COMPARISON OF MEDICAL COSTS AND CARE OF APPENDECTOMY PATIENTS BETWEEN FEE-FOR-SERVICE AND SET FEE FOR DIAGNOSIS-RELATED GROUP SYSTEMS IN 20 CHINESE HOSPITALS

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Abstract. The objective of this study was to compare the fee-for-service and set fee for diagnosis-related group systems with regard to quality of medical care and cost to appendectomy patients. We conducted a retrospective study of 208 inpatients (from 20 hospitals) who undergone appendectomy in Changsha, China during 2013. Data were obtained from databases of medical insurance information systems directly connected to the hospital information systems. We collected and compared patient ages, length of study, and total medical costs for impatient appendectomies between patients using fee-for-service and set fee for diagnosis-related group systems. One hundred thirty-three patients used the fee for service system and 75 used the set fee diagnosis related group system. For those using the diagnosis-related group system, the mean length of hospitalization (6.2 days) and mean number of prescribed antimicrobials (2.4) per patient were significantly lower than those of the patients who used the fee-for-service system (7.3 days and 3.0, respectively; $p = 0.018$; $p < 0.05$) and were accompanied by lower medical costs and cost of antimicrobials (RMB 2,518 versus RMB 4,484 and RMB476 versus RMB1,108, respectively; $p = 0.000$, $p = 0.000$). There were no significant differences in post-surgical complications between the two systems. The diagnosis-related group system had significantly medical costs for appendectomy compared to the fee-for-service system, without sacrificing quality of medical care.

Keywords: fee-for-service, diagnosis-related group, appendectomy, medical cost, Chinese patient

INTRODUCTION

Health expenditures have been steadily increasing worldwide (OECD, 2010). To reduce health-related costs and to improve the quality of medical care, a system called a diagnosis-related group (DRG) was developed at Yale University in 1980 (Fetter *et al,* 1980).With the DRG system, medical reimbursements are not related to the actual patient cost it is a set amount for a specific diagnosis. Since hospitals are able to choose the best therapeutic regimen, the average length of stay (LOS) in the hospital tends to be shorter and medical resources tend to be

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used more efficiently (Schuetz *et al*, 2011; Cheng *et al*, 2013), medical costs can be reduced. In contrast to the DRG system, the fee-for-service (FFS) system is associated with medical services delivered to the patient. This encourages hospitals to provide excessive medical services to patients for more profit; consequently, the FFS system can result in higher medical costs.

The DRG system was first used by the United States government for its social health insurance program (Medicare) in 1983 (May and Wasserman, 1984). Since then, other countries have incorporated DRG system into their health insurance systems and have achieved encouraging successes in reducing medical costs (Forgione *et al*, 2004; Moreno-Serra and Wagstaff, 2010). In Japan, the DRG system has gradually replaced the FFS system and the average LOS in hospitals has been shortened by 15 days from 1995 to 2010 (Ministry of Health, Labor and Welfare, 2010; Kondoa and Kawabuchi, 2013). In Italy, Sweden and Korea the introduction of the DRG system has also decreased medical costs and LOS (Gerdtham *et al*, 1999; Louis *et al*, 1999; Kwon, 2003; Kroneman and Nagy, 2010).

Medical insurance for urban workers (UEBMI) began in 2000 in Changsha City, China. Insured persons include employees of state-owned enterprises, collective enterprises, foreign-invested enterprises, private enterprises, government agencies, institutions and social organizations. The insurance premium is paid by the employer and the employee together. The number of insured persons was 1.7-1.8 million, comprising 35.9-37.2%% of the total population in Changsha City in 2013 (Statistics Bureau of Changsha, 2014). Insured persons use one of two medical insurance institutions. One medical insurance institution covers 80% of insured persons and the other covers 20% (Medical Insurance Bureau of Changsha City, 2013). The data for this study were derived from the second medical insurance institution comprising 20% of insured persons and included 313,900 insured persons in 2013 (Medical Insturance Bureau of Changsha City, 2013).

Reimbursements for medical care in Changsha City are primarily guided by the FFS system, although the use of the DRG system has been encouraged by the Medical Insurance Bureau of Changsha City since 2008. The DRG system in Changsha City contains 32 case groups. Patients who have similar diseases (*eg*, appendicitis) are treated in the same case group following the same treatment protocol. Reimbursement of the hospital for each admission is made according to a fixed rate.

