	2955	1272	3308	
Minimum	1313.58	205.70	290.40	213.93	808.02	581.87	1799.49	1304.05	1906.68	235.47	
Maximum	18566.57	26167.74	54648.05	31400.31	18494.49	39952.41	21850.68	24222.95	20193.28	32455.36	
Mean	5638.55	6075.16	6629.45	6929.52	6428.06	7544.60	7338.75	8445.70	8365.75	10011.70	
Std. Deviation	3035.07	3770.90	5383.92	4571.11	3622.30	4772.54	3866.42	4254.63	3637.19	4645.44	

Monetary unit of all charges is in Renminbi (RMB), ^aH: hypertension, ^bCHD: coronary heart disease.

Table-III: Independent samples test of hypertension and coronary heart disease.

		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	14.680	0.000	4.519	2211	0.000	980.93276	217.05445
	Equal variances not assumed			4.758	1158.099	0.000	980.93276	206.14649

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. (Table-I)

Hypertension and coronary heart 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 hypertension (H) and coronary heart disease (CHD) in five years. Although the maximum and minimum medical expenses for the two diseases fluctuated yearly, there was an upward trend. The mean expense for hypertension had increased from RMB 5,638.55 to RMB 8,365.75 in five years. 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-II & III)

For Table-IV and V, 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 coronary heart disease, overall the model had a high goodness of fit, with R Square= 0.615. Despite that the Unstandardized Coefficients of gender and regions with moderate economic level were not statistically significant, the impact of coronary heart disease patients' genders on medical expenses was statistically significant, with P value less than 0.05. The Unstandardized Coefficients of regions with moderate economic level alone was not statistically significant. For the medical expenses of patients with hypertension, age, gender, length of stay and economic level had a greater impact (with P value less than 0.05).

DISCUSSION

DRGs has become the global trend in medical payment reform. This prospective payment system is not the privilege of developed countries, many developing countries (like Iran) have begun to adopt DRGs. However, due to the level of medical standards and economic constraints, the direct translation of foreign experience is undesirable. It is particularly important for developing countries to handle the transition to DRGs from its current medical payment system. Analyze the factors that affect the medical expenses of specific diseases. Simplify the DRGs standard- setting process.

According to CISS, the DRGs standard setting process includes 1) definition of the objectives of the DRG system, 2) analysis of feasibility, 3) choosing the classification system for patients, 4) level of implementation, 5) integration of the components, 6) operation of the system, 7) consolidation in the long

Table-IV: The results of regression model of hypertension and impact factors.

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	-2025.437	611.807	-3.311	0.001	
age	43.004	8.398	0.136	5.121	0.000
LOS ^a	470.399	16.590	0.740	28.354	0.000
gender	104.047	224.574	0.012	0.463	0.643
high ^b	1563.142	286.359	0.162	5.459	0.000
mid	476.814	248.404	0.057	1.920	0.055

^aLOS: length of stay, ^bHigh or mid: Economic level of areas, R Square=0.615, Adjusted R Square=0.612

Table-V: The results of regression model of coronary heart disease and impact factors.

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	-2681.777	591.573		-4.533	0.000
age	47.183	7.481	0.108	6.307	0.000
OS	588.240	14.004	0.712	42.004	0.000
gender	-339.481	160.611	-0.036	-2.114	0.035
high	1350.681	208.863	0.135	6.467	0.000
mid	191.161	195.310	0.020	0.979	0.328

^aLOS: length of stay, ^bHigh or mid: Economic level of areas, R Square=0.546, Adjusted R Square=0.544

term. Although the implementation of DRGs is very standardized in developed countries, it is difficult for developing countries with limited resources to directly adopt the seven steps foreign experience when implementing DRGs. This is the reason why Shanghai's adoption of DRGs is not progressing in the past ten years since 2004. To implement DRGs successfully, developing countries such as China have to prioritize its steps. Starting with definition of the objectives of the DRG system, the most common diseases in each disease group should be first targeted so as to formulate pricing standards for each disease group and increase the feasibility of implementing DRGs.

For example, the research has first confirmed that hypertension and coronary heart diseases are the most common circulatory diseases in Shanghai. Then through the sample analysis, gender is found to be an unimportant factor for hypertension medical expense, but affects the medical expenses of coronary heart disease patients. Therefore, gender should be included in formulating payment standard for hypertension, but not for coronary heart disease. 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: In hypertension and coronary heart disease, which are the two highest incidence circulatory diseases, age and length of stay are common influencing factors for medical expenses, thus these two factors should be considered in disease grouping. In particular, length of stay was positively correlated with the expense of medical treatment, which brings hope to resolving the two current medical dilemmas in developing countries: high medical expenses and bed turnover inefficiency. These two dilemmas have caused the headache of expensive and difficult medical treatment in China. The good news is a

large number of studies have confirmed that DRGs can effectively improve bed turnover rate and reduce hospital bed days. 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 increase the efficiency of implementing DRGs in developing countries.

