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Patient Copayments, Provider Incentives and Income Effects: Theory and Evidence from China's Essential Medications List Policy

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Abstract:

How do demand- and supply-side incentives interact, when there are potentially large provider income effects? We develop a simple model and empirically test it with data from China's Essential Medications List (EML) policy, which reduced patient copayments and changed provider incentives by removing a large source of revenue from primary care providers: drug dispensing revenues. Using a panel of patient-level spending and clinical data for Chinese patients with diabetes or hypertension over two and a half years, we find evidence of strategic provider response that dampened the impact of patient copayment reductions. Resource use and patient out-of-pocket spending did not change, when taking account of patient utilization outside primary care.

JEL codes: I11, I13

Key words: provider payment, insurance, chronic disease management, China, income effects

1. Introduction

Assuring access to essential health care without encouraging wasteful overutilization of health care resources is a perennial challenge for policymakers. Many developing and higher-income countries alike seek to improve insurance coverage to reduce the out-of-pocket burden on patients, while constraining costs by giving providers incentives for efficiency. Improved risk protection may also lead to health benefits if lower copayments enhance adherence to recommended therapy, as in the case of patients with chronic disease faithfully taking their medications.

Both economic theory and previous empirical evidence suggest that implementation of a demand-side reform -- such as expanding insurance or reducing patient co-payment burden for specific medications -- can be complicated by strategic supply-side response. However, the related theory does not routinely take account of provider income effects (e.g. Ellis and McGuire 1993; Ma and McGuire 1997; Eggleston 2005), which can be large for primary care providers when payment for basic services changes; and studies of these effects in developing countries are limited. This paper aims to contribute to filling this theoretical and empirical gap in the literature.

Expansion of insurance generally increases expenditures through static and dynamic moral hazard. Providers paid by fee-for-service (FFS) have little incentive to constrain utilization; in fact, it is in their financial interest to indulge moral hazard and recommend (over)use of profitable services. Insurance reduces the demand-side constraint on supplier-induced demand. Therefore reforming provider incentives to introduce more supply-side cost sharing, particularly in the presence of demand-side moral hazard, is increasingly viewed as crucial for affordable, sustainable access. Examples in the US include use of bundled payment alongside expansion of insurance under the Affordable Care Act. In developing and middle-income countries, new initiatives for universal health coverage rely on various supply-side mechanisms to constrain spending growth (such as capitation in Thailand and Colombia). In China and much of East Asia, to reduce provider incentives to over-prescribe, insurance expansion has been accompanied by policies to dislodge the longstanding tradition of physician dispensing.

Our paper examines these interactions between demand- and supply-side incentives both theoretically and empirically. First, we develop a simple model of how demand- and supply-side incentives interact to shape utilization, taking into account the potential for provider income effects. Second, we test specific hypotheses from the model by using one example of a policy reform that entailed potentially large provider income effects: China's policy removing drug dispensing revenues from primary care providers.

The parsimonious model developed here builds upon the pioneering work of McGuire and Pauly (1991) on physician response to fee changes, adding the ability to analyze demand-side incentives and their interaction with supply-side incentives. We first replicate their theoretical predictions with a model that constrains inducement through physician agency for patients, rather than the disutility of inducement that McGuire and Pauly themselves call a "somewhat peculiar utility function."[1] We then add demand-side incentives and analyze the interaction of demand- and supply-side incentives in a general context, before making specific predictions based on our empirical case.

We use these predictions to study the impact of China's 2010 Essential Medications List (EML) policy, using unique patient-level data from one of China's most populous provinces, Shandong. The EML policy contains both a supply- and a demand-side policy component. On the demand side, it requires China's social health insurance programs to provide more generous coverage for EML medications than for other medications. On the supply side, the policy requires government-owned primary care providers to dispense essential medications with zero price mark-up. Prior to the policy, most health clinics derived about half of their revenues from dispensing medications directly to their patients, so the requirement of zero mark-up entails large income effects.

We empirically test the theoretical predictions using a difference-in-difference design that exploits the phased implementation of China's EML policy, using a carefully constructed panel of patient-level spending and clinical data for over 800 patients with

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[1] "Our main point here is that the literal target income model can be reconciled with maximization (although with a somewhat peculiar utility function)" (McGuire and Pauly 1991, p. 389).

chronic disease over two and a half years. Our sample from two counties includes patients with a diagnosis of diabetes mellitus or hypertension who enjoy some outpatient insurance coverage through the New Cooperative Medical Scheme (NCMS) and have records of visiting a township health center at least once a year during the sample period (1 January 2009 through 30 May 2011).

