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# Addressing government and market failures with payment incentives: Hospital reimbursement reform in Hainan, China

Winnie Yip<sup>a,\*</sup>, Karen Eggleston<sup>b</sup>

<sup>a</sup> *Health Care Financing, Harvard School of Public Health, University Place, Suite 410, South, 124 Mt. Auburn St., Cambridge, MA 02138; USA*

<sup>b</sup> *Department of Economics, Tufts University, Medford, MA 02155, USA*

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## Abstract

This paper examines the role of provider payment policy as an instrument for addressing government and market failures and controlling costs in the health sector, particularly in developing countries. We empirically evaluate the impact of provider payment reform in Hainan province, China, on expenditures for different categories of services that had been subject to distorted prices under fee-for-service. Using a pre-post study design with a control group, we analyze two years of claims data to assess the impact of a January 1997 change to prospective payment for a sub-sample of the hospitals. This difference-in-difference empirical strategy allows us to isolate the supply-side payment reform effects from demand-side policy interventions. We find that prepayment is associated with a slower increase in spending on expensive drugs and high technology services, compared to fee-for-service. The fact that payment reform is associated with reduced growth in spending on the most expensive drugs is particularly encouraging, given that drugs account for a remarkably high percentage of both the level and growth of aggregate health expenditure in China. Payment reform can be an effective policy instrument for correcting market failures and adverse side effects of government health sector interventions (such as distorted prices to assure access to basic services), both of which can lead to excessive health care expenditure growth. Such health spending growth can have a particularly high opportunity cost for developing countries.

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*Keywords:* Prospective payment; Hospital reimbursement; Price distortions; Pre-post control study design; Urban health reform; China

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## Introduction

Throughout the world policymakers are searching for ways to improve the efficiency and financial sustainability of health care systems. Prominent among the proposed strategies is the introduction of stronger market forces to the health sector. Yet policy experience and empirical research in the industrialized countries have well established that there are important market failures in health care financing and provision, including adverse risk selection, moral hazard, and supply-side

market power. In light of these potent market failures, governments are frequently called upon to intervene. In the area of financing, for example, experience has shown that if a health care system is to achieve universal coverage, government must help organize social risk pooling.

Government intervention, however, is far from a panacea. Systems that rely on government facilities for health care provision, for example, are often plagued with inefficiencies from bureaucratic and monopolistic public management. In light of both market and government failures, there has been a trend towards “regulated competition” that attempts to harness competitive forces for efficiency and innovation while relying upon government-specified rules of the game to

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\*Corresponding author. Tel.: (617)-496-8840; fax: (617)-496-8833.

E-mail address: wyip@hsph.harvard.edu (W. Yip).

uphold social solidarity and correct market failures. Reforms in this spirit include organizational reforms such as hospital autonomy, corporatization, and separation of the roles of purchaser and provider, as undertaken for example in Britain's National Health Service. Others include selective contracting and payment reforms, such as the widely emulated Prospective Payment System in the US. Whereas there is emerging evidence on the effectiveness of these different policies for addressing market and government failures in advanced economies, empirical evidence is very limited for developing countries. Often, these reforms require sophisticated managerial, financial, and institutional support, such as advanced information systems and administrators who understand economic incentives. It therefore remains unclear to what extent the experience of advanced economies can directly translate into sound policy advice for developing countries.

A particular challenge for most developing and transitional countries is the institutional transformation from a system originally based on heavily subsidized public providers. Although such a national health service offers implicit insurance and therefore widespread access to care, many transitional and developing countries seek to replace this system with formal social insurance schemes and separation of purchaser and provider, at least for the urban population. Governmental budget pressures can further spur reform that decreases providers' reliance on subsidies and expands cost recovery through user charges. To prevent patient charges from compromising access to necessary services during this transition, pricing and payment policies can be important government policy instruments.

Distinctive as a developing transitional economy, China is an important case to study. Chinese pricing of health services has sought to guarantee universal access to basic services by pricing such services at or below average cost. Adverse side effects of this policy came to the fore during the economic reform era. Public health care providers such as hospitals, once heavily subsidized, came under financial pressure as shrinking government budgets led to dramatic cuts in subsidies. To compensate providers, they were allowed to charge payers (e.g., employers or patients themselves) more than average cost for other services, such as high technology diagnostic procedures and many prescription drugs. This pricing scheme is potentially a second-best government intervention, trading off pricing efficiency for equitable access. Unfortunately, the distorted incentives implicit in this price system can lead to large adverse side effects when combined with supply-side market power in health care. As could be predicted, Chinese hospitals began to view high technology medicine and prescription drugs as their financial salvation, and exerted pressure through physicians to increase demand for these services. These forces are

suspected to be at the root of much of China's rapid health expenditure cost escalation.

Although one logical solution to the cost inflation dilemma is to rationalize prices and assure universal access instead through formal social insurance, current financing reform in urban China will only cover 50 percent of the urban population when fully implemented. If prices are adjusted to reflect the full cost for basic services, access could become a problem for the uninsured population and could potentially lead to social unrest as well as affecting the health of the population. Therefore, as long as China's urban social insurance system does not cover the entire (urban) population, it is inevitable that FFS will remain a dominant form of payment for the uninsured, and maintaining the implicit cross-subsidization of basic care through distorted prices may represent the best feasible solution. Unfortunately, this policy leaves in place incentives for cost escalation.