ACKNOWLEDGEMENTS

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

Source of funding: This work was supported by the Fundamental Research Funds for the Central Universities (2012KJ017), Research Funding from the Health bureau of Shanghai((20124y182&XYQ2013111), Shanghai Postdoctoral Scientific Program(13R21416600) and China Postdoctoral Science foundation (2013M531223).

Conflict of interest: We declare that we have no conflict of interest.

REFERENCES

- Street A, Kobel C, Renaud T, Thuilliez J. How well do Diagnosis Related Groups explain variation in costs and length of stay among patients and across hospitals? *Methods for analysing routine patient data.* *Health Economics.* 2012;21 (2): 6-18.
- Pongpirul K, Walker DG, Winch PJ, Robinson C. A qualitative study of DRG coding practice in hospitals under the Thai universal coverage scheme. *BMC Health Services Res.* 2011;11(1):71-82.
- DRG coding practice: A nationwide hospital survey in Thailand. *BMC Health Services Res.* 2011;11:290-299.
- Roeder N, Rochell B, Juhra C, Mueller M. Empirical comparison of DRG variants using cardiovascular surgery data: Initial results of a project at 18 German hospitals. *Aust Health Rev.* 2001;24(4):57-80.
- Busse R, Schreyögg J, Smith PC. Hospital case payment systems in Europe. *Health Care Management Science* 2006;9:211-213.
- Hindle D. Implementing DRGs in Slovenia: Why the Australian variant was selected. *Aust Health Rev.* 2003;26(3):50-60
- Grubinger T, Kobel C, Pfeiffer K. Regression tree construction by bootstrap: Model search for DRG-systems applied to Austrian health-data. *BMC Medical Informatics & Decision Making.* 2010;10(1):1-11.
- Mallick SM. A review of health services in west Pakistan. *Pak J Health.* 1957;7(2):43-46.
- Noronha MFd, Portela MC, Lebrão ML. Potential uses of AP-DRG to describe the health care profile in hospital units. *Cad Saude Publica.* 2004;20(Suppl 2):S242-S255.
- Ghaffari S, Jackson TJ, Doran CM, Wilson A, Aisbett C. Describing Iranian hospital activity using Australian refined DRGs: A case study of the Iranian social security organisation. *Health Policy.* 2008;87(1):63-71.
- Ghaffari S, Abolhallaj M, Ghafouri A. DRG, BSC and EBM: Time to work with one another. *BMC Health Services Res.* 2010;10:1-1.
- Liang X, Guo H, Jin C, Peng X, Zhang X, Baradaran HR. The effect of new cooperative medical scheme on health outcomes and alleviating catastrophic health expenditure in china: A systematic review. *PLoS ONE.* 2012;7(8):1-11.
- Gong Z, Duckett SJ, Legge DG, Pei L. Describing Chinese hospital activity with diagnosis related groups (DRGs). A case study in Chengdu. *Health Policy.* 2004;69(1):93-100.
- Interfax. Anhui to implement DRGs for rural insurance participants. *China Business Newswire.* 2011:1.
- Zhang J. The impact of a diagnosis-related group-based prospective payment experiment: The experience of Shanghai. *Applied Economics Letters.* 2010;17(18):1797-1803.
- Jian W, Lu M, Cui T, Hu M. Evaluating performance of local case-mix system by international comparison: A case study in Beijing, China. *Int J Health Plann Manage.* 2011;26(4):471-481.
- Jian W, Chan KY, Tang S, Reidpath DD. A case study of the counterpart technical support policy to improve rural health services in Beijing. *BMC Health Serv Res.* 2012;12:482-482.
- Wei JW, Heeley EL, Jan S. Variations and determinants of hospital costs for acute stroke in China. *PLoS ONE.* 2010;5(9):1-9.
- Jian W, Cui T, Wang H. Using diagnosis relative groups mortality risk classification to assess medical quality. *Beijing Da Xue Xue Bao.* 2007;39(2):145-148.
- Shi G, Wu T, Xu W. A survey on the attitudes of doctors towards health insurance payment in the medical consortium. *China Med J (Engl).* 2011;124(2):223-226.

Authors' Contributions:

ZXW and RL drafted the manuscript and conducted the study. CHJ conceived and planned the study. PL participated in introduction, results interpretation and discussion of this manuscript. All authors have read and approved the final manuscript.