Our study offers several theoretical and empirical findings. First, our simple model allows general analysis of demand- and supply-side incentives, allowing physician agency to reduce both under-provision (stinting) as well as overprovision (inducement).We highlight the importance of physician income effects and show that policies impacting the supply-side (reduction in physician income) and demand-side (increase in insurance coverage) may act in opposing directions and cancel their respective effects, with an ambiguous impact on the equilibrium quantity of health care utilization and spending. In the empirical context of EML, we find that, consistent with theoretical predictions, the concurrent implementation of both supply-side and demand-side policies may have had a constraining effect on increased demand in the presence of insurance coverage expansion. However, providers engaged in strategic response, and difference-in-difference analyses suggest little longer-term impact on spending or patient out-of-pocket burden, when taking account of spending at all providers. Second, the same policy may have differing outcomes among different patient groups. For example, we find that diabetic patients had more pronounced, if transitory, effects than hypertensive patients in reaction to the same policy changes. Finally, the clinical measures show little improvement in management of chronic disease.

We organize the remainder of the paper as follows: In section 2, we develop the model and draw several testable hypotheses. In section 3, we describe China's EML policy and briefly summarize related literature. Section 4 covers our data and methodology. The final two sections present empirical results and a concluding discussion.

2. Conceptual Framework

2. 1 A simple model of demand- and supply-side incentives with provider income effects

This section develops a parsimonious model of how demand- and supply-side incentives interact to influence physicians' choice of the quantity of each service to recommend to patients. We begin with the simple case of a patient demanding a single medical service, and then extend the model to account for physicians recommending multiple treatment options. Because the patient's net benefits enter the physician's utility function directly, we can analyze how patient co-payments interact with the provider's fees to shape the quantity of each treatment recommended by the physician. This model is general enough to encompass many specific cases, not confined to the Chinese case that we study empirically.

2.1.1 Patient demand: A single service

A patient with utility V experiences a health shock -- diagnosis with a chronic disease -- that reduces utility. Let q represent health service quantity for the patient over a given period of time (e.g. a quarter or a year). Clinical benefits from health service utilization, $v(q)$, can ameliorate the health loss; these benefits are increasing and concave in quantity. The efficiency benchmark for *ex post* efficiency in use of health care resources would be given by $\underset{<q>}{Max}\left[v(q)-cq\right]$, where c represents the social marginal cost of health care use; the efficient level of utilization, q^{**}, equates the marginal patient benefit with the marginal cost of resource use, $v_q\left(q^{**}\right)=c$.

Let p represent the unit price of services, and m the margin (as a percentage of the unit price) that the provider is allowed to charge above the unit price. In China, providers are allowed a substantial margin or mark-up above acquisition price for medications that are directly dispensed to patients in the doctor's office or at the health center pharmacy. The patient must pay co-insurance θ $(0 \le \theta \le 1)$ representing a fraction of the total treatment expenditures, $(1+m)pq$.[2] The patient's utility is $v(q)-\theta(1+m)pq$. Patient

[2]Usually, the greater the risk pooling for health spending, the more generous the benefits covered and the

demand is defined by that level of utilization that equates the marginal clinical benefit with the marginal out-of-pocket cost the patient faces:

$$v_q(q^d) = \theta(1+m)p.$$

Generally, demand increases when insurance generosity increases (θ decreases): $\frac{dq^d}{d\theta} = \frac{(1+m)p}{v_{qq}} < 0$. This model of patient demand produces the usual relationships: a larger moral hazard effect of insurance when prices are high; a larger utilization-reducing impact of a price increase if co-payment requirements are high; and higher demand when the provider mark-up is lower (for a given co-insurance rate and price level). Patients demand the socially efficient utilization level only when they have accurate information about clinical benefits and face, through co-payment requirements, exactly the social marginal cost: $q^d = q^{**}$ if and only if $\theta(1+m)p = c$.