In this setting, payment policy for the insured may be a useful instrument for Chinese policymakers to pursue cost control. In particular, replacing fee-for-service (FFS) payment according to the distorted pricing system with aggregated pre-payment for patients covered by social insurance can mitigate the incentive for cost escalation. Payment reforms should be carefully monitored and evaluated, however, to determine whether providers genuinely reduce cost growth or instead shift costs to patients not covered by pre-payment, which could exacerbate access problems for the uninsured.

The primary objective of this paper is to assess empirically the impact of payment reform on services originally subject to different pricing distortions, using the experience of Haikou City in Hainan Province in China. Although Hainan is a small province, Haikou is one of a handful of Chinese cities that has several years' experience with city-wide risk pooling and payment reform. Unlike other cities, which introduced insurance and payment reforms simultaneously, Haikou introduced insurance reforms in mid-1995, whereas payment reform began in January 1997. Thus, during the first year and a half of Hainan's insurance reforms, all hospitals were reimbursed on a FFS basis. This temporal separation of insurance and payment reforms allows us to isolate their effects on health expenditures. A second critical strength of the Hainan case is the ability to decompose inpatient expenditures into components that were subject to contrasting pricing incentives under FFS. In particular, we have patient-level data on spending for expensive drugs and high technology diagnostic and medical procedures, which were very profitable under FFS, and standard bed charges, which were not. By contrasting the impact of prepayment on expenditures in these different categories, we can gain an understanding of how effective payment policy might be in addressing the adverse side

effects of government pricing distortions. Furthermore, since only a selected subset of Hainan hospitals became pre-paid in January 1997, there is a ‘control group’ consisting of those hospitals of comparable size and structure that remained under FFS reimbursement. We employ a pre-post study design with control group—a difference-in-difference empirical strategy—to identify the effects of supply-side payment reform on different sub-categories of expenditures.

Consistent with theory and empirical findings in advanced economies, we find that prepayment is associated with a slower rate of growth of expenditures on services that were profitable under FFS, especially spending on expensive drugs and high technology procedures. In contrast, expenditures on standard bed charges, not subject to the same pricing distortions, were basically unaffected by the payment reform.

The effectiveness of payment reform in moderating drug spending is especially of note, since drugs are the most rapidly growing component of total health care expenditure in China. Unfortunately the data do not allow us to analyze overall efficiency and welfare effects (since we lack data on outpatient expenditures and spending of the uninsured). Results should therefore be interpreted with caution. Nonetheless, the results are encouraging and should be quite policy relevant as Chinese reforms expand into new localities throughout the nation.

The paper is organized as follows. The next section provides background on China’s urban health care system and the causes leading to reform, the experiences of health insurance and provider payment reforms in various reform sites, and Hainan’s reforms in particular. The following section describes the natural experiment, the data, and our empirical methodology. The penultimate section presents results. The Conclusion section discusses policy implications and limitations.

## **China’s urban health system and payment reforms**

### *China’s urban health system reforms*

Established in the 1950s, China’s health protection system for urban residents consists of an extensive subsidized public delivery system—implicit coverage—and two explicit health insurance programs, the Government Insurance Scheme (GIS) and Labor Insurance Scheme (LIS) that together currently cover half the urban population. Financed by government budgets through general revenues, GIS covers government employees, retirees, disabled veterans, university teachers, students and their dependents. LIS covers employees, retirees and their dependents in state enterprises. State enterprise insurance is financed by an 11–14 percent payroll tax. Each enterprise annually sets

aside that percentage of the total wage bill as a welfare fund to cover health expenditures, keeping the funds in their own enterprise account. Thus, although nominally national insurance programs, risk pooling under both GIS and LIS is limited to the individual work unit (e.g., government agency or state-owned enterprise), albeit with GIS recourse to some risk pooling through general revenue financing and both potentially offset by soft budget constraints. Beneficiaries seek medical services from providers at their work unit or in public facilities and enjoy relatively comprehensive coverage with little demand-side cost sharing (except for dependents).

Urban health care providers have traditionally been paid on a fee-for-service (FFS) basis. That is, either patients pay for each service, or the formal payer—GIS or LIS unit—reimburses the hospital and clinic, both based on a governmentally defined fee schedule.<sup>1</sup> Prices (for both insured and uninsured patients) have been set below cost to allow the average uninsured or poor Chinese to access basic health services. This pricing system aimed to guarantee implicit universal coverage for basic care. The revenue shortfall was subsidized by government budgets, which made up more than 60 percent of total hospital operating revenue in the pre-economic reform era. Under such a system, general revenue financed wide access to care, through subsidized public providers rather than through formal insurance.

After urban economic reforms began in the 1980s, however, reduced government fiscal capacity rendered this system of subsidization untenable. To compensate hospitals and other providers for greatly reduced state budgets, they were allowed to recover revenue through charges for prescription drugs and high technology tests, two areas where the allowed fees exceed average cost. However, prices for other, basic services remain below cost. The resulting price structure has led to predictable distortions as behavior became more guided by price signals under market reforms.