Hospitals in China are divided into three levels: primary, secondary, and tertiary level hospitals. The primary level hospital provides preventive, rehabilitative, and medical care mainly for residents in the local community. Secondary level hospitals provide comprehensive medical services to residents from multiple communities and are also involved in teaching and medical research. Tertiary levels hospitals provide medical services for patients from large geographic areas or even nationwide; they play a major role in teaching, medical training and research. Charges for the same medical service (*eg*, appendectomy) are highest at tertiary levels hospitals, lower at secondary level hospitals and lowest at primary level hospitals, according to the policies of the Medical Insurance Bureau of Changsha City.

The 3-tier structure for medical care in China is different than western countries; therefore, the consequences of implementing the DRG system are not clear. The aims

of the present study were to compare the medical costs and quality of care for appendectomy between patients using the FFS and DRG systems in Changsha City, Hunan, China.

MATERIALS AND METHODS

Participating hospitals

A total of 20 hospitals carried out appendectomies in Changsha during 2013: two primary hospitals, twelve secondary hospitals and six tertiary hospitals. The FFS system was used in twelve hospitals and the DRG system was used in eight hospitals.

Patients

Two hundred eight patients aged 18 to 80 years were enrolled in the study conducted from January to December, 2013. This study was an observational retrospective study. All patients had been given a diagnosis of acute uncomplicated appendicitis (ICD10 classifications K35.1-K35.9) with no complications during hospitalization. They had appendectomy (ICD9CM, 3:47. 09) using a standard laparotomy. Of the 208 patients, 133 were in the FFS system and 75 were in the DRG system. The study was approved by Medical Ethics Committee, Hunan University for Traditional Chinese Medicine. All participants provided written informed consent for the surgery.

Assessment of medical care systems

Data were extracted from databases of a medical insurance system, administered by the Medical Insurance Bureau of Changsha City, which directly connects with those hospital information systems. Hospitalization LOS from admission to discharge and post-surgical complications were used to evaluate quality of medical care provided by the two insurence systems. Post-surgical complications included wound infections, abdominal abscesses, and intestinal adhesions. Information about the number and cost of antimicrobials used during hospitalization was also collected for both insurance systems.

Statistical analyses

Data were entered into SPSS, version 19.0 (IBM, Armonk, NY) and subsequently subjected to statistical analysis. Comparisons of the patient ages, LOS, total medical costs for appendectomy, medical costs per day, and costs of antimicrobials for both the FFS and DRG systems were performed with a Student's *t*-test. The Pearson's chi-square test was used to compare patient gender, distribution among the different tiers of hospitals, and numbers of antimicrobials used between the two systems. A p-value < 0.05 was considered statistically significant.

RESULTS

Patient's demographics

Of the 208 patients, 133 (72 men, 61 women) were enrolled in the FFS system and 75 (45 men, 30 women) in the DRG system (Table 1). The mean patient age and gender distribution for those using the FFS were 37.9 ± 13.1 years and 54% men and for those using the DRG were 40.0 ± 10.4 years and 60% men, respectively. These differences were not significant ($p = 0.225$ and $p = 0.413$, respectively).

The proportions of patients using the different levels of hospitals were significantly different between the FFS and DRG systems ($p = 0.000$) (Table 1); more patients using the DRG system (27) than the FFS system (18) used primary level hospitals and more patients using the FFS system (85) than the DRG system (21) used

Table 1
Patient demographics and hospital tier levels.

		Total (*N*=208)	FFS (*n*=133)	DRG (*n*=75)	*p*-value
Age in years		38.7 ± 12.2	37.9 ± 13.1	40.0 ± 10.4	0.225
Number of patients (%)	Men	117 (56.3)	72	45	0.468
	Women	91 (43.7)	61	30	
Number of hospitals	First	45	18	27	0.000
	Secondary	57	30	27	
	Tertiary	106	85	21	

Table 2
Comparisons of quality of medical care between the FFS system and the DRG system.

	All (*N*=208)	FFS (*n*=133)	DRG (*n*=75)
Average length of stay in days	6.9 ± 2.0	7.3 ± 1.8	6.2 ± 2.17[a]

FFS, fee for service; DRG, diagnosis related group. [a]$p<0.05$.

Table 3
Comparisons of medical cost between the FFS system and the DRG system.