The patient's demand, q^d, may in general differ from the provider's recommended utilization, q^s, either because the patient is ill informed about true clinical benefits, or the provider is an imperfect agent with recommendations shaped by supply-side incentives, or both. We assume that actual utilization *q* is a function of both patient demand and provider recommended treatment:

$$q = F(q^d, q^s).$$

For example, a patient may use q^s to guide their estimation of clinical benefits from treatment. If, as in China, patients are generally (and justifiably) suspicious of supplier-induced demand, they may discount the provider's recommended utilization level by some proportion, but their actual utilization will nevertheless be shaped to some extent by the provider's recommendation.

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lower the patient's co-insurance rate. Complete lack of risk pooling (and corresponding total reliance on out-of-pocket spending) is represented by the extreme case of $\theta = 1$. The opposite extreme of universal first-dollar coverage is represented by $\theta = 0$. We focus on the patient's medical-related utility (net benefits from treatment), since it is the aspect of patient utility for which the provider acts as agent. A broader definition of patient utility would include non-medical consumption affordable from income net of any health insurance premium (or taxation for government subsidized health insurance).

2.1.2 Provider Recommended Treatment: A Single Service

How does the provider choose the recommended treatment level, q^s? We assume the provider derives utility from patient net benefits *V* and from provider net revenue π, with provider utility linear in patient net benefits, but possibly concave in net revenue: $u(V,\pi) = \alpha V + U(\pi)$, with $U' > 0$. Following the pioneering work of McGuire and Pauly (1991) on the importance of income effects for physician response to fee changes, we examine the case of diminishing marginal utility of net revenue, $U'' < 0$ (income effects), compared to the benchmark case of no income effects ($U'' = 0$).

We assume that providers care about patient net benefits ($\alpha > 0$), either because the physician is inherently benevolent, or is constrained by competition and social norms to take account of patient well-being to a certain extent.[3] Pauly and McGuire (1991) assume physicians choose a level of inducement subject to a disutility-of-inducement function. In contrast, this model uses the fairly common assumption of imperfect agency for patients. This specification of the physician utility function allows analysis of under-provision (stinting) as well as overprovision (supplier-induced demand), and may also correspond more directly with empirical estimation of imperfect agency. While the weight that a physician places on patient welfare is difficult to observe or estimate, it is possible to isolate the monetary value of the trade-off that physicians make. For example, Iizuka (2007) estimates that a Japanese physician in the 1990s was willing to give up one dollar of profit to save a patient 28 cents in co-payment.

Net revenue is the product of the margin and total expenditure on the service: $\pi = mpq$, where *m* ($0 \le m \le 1$) represents the margin the provider receives above the cost of providing the service (e.g., for pharmaceuticals, the mark-up above the acquisition price *p*).

Given these fairly general assumptions, the provider's choice of treatment

[3] As Chandra, Cutler and Song (2012) note, one way of modeling physicians as imperfect agents is to assume that the equilibrium quantity is "not too far from" the patient's desired quantity (p.406).

quantity for the patient is given by the following first order condition:

$$\alpha\left(v_q\left(q^s\right) - \theta(1+m)p\right) + U_\pi mp = 0, \text{ or}$$

$$v_q\left(q^s\right) = \theta(1+m)p + \frac{-U_\pi mp}{\alpha}. \qquad (2)$$

This first order condition shows that the physician recommends treatment up to the point where the patient's marginal clinical benefit is equal to the sum of the patient's copayment burden and provider net revenue, weighted by the agency parameter. The net revenue term $\frac{-U_\pi mp}{\alpha}$ is symmetric with the patient's co-payment burden: an increase in the provider's margin or a decrease in patient cost-sharing will lead the provider, as agent for the patient ($\alpha > 0$), to increase recommended treatment. Conversely, a decrease in the provider's margin will lead the provider to recommend a smaller treatment quantity q. This observation leads to one of the key testable hypotheses in the empirical portion of our paper – that an expansion in insurance coverage on the demand side when accompanied by supplier constraint will be more likely to prevent potentially wasteful (over)use of health care resources. However, this supply response depends on the magnitude of provider income effects.[4]

These two terms in the provider's first order condition illustrate that impact of reducing the provider's margin on a service includes the direct effect of the lower margin charged to patients (through $\theta(1+m)p$), and the indirect effect of any strategic response in recommended treatment (through $\frac{-U_\pi mp}{\alpha}$). Similarly, the impact of a reduction in co-payment requirements includes the direct patient effect of lower payments for the same services, as well as the indirect effect of higher utilization desired by the patient (i.e., moral hazard) and the increased recommended treatment by a provider acting as the patient's agent.