One service for which prices are particularly distorted is that of prescription drugs. The Price Administration has allowed markups of 15 percent at both the wholesale and retail levels, giving hospitals incentives to over-prescribe high profit-margin drugs. Providers profit from such objectionable practices as treating almost all outpatients with intravenous solutions of glucose, vitamins, antibiotics and other drugs even if not medically indicated. Given this incentive structure, it is not surprising that pharmaceuticals accounted for a remarkably high share of hospitals’ revenue—60–75 percent—and a large portion of aggregate health spending in China—52 percent in 1998. This under-

<sup>1</sup>Individual physicians are often salaried employees with bonuses tied to the profitability of the hospital or clinic.

scores the policy importance of payment reforms that reduce overuse of expensive prescription drugs.

A second important category of profitable services under China's FFS pricing scheme was high technology procedures. Based on a national sample of hospitals, a recent study showed that the allowed price for hospital beds only represents 10 percent of the cost. In contrast, the allowed prices for CT and ECT represent 150–300 percent of the cost (Bin et al., 1998).

FFS payment under this distorted price structure, combined with little demand-side constraint on utilization, has contributed to a serious problem of double-digit health cost inflation in China. LIS (GIS) spending experienced annual real growth of 11 (14) percent between 1978 and 1986, accelerating to 13 (16) percent between 1986 and 1993 (Yip and Hsaio 1997; World Bank 1997). At the same time, the rapid growth in medical costs made it unaffordable for deficit-ridden SOEs to reimburse their employees' medical bills, leaving them uninsured in practice. It was largely this experience of medical care inflation outstripping real GDP growth that prompted experimentation with risk pooling and cost containment strategies.

To address these problems, China's national policy calls for urban health reforms to set up individual medical savings accounts, along with a social insurance fund for catastrophic expenses, usually at the municipal level. These financing reforms combine two elements: an emphasis on individual responsibility and market forces, embodied in individual accounts; and a concern for equity and financial protection that markets cannot achieve, embodied in mandatory social insurance for catastrophic expenses. Local authorities have considerable discretion regarding other aspects of reform, such as payment policy. Most urban providers remain public.

Official pilot reforms began in 1994 in two medium-sized cities along the Yangzi River, Zhenjiang and Jiujiang. In addition to city-wide pooling of GIS and LIS, these cities also introduced a fixed payment system for inpatient and outpatient episodes of care (Yip and Hsiao, 1997). Shanghai instituted global budgets for hospitals in 1994 together with other insurance reforms (Guo and Ge, 1998). These policies have reduced health care expenditure growth in Shanghai from 34 percent prior to 1993 to the 12–13 percent growth range currently, without evidence of reduced access or quality of care.<sup>2</sup>

### *Hainan's reforms*

Hainan province began similar health care financing reforms in 1995, combining individual medical savings

accounts (MSAs) with a social insurance fund (SIF), but with several distinctive features. Most prominently, the Hainan government decided to define catastrophic illness not by expenditure level but by patient diagnosis. If a beneficiary's diagnosis falls within the 184 categories on the List of Covered Diseases (*Bingzhong Mulu*), expenditures that exceed the deductible are paid from the SIF, with patient co-insurance. Individual medical savings accounts were to cover outpatient expenditures and co-insurance, without a requirement (as in Zhenjiang and Jiujiang) that the MSA be depleted prior to accessing the SIF (Hainan Social Insurance Bureau, 1997a). In 1997, the new health insurance system covered 123,479 individuals (101,556 employees and 21,923 retirees) associated with 2,232 work units, representing over 70% of the eligible population in Haikou (Hainan Social Insurance Bureau, 1997b).

### *Provider payment reform: a natural experiment*

A change in January 1997 in the way hospitals in the capital of Hainan province were paid offers a "natural experiment" for analyzing the impact of introducing prospective hospital payment on use of services previously subject to different incentives. Similar to the Prospective Payment System (PPS) introduced in the US, the Hainan payment reform aimed to induce hospitals to practice more cost effectively. One aspect of more effective practice would be reduction in over-use of services that had high profit-margins under FFS.

All Hainan hospitals were originally reimbursed on a FFS basis, with claims auditing by the SIF. In January 1997, this system was changed to prospective payment for six hospitals, chosen because together they represented close to 83 percent of the SIFs total expenditures and 75 percent of patient admissions under the insurance scheme (Hainan Social Insurance Bureau, 1998). Hainan's prepayment scheme is similar to a monthly global budget. The SIF administrators first calculate how much they reimbursed each hospital for a given month the previous year. Then they pre-pay the hospital 90 percent of that amount, promising to reimburse the remaining ten percent if the hospital demonstrates an acceptable level of quality at the end-of-year quality review. The Social Insurance Bureau adjusts overall payments to hospitals *ex post* to compensate for reasonable yet unexpected cost factors, such as an unanticipated increase in volume of patients.

Pre-paid hospitals face a somewhat complicated set of cost reduction incentives. To prevent excessive cost reductions, in addition to the quality assurance review, the Social Insurance Bureau stipulates that a hospital can retain budget savings only if (a) the number of patients treated is at least 90% of that of the previous year; and (b) total spending is at least 90% of the budget. Moreover, hospitals must share the costs of budget overruns. Specifically, hospitals pay 30% of the

<sup>2</sup>Data from authors' interviews at Shanghai Medical University and with representatives of the Shanghai Social Insurance Bureau, June 1998.

cost overrun if expenditures exceed the prospective budget by no more than 10%; 50% for cost overruns up to 20%; and 100% thereafter.