		Total (*N*=208)	FFS (*n*=133)	DRG (*n*=75)	*p*-value
Medical costs in RMB	Total	3,827	4,484	2,518	0.000
	Per day	593	660	404	0.000
Mean number of antimicrobials		2.81 ± 1.19	3.04 ± 1.14	2.41 ± 1.19	0.001
Mean antimicrobial cost in RMB		830	1,108	476	0.000

RMB, renminbi (official currency of PR China).

tertiary level hospitals.

Quality of medical care

Patients using the FFS system stayed significantly longer in the hospital (7.3 ± 1.8 days; 95% CI: 6.9-7.6 days) than those using the DRG system (6.2 ± 2.17 days; 95% CI: 5.78-6.7 days; $p = 0.018$) (Table 2). After adjusting for patient age, there was still a significant difference in the LOSs between patients using the two systems. None of the patients in either system experienced post-surgical complications.

Medical costs related to appendicitis

The median total cost for managing a case of appendicitis with the FFS system (RMB 4,484) was significantly greater than with the DRG system (RMB 2,518; $p = 0.000$) (Table 3). The median medical cost per day for patients using the FFS system was RMB 660. This was 1.6 times higher

than for patients using the DRG system (RMB 404; $p = 0.00$) (Table 3).

All the patients were prescribed antimicrobials before and after appendectomy. The mean number of antimicrobials prescribed for patients using the FFS system (3.04 ± 1.14) was greater than for patients using the DRG system (2.41 ± 1.19; $p = 0.001$) (Table 3). The median cost for antimicrobials for patients using the FFS system (RMB 1,108) was 2.33 times higher than that for patients using the DRG system (RMB 476; $p = 0.000$) (Table 3).

DISCUSSION

As far as we know, this is the the first study in China comparing medical cost and quality of care between the DRG system and the FFS system. Patients with uncomplicated appendicitis were chosen due to the consistency of treatment (*ie*, appendectomy). The mean LOS of patients using the DRG system was significantly shorter than those using the FFS system. Our findings are consistent with those from many other countries regarding the DRG system, for patients with different diseases (Kwon, 2003; Theurl and Winner, 2007; Hensen *et al*, 2008; Kroneman and Nagy, 2010; Zhang, 2010). Schuetz *et al* (2011) found the LOS for patients using the DRG system was significantly shorter than those using the FFS system for patients being treated for community-acquired pneumonia in Switzerland. Women with breast cancer who used the DR system in Japan had a shorter LOS in the hospital than those who used the FFS system under the DRG system (Kuwabaha and Fushimi, 2009). These results support the economic theory of provider behavior (Cutler, 1995), in which DRG system health care providers tend to make greater profits with lower cost. When the marginal revenue is zero, health care providers tend to use fewer resources.

Antimicrobial-related costs for our study patients using the FFS system were 2.33 times higher than for patients using the DRG system, although the quality of medical care was comparable. These results suggest the type of health care system can affect drug-related costs during hospitalization. Antimicrobials should be prescribed for patients on an individual basis, according to the patient's health situation, bacterial culture, and drug sensitivity testing not according to the factors linked to the medical care system. Reform of the payment system has been effective in reducing antimicrobial use in hospitals in Changsha City, China. Implementing the DRG system is an important means of regulating the behavior of healthcare providers. The DRG system overcomes some disadvantages of the FFS system, specifically reducing excessive medical services, standardizing physician medical behavior, protecting the safety of the medical insurance fund and reducing patient's financial burden (Wang *et al*, 2006).

Use of the DRG system has been recommended for hospitals of Changsha City. We found more primary hospitals have adopted the DRG system for patients with uncomplicated acute appendicitis than secondary or tertiary hospitals. One reason for this is that primary hospitals are allowed to charge the same amount as secondary and tertiary hospitals for appendectomy. Primary hospitals receive a greater profits by adopting the DRG system than the FFS system. Secondary and tertiary hospitals were more likely to use the FFS system because they were allowed to charge more money if they used the DRG system. Insurance companies should work with the government to resolve this dilemma.

Our study has some limitations. We only included patients with basic medical insurance for urban workers. We did not take into account other social medical insurance programs in China, such as basic medical insurance for urban residents and the new cooperative medical care in rural areas, covering the majority of China's population. Therefore, further investigations including other medical insurance systems are needed.

In summary, we found patients hospitalized for appendectomy who used the DRG system had shorter hospitalizations, lower medical costs, and similar quality of medical care compared with patients who used the FFS system among hospitals in Changsha City, China. These findings suggest the DRG system is a good model to consider for expansion nationwide as a part of health care reform.

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