The provider response is shaped by the magnitude of the income effects induced by the margin reduction. Indeed, when a labor-leisure trade-off is included in the model

[4] The larger the income effect of a fee reduction, the smaller the corresponding decrease in q (because the denominator of the comparative static becomes very large): $\frac{dq^s}{dm} = \frac{-U_\pi p}{\alpha v_{qq} + U_{\pi\pi}(mp)^2} > 0$.

and income effects are large enough, supply may be backward-bending: providers may increase quantity of a service for which the fee was decreased. This is easily shown in the model by adding a term $F(L)$ to the physician utility function to represent utility from leisure that is increasing and concave ($F_L > 0, F_{LL} < 0$); leisure is given by $L = L_0 - tq$, where *t* represents the physician time commitment per unit of quantity provided. Then equation (2) becomes

$$v_q\left(q^s\right) = \theta(1+m)p + \frac{-U_\pi mp}{\alpha} + \frac{tF_L}{\alpha}. \qquad (2')$$

The comparative static for how recommended quantity responds to a fee change is ambiguous—positive when income effects are absent ($U_{\pi\pi}$ =0) or small, and negative when income effects are large (because the positive $-U_{\pi\pi}mp^2$ term overpowers the negative $-U_\pi p$ term)[5]:

$$\frac{dq^s}{dm} = \frac{\alpha\theta p - U_\pi p - U_{\pi\pi}mp^2}{\alpha v_{qq} + U_{\pi\pi}(mp)^2 + t^2 F_{LL}}. \qquad (3)$$

Any "volume-offset behavior" indicates the presence of income effects and that the original fee was set well above resource costs (McGuire and Pauly 1991, p. 393). That this is quite possible for profitable medications, even in countries lacking the long tradition of physician dispensing, is evident from US oncologists' behavior after the Medicare Prescription Drug, Improvement, and Modernization Act of 2003 reduced payments for certain cancer drugs (Jacobson et al 2010).

Note that including the labor-leisure trade-off also shows that when a margin is reduced, the provider may have a financial incentive to substitute out of the less profitable service and into on-the-job leisure. A primary care provider may achieve this by referring more complicated patients to higher-level providers.

We note in passing also that the larger alpha, the closer the chosen treatment level is to the fully informed patient's ideal. The provider in general will not choose exactly what a fully informed patient would desire; such perfect agency arises only in the special case of no financial incentive: $m = 0$. Similarly, the physician will not have incentive to

[5] The denominator is always negative by the second-order condition for maximization.

deliver the most efficient spending except in certain specific circumstances. The provider chooses exactly the socially efficient spending only when the sum of the copayment and profit terms is equal to the true marginal cost of c: $q^s = q^{**}$ if and only if $\theta(1+m)p + \frac{-U_\pi mp}{\alpha} = c$.

To recapitulate, when the provider takes into account the patient clinical benefit and copayment burden, an expansion of insurance -- reduction in patient co-payment -- translates into higher recommended treatment. One way to constrain this utilization-increasing impact of greater insurance coverage is to impose a supply-side restraint alongside the demand-side expansion of coverage. The provider response will depend on income effects.

2. 2 Two services, with income effects

In this section, we extend the simple model to consider the more general case of two services. For simplicity, we normalize the per-unit price *p* to 1 and abstract from the labor-leisure trade-off. To focus on providers' strategic responses and income effects without overly cumbersome notation, we also subsume the margin the patient pays into the patients' copayment rate θ .[6] Let q_j represent quantity of health service *j*. A patient's total benefit from healthcare is the sum of benefits from each health service, $\sum_j v(q_j)$. Patient utility from medical care in the two-service case is

$$V = v(q_1, q_2) - \theta_1 q_1 - \theta_2 q_2$$

Provider utility therefore becomes

$$u(V, \pi) = \alpha(v(q_1, q_2) - \theta_1 q_1 - \theta_2 q_2) + U(\pi)$$

[6] One justification for this simplification is that patients do not often observe the physicians' true margin rates.

where $\pi = R + \sum_j \lfloor m_j q_j \rfloor$, with R representing any revenue that is not directly linked to quantity utilized by each patient (e.g., budgetary subsidies, flat bundled or case payments).