Such a prepayment system embodies multiple, but somewhat conflicting incentives. On one hand, it introduces “supply-side cost sharing” (Ellis and McGuire, 1993): the payer does not reimburse the provider for a certain proportion of charges. This shifts the risk of bearing financial responsibility partially from the SIF to the providers, giving them incentives to be cost-conscious in service provision. The higher the level of supply-side cost sharing, the greater the hospital’s incentive to reduce costs in order to increase net revenue.

Under FFS or cost reimbursement, there is no benefit to the hospital from cost reduction and therefore no incentive for efficiency. In fact, under FFS payment there is incentive to *increase* spending, especially for those services with the highest profit margins. Under China’s price structure, those services were most prescription drugs and high technology procedures.

In contrast, under purely prospective payment, the incentive to reduce costs is largest. Thus, payment reform that replaces FFS with prospective payment is predicted to increase a hospital’s incentive to control costs. Moreover, the incentive change is largest for those services that were most profitable under FFS and were therefore probably over-supplied. We seek to test empirically for this differential impact of the payment reform, as described below.

However, as mentioned previously, hospitals under Hainan’s payment scheme face a ceiling on residual savings (a maximum of 10 percent). This limits their incentive to reduce costs. Moreover, since hospitals’ prospective budgets for one month are based on reported costs for the same month the previous year, hospitals’ incentives to control costs are reduced through the well-known “ratchet effect” (Weitzman, 1980; Milgrom and Roberts, 1992). Cost reduction in one year “ratchets down” the budget and net revenue the next year. The more forward-looking hospital managers are, the more they will realize that aggressive cost reduction will reduce later payments. This reduced incentive for aggressive cost reduction is potentially appropriate, since it also limits providers’ financial reward for inefficient forms of cost cutting. For example, pre-paid hospitals might want to refer expensive-to-treat patients to other providers. Or they might shift costs from the insured, pre-paid patients to the uninsured, self-pay patients (albeit limited by those patients’ ability to pay). Whether or not reform hospitals will exert effective cost-control effort to reduce use of formerly profitable services, and whether this reduction is welfare enhancing or not, is ultimately an empirical question.

## Empirical analysis

### Data

Our analysis of the impact of payment reform is based on inpatient claims data for insured patients treated at 14 hospitals as reported to the Hainan Social Insurance Bureau 1997a, b, 1998. The study period spans the two years from mid-1995 to mid-1997 (i.e., including half a year of claims after the payment system reforms began in January 1997).

Although the original data set included over five thousand inpatient admissions, elimination of observations with incomplete or incorrectly coded records, Hadi multivariate expenditure outliers ( $p=0.05$ ), hospitals with exceptionally low volume of insured patients admissions, resulted in a final sample of 4213 inpatient admissions. The definitions, means and standard deviations of variables are listed in Table 1.

We focus on expenditures (based on claims, not actual costs) in three specific categories. The first is “expensive drugs” (*guizhong yaopin*), a list of prescription drugs compiled by the Hainan Social Insurance Bureau to include medications that are significantly more expensive than average (Hainan Social Insurance Bureau, 1997a, b). Of the total observations, 28 percent include positive expenditures on expensive drugs. The average expenditure in this category, conditional on positive expenditure, is 2,361 RMB yuan, representing on average 25 percent of total hospital expenditures for these patients.

A second category of expenditures is “high technology procedures”, including such items as dialysis, ultrasound, pacemaker insertion, electroconvulsive therapy (ECT), organ transplants, computed tomography (CT), and magnetic resonance imaging (MRI). Over 47 percent of patients incurred expenditures for high technology procedures. These patients on average spent 1,380 RMB yuan in this category, representing 21 percent of their total expenditure. We contrast the impact of payment reform for expensive drugs and high technology procedures with that of standard inpatient bed charges (average spending of 491 RMB yuan).

Unfortunately, there is no data available for uninsured patients or for outpatient spending for any patients. There also is no data on severity of illness within diagnostic group or referrals among facilities, which would be useful for detecting avoidance of high-cost cases. We likewise lack quality of care or outcomes data. These data limitations preclude analysis of the overall welfare impact of the payment change. We are unable to establish to what extent providers’ inpatient cost reductions may have arisen from cost shifting to uninsured inpatients or substituting to outpatient care. However, since the insurer pays for all catastrophic care (even if in rare cases such treatment does not require

Table 1  
Variables: Definitions, means and standard deviations ( $N=4213$ )

Variable name	Definition	Mean	Standard deviation
Anydrug	Dummy variable = 1 if patient has positive expenditures on expensive drugs	0.28	0.45
Expdrug	Expenditures on expensive drugs (RMB)	649.46	2201.18
Anyhitek	Dummy variable = 1 if patient has positive expenditures on high technology procedures	0.48	0.50
Hitech	Expenditures on high technology procedures (RMB)	657.02	2208.69
BedChg	Standard hospital bed charges (RMB)	490.63	577.64
Reform	Dummy variable = 1 if hospitalized in a reform hospital (in any year)	0.91	0.28
Policy	Dummy variable = 1 if hospitalized in 1997	0.23	0.42
Reform* Policy	Dummy variable = 1 if hospitalized in 1997 in a reform hospital	0.20	0.40
Age	Patient age in years	51.25	14.12
Age <sup>2</sup>	Patient age in years squared	2826.30	1428.04
Retired	Dummy variable = 1 if patient is retired	0.38	0.48
Male	Dummy variable = 1 if male, 0 if female	0.68	0.47
Infect	Dummy variable = 1 if patient diagnosed with an infectious disease	0.07	0.25
Tumor	Dummy variable = 1 if patient diagnosed with a tumor	0.16	0.37
Circu	Dummy variable = 1 if patient diagnosed with a circulatory system condition	0.22	0.42
Resp	Dummy variable = 1 if patient diagnosed with a respiratory system condition	0.10	0.30
Digest	Dummy variable = 1 if patient diagnosed with a digestive system condition	0.14	0.35
Urolrep	Dummy variable = 1 if patient diagnosed with urology and/or reproductive system condition(s)	0.10	0.30

hospitalization), we can pinpoint the effects of prepayment on program spending in various categories of expenditures. Whether expenditure reductions were achieved at the expense of quality of care cannot be determined from our data.

In light of these factors, results should be interpreted with caution. Policymakers may nevertheless be interested in rigorous analysis of the available data, ideally to be supplemented by more detailed and long-term evaluation of the overall social impact of payment reform when more data become available.

#### Empirical specification

Our analysis is based on the following empirical specification:

$$\ln(\text{expen}_i) = \beta_0 + \beta_1 \text{Reform}_i + \beta_2 \text{Policy}_i + \beta_3 \text{Reform}_i * \text{Policy}_i + \beta_4 \text{Age}_i + \beta_5 (\text{Age}_i)^2 + \beta_6 \text{Retired}_i + \beta_7 \text{Male}_i + \beta_8 [\text{Diagnosis}_i] + \beta_9 [\text{Year}_i] + \beta_{10} [\text{Month}_i] + \varepsilon$$

The dependent variable is one of the three specific categories of expenditures, analyzed in natural log form. The specification of explanatory variables operationalizes a difference-in-difference (DD) methodology, or a pre-post design with control group. This methodology allows isolation of supply-side payment effects from area-wide trends such as demand-side factors that affected all the hospitals studied. *Reform* is a dummy variable equal to 1 if the patient is treated in a reform

hospital. *Policy* is a dummy variable equal to 1 if the date of hospitalization is after January 1997, when prospective payment was implemented for the reform hospitals.  $\beta_1$  therefore captures differences between “treatment” and “control” hospitals that are constant over time, such as case mix differences.  $\beta_2$  captures differences in expenditure over time that are the same for both the “treatment” and “control” hospitals. These include, for example, the insurance reform, provincial economic factors and medical-specific cost inflation. The difference-in-difference estimate of the impact of payment reform is captured by the coefficient  $\beta_3$  on the interaction term *Reform\*Policy*. This DD variable is equal to 1 if the year is 1997 and the hospital is prospectively paid. It measures differences in expenditure before and after the payment reform for the reform hospitals, compared to the FFS hospitals. We include controls for year and month effects and patient characteristics (age, gender, retiree status—see Table 1). *Diagnosis* is a vector of dummy variables denoting broad diagnosis categories.<sup>3</sup>

To analyze the impact of prepayment on difference sub-categories of inpatient expenditure, we use a two-part model (Newhouse et al., 1993) along with the difference-in-difference identification strategy. Applied to expensive drugs, this model separately examines the

<sup>3</sup> For further discussion of the difference-in-difference methodology and a diagrammatic representation of how it isolates the treatment effect from trends, see our companion paper (Yip & Eggleston, 2000).

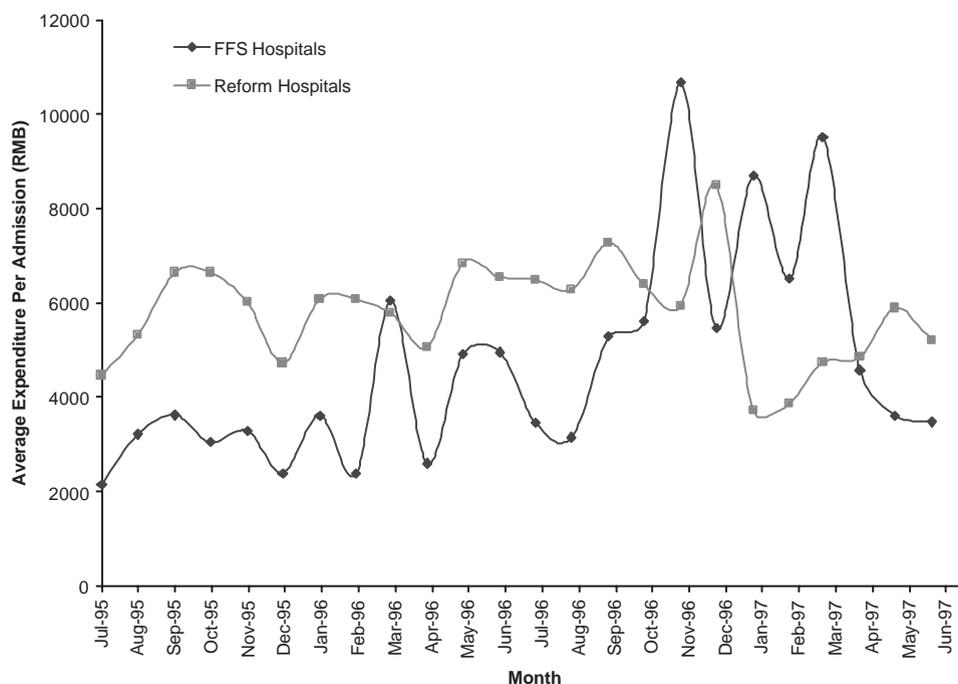


Fig. 1. Average expenditure per admission in reform and FFS hospitals, by month, July 1995 to June 1997.

probability of expensive-drug use (a probit analysis) and the level of expenditure conditional on positive use of expensive drugs (OLS regression on log-normal drug expenditures). We analyzed the impact of prepayment on expenditures in the other two categories with the same empirical specification.