The first order conditions are

$$\alpha\left(v_{q_1} - \theta_1\right) + U_\pi m_1 = 0$$
$$\alpha\left(v_{q_2} - \theta_2\right) + U_\pi m_2 = 0$$

The corresponding determinant of the Hessian matrix H is positive by assumed concavity, where

$$|H| = (\alpha v_{11} + U_{\pi\pi} m_1^2)(\alpha v_{22} + U_{\pi\pi} m_2^2) - (\alpha v_{12} + U_{\pi\pi} m_1 m_2)^2 > 0$$

Because it is unlikely that provider behavior is subject to no income effects, we present the comparative statics results in Table 1 assuming the $U_{\pi\pi} < 0$. Note that the effects of fee *reductions* and co-payment *reductions* (increased insurance coverage) are the opposite sign of the comparative statics.[7]

When there are no income effects, recommended treatment quantity for a given service (and its complementary services) always decreases when the fee for that service decreases, and recommended treatment (for a service and its complements) always increases when the fee increases. Strategic substitution implies substituting out of a less profitable service and toward a more profitable service, mitigated by provider agency for clinical benefits. However, with income effects, the comparative statics are more complicated. As long as the agency-for-patient effect dominates provider income effects, then the supply curve for a given service will still be the standard upward-sloping curve: an increase in margin will prompt the provider to recommend more of that service. However, when income effects dominate, supply may be backward-bending (providers

[7] We discuss the two cases of the services being either complements (in the sense that as the quantity of one service increases, the marginal clinical benefit of the other service also increases: $v_{12} > 0$) or substitutes (in the sense that as the quantity of one service increases, the marginal clinical benefit of the other service decreases: $v_{12} < 0$).

may increase spending on a service for which the fee was decreased—see equation 2' above) and substitution between services is more complicated.

The model also has implications for referral of patients to higher-level providers. Consider the case where m_1 represents the margin on non-EML pharmaceuticals (i.e., drugs not listed on the EML). SEML reduces this margin to zero by proscribing sales of non-EML medications. When income effects are modest, the physician has financial incentive to refer more complicated patients—those requiring non-EML pharmaceuticals and their complementary services—elsewhere for treatment, such as hospitals.

Strategic response will also be shaped by the overall incentives of the provider compensation scheme. For example, provider net revenue could be subsidized by direct government payments for services, as are the township health centers in our data. In the case of government-owned providers in particular, such subsidies may have an implicit or explicit guarantee that if revenue from other sources falls precipitously, the government will allocate sufficient funds so that the provider does not go bankrupt. Expectation of such a bail-out is known as a soft budget constraint (Kornai 1986) and has been shown to significantly shape behavior in a variety of contexts (Kornai et al. 2003). It is straightforward to include such a soft budget constraint in the model to illustrate another reason why utilization and spending may not have changed much in our observed empirical setting.[8] Soft budget constraints mitigate provider responsiveness to fee changes.

2.3 Summary of predicted effects

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[8] For example, assume that the government has a policy that government-owned providers of primary care will receive a subsidy of $R(m_1)$ to compensate for loss of revenues $-m_1 q_1$ from reduction in the margin for service 1 (e.g., profit margin for prescribing essential medications) from m_1^0 to m_1^1. Let the replacement rate be *r*: $R(m_1) = r(m_1^0 - m_1^1)[m_1^0 q_1]$, where $0 \le r \le 1$. Then the provider is less responsive to any fee decrease for that service, knowing that the revenue implications will be less severe. The first order condition for provider recommended treatment becomes $\alpha(v_{m_{q1}}(q_1^s, q_2^s) - \theta_1) + U_\pi m_1(1-r) = 0.$ In the limit, if the provider receives 100% compensation for "lost revenues" (r=1), then income effects disappear.

The theory suggests that the impact of reducing provider's margin for a specific service, like essential medication prescribing, depends crucially on several factors. Intuitively, providers may substitute away from a lower-margin service and toward more profitable services. In this scenario, the incentive for profit-related service substitution may be tempered by agency for patients and patient copayment burden. A physician may choose to substitute into other services complementary with EML drug prescriptions, as well as substitute into on-the-job leisure by referring more complicated patients (those with non-EML drug prescriptions) to other providers.