## Results

Average expenditures per admission in the FFS and reform hospitals (Fig. 1) seem to follow a similar rising trend in the pre-reform period, with a trend break for the reform hospitals coinciding with the payment reform in January 1997.<sup>4</sup> We focus on sub-components of expenditures that were subject to price distortions under FFS, first by comparing the average expenditure on the three categories of services in reform and FFS hospitals before and after the 1997 payment reform (Table 2).

Patients treated in reform hospitals were more likely than their FFS counterparts to receive some expensive drugs (29 vs. 10 percent); but the growth in incidence of positive expensive drug spending was smaller for the reform than the FFS hospitals (2 percent compared to 5

percent). The difference-in-difference (DD) estimate of the impact of reform on expensive drug use therefore reveals a small relative decline in the frequency of cases with positive spending on expensive drugs. In addition, prior to payment reform, patients who received expensive drugs spent on average more (2,571 RMB yuan) in the reform hospitals than in FFS hospitals (2,078 RMB yuan), but this was reversed after payment reform (1,717 vs. 2,335 RMB yuan). Since reform hospitals in essence prevented the expenditure growth that FFS hospitals experienced and in addition achieved a 854 RMB yuan reduction, the DD estimate of the impact of prepayment on conditional expensive drug spending is 1,111 RMB yuan, or a 43 percent reduction, although in the absence of controls this effect is not statistically significant.

For reform hospitals, cases receiving high technology procedures fell by nine percent after reform, whereas FFS hospitals showed a slight increase. This suggests that prepayment was associated with a ten percentage point or an almost twenty percent overall reduction in the number of cases receiving high tech procedures. The impact of payment reform on the level of such expenditure, conditional on positive spending, is even more significant. Patients receiving high tech procedures in reform hospitals spent 97 RMB yuan less on average than prior to reform, whereas FFS patients paid on average 1,585 RMB yuan more for high tech procedures. These numbers suggest an almost 130 percent relative reduction in (conditional) expenditure on high tech procedures associated with prospective payment.

<sup>4</sup>Focusing on overall expenditures per admission, Yip and Eggleston (2000) found a significant decrease in expenditure growth for inpatient treatment in pre-paid hospitals, relative to similar hospital that continued to be reimbursed on a FFS basis.

Table 2  
Average Expenditure on Selected Categories of Services in Reform and FFS Hospitals, Before and After January 1997 Payment Reform

	Reform Hospitals			FFS Hospitals			Diff-in-Diff	Diff-in-Diff as % of Reform Before
	Before	After	Diff	Before	After	Diff		
Positive expenditure on expensive drugs	0.29 [0.45]	0.31 [0.46]	0.02 [0.02] {1.28}	0.10 [0.30]	0.15 [0.36]	0.05 [0.04] {1.31}	-0.03 [0.05] {0.95}	-10.34%
Average expensive drug expenditure, given positive drug spending	2570.82 [3554.60]	1716.71 [3682.83]	-854.11 [252.59] {-3.38}	2078.16 [6336.57]	2335.21 [3365.78]	257.05 [1716.68] {0.15}	-1111.16 [1187.03] {-0.94}	-43.22%
Positive expenditure on high technology procedures	0.52 [0.50]	0.43 0.49	-0.09 [0.02] {-4.95}	0.21 [0.40]	0.22 [0.41]	0.01 [0.05] {0.25}	-0.10 [0.06] {-1.80}	-19.23%
Average high technology procedure expenditure, given positive spending	1316.48 [2423.74]	1219.27 [3118.16]	-97.21 [148.97] {-0.65}	2976.42 [8352.61]	4561.25 [8878.32]	1584.83 [2118.97] {0.75}	-1682.04 [770.11] {-2.18}	-127.77%
Average standard bed charges (given positive bed spending)	534.13 [598.96]	397.21 [368.79]	-136.92 [21.61] {-6.34}	691.47 [830.67]	461.19 [627.67]	-230.28 [91.4] {-2.52}	93.36 [71.53] {1.31}	17.48%

Note: "Before" is 1995/96; "After" is 1997; "Diff" is after minus before; "Diff-in-diff" is diff for reform hospitals minus diff for FFS hospitals. Standard deviations are in straight brackets [ ] and *t*-statistics are in curly brackets { }.

We contrast the impact of prepayment on the above two categories of medical services with the impact on standard bed charges, which were priced below cost pre-reform. Consistent with expectations, prepayment has far less impact on this category of expenditures. Bed charges fell for both reform and FFS hospitals, largely attributable to a decline in length of stay.<sup>5</sup> (Since the decline was relatively smaller for reform hospitals, the DD impact of prepayment was actually an almost

twenty percent increase in spending on standard bed charges for patients treated in reform compared to FFS hospitals.)

Table 3 reports the results of the two-part model analysis. Although the reform hospitals are more likely to prescribe expensive drugs on average and prescribe a larger amount of them, compared to their FFS counterparts (*Reform*), prospective payment moderated growth in such use. In particular, conditioning on positive use, the reform hospitals showed a statistically significant reduction in expensive drug expenditures compared to their FFS counterparts.

Regression analysis also confirms that the impact of prepayment on use of high tech procedures was similar to that on expensive drugs. As shown in Table 4, controlling for patient demographic characteristics, diagnosis category, and month of hospitalization,

<sup>5</sup>The average length of stay (LOS) for the sample was 27.5 days, and declined by about 7 days for both reform and FFS hospitals in 1997. Although this LOS is almost three times the median for OECD countries, it is not unusually long compared to many other developing countries, particularly in East Asia. For example, in 1997 the average LOS in Japan was over 40 days (OECD Health data, 1999).

Table 3  
Multivariate regression difference-in-difference estimates of the impact of payment reform on use of expensive drugs

Variable	Probability of expensive drug use	Level of expensive drug expenditures, conditional on positive drug expenditures
Reform	0.6920** (0.1103)	0.8641** (0.2472)
Policy	1.2475** (0.2043)	0.9690* (0.4219)
Reform* Policy	−0.2489 (0.1927)	−1.3178** (0.4053)
Age	−0.0154 (0.0101)	0.0142 (0.0174)
Age2	0.0002* (0.0001)	−0.0001 (0.0002)
Retired	−0.1044 (0.0726)	−0.0703 (0.1240)
Male	0.0321 (0.0501)	0.2859** (0.0864)
Infectious	0.3050** (0.0995)	0.8589** (0.1795)
Tumor	0.6904** (0.0722)	0.5374** (0.1294)
Circulatory	0.0721 (0.0726)	0.5179** (0.1389)
Respiratory	0.5830** (0.0833)	0.6272** (0.1454)
Digestive	0.3878** (0.0770)	0.2380 (0.1414)
Urol_Repr	−0.0020 (0.0898)	0.3007 (0.1757)
Constant	−2.3998** (0.2901)	5.1287** (0.5098)
N	4213	1159
	LR chi2(25) = 443.83	F(25, 1133) = 5.15
	Pseudo R <sup>2</sup> = 0.0895	Adjusted R <sup>2</sup> = 0.0823
	Log likelihood = −2256.4544	Root MSE = 1.2381

Note: standard errors in parentheses; \* = statistically significant at the 5% level; \*\* = statistically significant at the 1% level; all regressions also include year and month dummy variables.

patients in reform hospitals are more likely to receive high tech procedures (*Reform*), and there is a trend toward increasing utilization of such procedures regardless of site of care (*Policy*). Yet with the introduction of prepayment, the increase in incidence of high tech procedures was less than that for patients who continued to be treated in a FFS environment (*Reform\*Policy*). The expenditure on high tech tests and interventions, conditional on positive such spending, also showed a statistically significant negative DD impact. Prepayment is thus associated with a relative decline in high tech expenditures both in terms of number of cases and intensity of use per case.<sup>6</sup>

In contrast, the last column of Table 4 reveals that the DD variable for bed charges is not statistically significantly different from zero. This finding is consistent with the hypothesis that pre-paid providers focus their (at least initial) cost control efforts on services that had been inefficiently over-used under FFS because of their high profit margins under the distorted official pricing structure, rather than basic services.

Caution is warranted because large reductions in relative spending could be associated with under-

provision and decrease in quality of care. Nevertheless, previous studies (e.g. World Bank, 1997) suggest there was considerable waste and overuse of profitable services under FFS, so that payment reform that removes the distorted FFS price signals for providers treating insured patients has the potential to target inefficient practices without reducing quality of care. Moreover, the fee schedule is retained for uninsured patients, allowing cross-subsidization of basic care by patients willing and able to pay for newer high technology medicine. This payment strategy has the potential to maintain implicit universal coverage for basic care before social insurance can be extended to the entire population. We should emphasize, however, that payment reform for the insured population can potentially lead to cost-shifting to the uninsured. We cannot assess the existence and extent of such cost shifting with the data at hand, but an overall assessment on the impact of access for the uninsured, especially the poor, is an important area for future research.

## Conclusion

Taking advantage of a natural experiment of payment reform in Hainan Province in China, we employed a difference-in-difference methodology to assess the impact of provider payment in addressing government and market failures and controlling cost. Consistent with theory, we find that prepayment is associated with a

<sup>6</sup> As might be expected, use of high tech procedures increased (at a decreasing rate) with the age of the patient, and differed significantly according to diagnostic category. Interestingly, male patients were more likely than their female counterparts to receive high tech procedures and spend more on them (as well as on expensive drugs).