Recommended treatment quantities for the patients who remain in primary care may change little despite a reduction in margin for several reasons. First, large income effects may entail some "volume offset" behavior. Second, physician agency and patient copayment may together offset the strategic response to income effects of the fee change. Third, the service may be strictly complementary with the other services that the provider wishes to recommend to patients (i.e., registration revenue from additional visits can be obtained if still prescribing drugs).

Furthermore, there may be reasons that policy results do not conform to the theoretical predictions of this parsimonious model, but which could be easily predicted by a slightly enriched model that included other behavioral margins of the EML policy. For example, the net revenue from a specific service like prescribing essential medications might still be positive even under a requirement of "zero mark-up" (m=0) because (i) providers could still be receiving unofficial revenue streams (e.g. kick-backs from the pharmaceutical companies for prescribing those drugs); or (ii) the provider may receive subsidies explicitly or implicitly linked to lost revenue from the margin change, as embodied in the soft budget constraint for government providers (and relevant for China's essential medication policy for government-owned primary care providers). In addition, non-financial factors such as clinical habits may reinforce the current treatment and prescribing patterns.

Moreover, it is worth considering the "black box" of how actual utilization q is determined as a function of both patient demand and provider recommended treatment:

$q = F(q^d, q^s)$. The patient may put more credence on the provider's recommendations q^s if they are less suspicious of supplier-induced demand because of the reduced margin. However, when the reduced margin is accompanied by a reduction in the scope of services provided (as the EML did by restricting primary care providers to prescribing drugs from a specific list), the patient may prefer to self-refer to alternative providers with fewer restrictions on treatment despite higher prices, especially if those providers have a higher reputation for quality. Utilization and spending may decrease at the provider whose margin was reduced, while overall utilization and spending—when considering all providers—may remain unchanged or even increase.

Thus it is ultimately an empirical question to what extent a change in provider margins—such as the essential medications policy in China—will change overall utilization and spending of the patients when all providers (including non-EML providers) are considered. In the empirical section of this paper, we test the impact of China's EML policy given the theoretical ambiguity of a fee reduction, particularly in combination with an increase in insurance coverage generosity.

3. Empirical Case Study: The Essential Medications List in China

3.1 Prescribing and Dispensing in China and the EML Policy

Physician dispensing and provider reliance on revenue from drug sales have deep historical and cultural roots in East Asia.[9] Supporting hospitals through drug sales (*yi yao yang yi*) is widely recognized as a problem in China, decried by the Minister of Health, and is the explicit target of the EML policy reforms. Since at least the 1950s, China's health care providers receive between 15% (the official mark-up) and 40% or more of the retail price of pharmaceuticals that they directly dispense to patients. These margins became significant determinants of provider behavior when prospective budgets

[9]Eggleston (2011) develops a model predicting physician-dispensing prevailed until the perceived social cost from supplier-induced demand outweighed the benefits of the previous self-reinforcing equilibrium, inspiring search for ways to change provider incentives, as embodied in the current EML policy and public hospital reform. The proposition predicts that China will adopt more rigorous separation policies as it commits to universal coverage and (gradually) replaces demand-side constraints with supply-side constraints on spending.

declined under the 1980s and health care providers had to earn profits to remain operational.

China’s EML policy includes several components. First, the policy required government-owned primary care organizations to implement a zero mark-up policy for dispensing drugs to their patients, and they were proscribed from dispensing drugs not included in the EML. We call this supply-side EML (SEML), although the reduction in mark-up also constitutes a reduction in price for consumers. Most local governments allowed providers a transition period in which they could continue to dispense non-EML drugs and retain some drug dispensing revenue. In the county we study, for example, this transition period extended from March through June 2010.

Second, EML policies required more generous insurance coverage for EML drugs than non-EML drugs. We call this demand-side EML (DEML). This component of EML involves changing the benefit package of social insurance, and its implementation timing generally differed from SEML. In the counties we study, for example, DEML took force at the beginning of 2011 as part of the annual insurance package updates for county-specific rural health insurance (NCMS), six months after SEML was implemented.

Third, the national EML policy implemented in March 2010 set guiding retail prices and called for provincial-level bidding for medications listed in the national essential medications list.[10] These supply-side reforms may have reduced the price of EML drugs through changing the industrial organization of the drug market. Our empirical study design examines two counties within the same province and prefecture, so that difference-in-difference estimates are net of any market-wide effects on EML drug prices.