Table 4

Multivariate regression difference-in-difference estimates of the impact of payment reform on high technology procedure spending and standard hospital bed charges

Variable	Probability of use of high technology procedures	High technology expenditures, conditional on positive expenditures	Standard hospital bed charges, conditional on positive bed charges
Reform	0.8954** (0.0932)	-0.0491 (0.1349)	-0.0812 (0.0570)
Policy	0.5660** (0.1837)	0.4330 (0.2575)	-0.1090 (0.1115)
Reform* Policy	-0.4019* (0.1753)	-0.6057* (0.2503)	0.1529 (0.1059)
Age	0.0585** (0.0098)	0.0711** (0.0116)	0.0418** (0.0063)
Age2	-0.0005** (0.0001)	-0.0006** (0.0001)	-0.0004** (0.0001)
Retired	-0.0592 (0.0681)	-0.0753 (0.0703)	0.0211 (0.0451)
Male	0.1432** (0.0467)	0.0288 (0.0513)	0.0848** (0.0309)
Infectious	-0.4760** (0.0957)	-0.3958** (0.1266)	0.3420** (0.0608)
Tumor	0.1105 (0.0670)	0.1797* (0.0739)	0.0738 (0.0455)
Circulatory	0.5677** (0.0652)	-0.0804 (0.0665)	0.0423 (0.0431)
Respiratory	-0.2853** (0.0792)	-0.4245** (0.0962)	-0.1443** (0.0520)
Digestive	-0.2479** (0.0710)	-0.6848** (0.0851)	-0.3785** (0.0469)
Urol_Repr	0.2578** (0.0769)	0.7574** (0.0818)	-0.2443** (0.0543)
Constant	-2.8646** (0.2696)	4.8471** (0.3338)	4.4957** (0.1745)
N	4213	2005	4031
	chi2(25) = 602.65	F(25, 1979) = 16.01	F(25, 4005) = 19.18
	Pseudo R <sup>2</sup> = 0.1034	Adj R <sup>2</sup> = 0.1577	Adj R <sup>2</sup> = 0.1013
	Log Likelihood = -2614.0126	Root MSE = 0.9661	Root MSE = 0.8484

Note: standard errors in parentheses; \* = statistically significant at the 5% level; \*\* = statistically significant at the 1% level; all regressions also include year and month dummy variables.

slower rate of growth of expenditures on services that were profitable under FFS, especially spending on expensive drugs and high technology procedures. Expenditures on standard bed charges, not subject to the same pricing distortions, were basically unaffected by the payment reform. These findings suggest that prepayment for the insured population can help to counteract the adverse effects of FFS pricing distortions that contribute to rapid cost escalation. These results provide useful information for Chinese policymakers regarding the effectiveness of payment reforms for improving health sector performance, especially in light of the lack of rigorous empirical analysis of policy interventions in China to date.

Certain caveats are in order for interpreting our empirical findings. For example, with only six months of data after the reform, we are unable to assess the long-term impact of payment reform. We also lack the necessary data to differentiate efficient cost control effort from potential adverse side effects of prepayment, such as reduction in quality, cost shifting to the uninsured, and avoiding treatment of expensive patients. We hope that in the future data become available for analysis of the social welfare impact of payment reform.

Nonetheless, our results suggest that payment reform can be an effective policy instrument to help correct health sector government and market failures that lead to excessive health care expenditure growth. Policymakers should take steps to mitigate potential negative

side effects and to assure quality. Particularly important for developing countries are efforts to build government capacity to monitor provider behavior, including collection and analysis of data on substitution across services that entail different financial incentives, referrals to alternative providers, and utilization patterns of the uninsured. These efforts can help to assure that cost reductions are not gained at the expense of equitable access and quality of care.

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#### References

- Bin Y, Meng, Q, et al. (1998). Comparison of allowed charges and costs for selected services in China. *China Health Management*, 1998, issue number 7.
- Ellis, R. P., & McGuire, T. G. (1993). Supply-side and demand-side cost sharing in health care. *Journal of Economic Perspectives*, 7, 135–151.

- Guo, S., & Ge, S., (1998). *Zhongguo shehui baoxian de gaige yu tansuo* (The reform and exploration of China's social insurance). Shanghai Caijing University Publishing House Shanghai, PRC.
- Hainan Social Insurance Bureau (1997a). *Hainan yiliao baoxian zhidu gaige de zhuyao neirong ji shishi qingkuang* (The primary content and implementation experience of Hainan's health insurance system reforms), Quanguo shehui baoxian juzhang huiyi cailiao zhi qi (Material #7 for the 1997 national conference of social insurance bureau heads), mimeo.
- Hainan Social Insurance Bureau (1997b). *Hainan yiliao baoxian zhidu gaige shuju baogao* (Statistical report on the health insurance system reforms of Hainan), Yigai huibao fujian er (Second appendix to the health reform report), December.
- Hainan Social Insurance Bureau (1998). *Answers to a few questions about payment reform*. Written communication to authors, June.
- Milgrom, P., & Roberts, J. (1992). *Economics, organization and management*. Englewood Cliffs, NJ: Prentice Hall.
- Newhouse, Joseph P., & the Insurance Experiment Group. 1993. *Free for all? Lessons from the RAND health insurance experiment*. Cambridge, MA: Harvard University Press.
- OECD Health Data (1999) *A Comparative Analysis of Twenty-Nine Countries*, Paris.
- Weitzman, M. (1980). The ratchet principle and performance incentives. *Bell Journal of Economics*, 11, 302–308.
- World Bank (1997). Financing health care: issues and options for China. *China 2020 Series*. Washington DC: World Bank.
- Yip, W., & Eggleston, K. (2000). *Provider payment reform in China: The case of hospital reimbursement in Hainan province*. Harvard School of Public Health Program in Health Care Financing working paper.
- Yip, W., & Hsiao, W. (1997). Medical savings accounts: Lessons from china. *Health Affairs*, 16, 244–251.