Statements by China's officials praise EML as helping to control spending, enhance access, reduce over-prescribing and thereby improve quality of care.[11]

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[10] Provinces could add medications to their own province-specific EML, if they also provide subsidies to compensate provincial government-owned primary care providers for those additional lost revenues. On average provinces supplemented the 307 medications on the national EML with 207 additional medications (Tian, Song, and Zhang 2012).

[11] For example, Minister of Health Chen Zhu stated in a 2012 interview that EML policies clearly reduce

3.2 Previous Literature

A few previous studies confirm that provider financial incentives substantially impact treatment recommendations in China. Through an audit study using students as simulated patients, Currie, Lin and Meng (2012) find that Chinese hospital-based physicians dramatically reduce prescription of antibiotics—and completely eliminate prescription of the most expensive and powerful antibiotics—when the financial incentive is removed.

Many scholars have investigated the effects of EML, with mixed results regarding impact on drug prices, health care utilization, and patient out-of-pocket burden (see the appendix for a summary). Several studies showed that instead of increasing utilization in primary care, after EML many patients with more complicated conditions were referred to higher-level providers (Yang et. al., 2012; Wang et. al., 2012; Ye et. al. 2011). Patients may also self-refer to hospitals if they perceive EML medications to be inferior quality (Sun et. al., 2011). Whether from provider selective referral or patient self-referral, utilization at primary care providers in many cases appears to have decreased (Li et. al., 2012), while the number of inpatients in county hospitals and higher-level hospitals increased (in Anhui, by 18% on average; Sun et. al., 2012). Similarly, Tian and colleagues (2012) suggested that after EML implementation, more patients received care at hospitals and spending per visit continued to increase, albeit with some moderation in the out-of-pocket share of per-visit spending.

The evidence is limited by several weaknesses of previous study designs. Many analyses compare pre-EML and post-EML trends, without a comparison group or strategy to distinguish the impact of EML from other general changes (e.g. expansion of insurance coverage, policy reforms designed to strengthen primary care, and so on). Few studies distinguish supply-side and demand-side impacts. No study to date has examined the impact of EML on the overall spending of patients at all providers. No previous study

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people's burden of drug costs, and that prescriptions for antibiotics, stimulants, and intravenous infusions as a percentage of total expenses for outpatient and inpatient care have all declined in varying degrees (Cheng 2012, p.2538 and p.2539).

has compiled panel data at the patient level linking expenditures to clinical measures of severity for both an intervention and comparison group, as we do.

4. Data and Methods

4.1 Data

This study links patient-level clinical and spending data for over 800 patients with chronic disease—hypertension and/or diabetes mellitus—treated at rural primary care providers in Shandong province, China.[12] Two rural counties of Shandong were chosen for this study based on the ability to obtain a random sample of patients who received care for either hypertension or diabetes in both the pre- and post- periods, linked to NCMS insurance claims and provider clinical records.[13] County A is one of the pilot counties that implemented the zero mark-up policy (SEML) in June 2010, after a three-month transition period; County B is a matched comparison county that did not implemented SEML during the study period. County B is similar to County A in socioeconomic characteristics. Both counties' per capita income levels are around the average for Shandong, and slightly above the rural average for China. Their age structure is representative of Shandong, with slightly more elderly than the national average. Compared to County A, County B is slightly more populated (975,000 compared to 813,000 residents) and slightly more developed. Illiteracy is low (5%) but slightly higher than the national average (4%), consistent with a slightly larger proportion of elderly than the national average.

Summary statistics

[12]The national EML includes 9 western medications for treatment of hypertension (Captopril, Enalapril, Sodium Nitroprusside, Magnesium Sulfate, Nitrendipine, Indapamide, Phentolamine, Compound Reserpine, Compound Hypotensive) and 4 for treatment of diabetes (Insulin, Metformin, Glibenclamide, and Glipizide).

[13]The sample is neither a random sample of patients treated at the SEML providers in the pre-period (because patients in our sample are required to have also visited the provider in the post-period, which not all patients did) nor a random sample of patients treated at those providers in the post period (because not all such patients would have visited the provider in the pre-period, as our sampling frame requires).

Table 2 summarizes the data used in the EML analyses. The mean age is 58; 42% are male; 71% have an elementary school education or less, 24% graduated from middle school, and 4% from high school; and 98% are farmers. About two-thirds are hypertension patients, and the other one-third, patients with diabetes. On average records show 4.8 primary care visits per patient during the 33 months covered by the study. Mean medical expenditures per quarter were 545 RMB (about USD $89, standard deviation of 981 RMB), and mean out-of-pocket expenditures were 254 (standard deviation of 400 RMB).[14]

NCMS insurance coverage was expanding over the time period of this study. The risk protection provided by NCMS nevertheless remained limited, even for this group of chronically ill patients. For all patients, mean total expenditures per quarter before June 2010 were 437 RMB, with NCMS covering 50% (221 RMB) and the remainder -- an average of 216 RMB per quarter, or 866 RMB per year -- paid out-of-pocket (see Appendix). After June 2010, mean quarterly expenditures increased by 222 RMB, 65% of which was covered by NCMS and 35% of which was paid out-of-pocket by patients. Overall, out-of-pocket spending accounted for fully 45% of quarterly average expenditures (294 RMB per quarter, or 1175 RMB per year).[15]

Patients in County B are slightly older, more female, and slightly better educated than patients in County A. County B patients also spend less on medical care than patients in County A at baseline. Mean pre-period total expenditures by patient quarter in County B were 69% of those in County A, for example. Mean expenditures increased about 50% in the post-period for both patients in both counties, with a slightly slower pace of increase in County A. Although these two counties cannot be considered representative of rural China as a whole, they are reasonably representative of Shandong, which is itself close to national average per capita income.

[14]One US dollar is about 6.1485 RMB yuan (or 0.1626 RMB yuan per US dollar). Average per capita income in rural areas of this prefecture (the region that includes both County A and County B) was about 7600 RMB Yuan in 2010, indicating that the average out-of-pocket medical expenditures for these rural patients with chronic disease constituted about 13 percent (1000/7600) of annual per capita income.
[15]Because we are reporting average spending with rounding to the nearest RMB, numbers do not always add up; please see the Appendix tables for exact numbers.

In each county, we collected information on all twelve township health centers (THCs), the providers required to implement SEML. Township health centers are the equivalent of primary care clinics in rural areas. All the THCs in our sample are government-owned and managed, as are the vast majority of China's primary care providers in both urban and rural areas (except village clinics). Clinical measures collected by hand from provider medical records were merged into NCMS claims data to compile a quasi-random panel dataset from among the "regular customers" of THCs. Patients with primary diagnoses other than diabetes or hypertension, or who did not visit the THC during the post-SEML period (after June 2011) were excluded.

Our sample of patient records from these THCs was chosen specifically to include patients most likely to experience an impact from EML: (i) patients with diagnosed hypertension or diabetes, so that they were most likely already prescribed a medication listed in the EML; and (ii) patients who visited the supply-side EML providers (THCs) in both the pre- and post- EML period. Compared to patients without a chronic disease or who irregularly visited THCs, these patients were most likely to experience, in their clinical indicators and spending, any beneficial impact of the EML in terms of (a) lower out-of-pocket or total spending; (b) better access and therefore potentially better adherence to treatment; perhaps leading to (c) better outcomes (lower blood pressure, or more likely to have blood pressure under control).

To account for some clear coding errors and large outliers, all outcome variables were trimmed to the 95% percentile.

Our clinically-linked sample includes 856 patients overall, 571 with a primary diagnosis of hypertension and 285 with a primary diagnosis of diabetes mellitus. A little over half of the patients within each diagnosis are from between County A (312 hypertension patients and 149 diabetes patients), with the remainder from the control county, B. As shown in Table 1, we have average systolic blood pressure (SBP) and diastolic blood pressure (DBP) for at least one point prior, and one point after, the policy change, for 738 of our total 856 patients (86%), including both hypertension (HP) and diabetes (DM) patients. We have 376 measurements of fasting plasma glucose for the 285 diabetes patients, i.e., we have more than one reported observation of fasting glucose for some of the diabetes patients.[16] Details for each of the sub-sample of patients are given in the Appendix tables.

For the regression analyses, we aggregate patient-specific spending by quarter and link to the clinical data with one measurement pre-intervention and one measurement post-intervention. This procedure results in a total of 1254 observations of quarterly expenditures in the pre-period and 1195 quarterly observations in the post-period, with mean values given in Table 1. Unfortunately we only have pharmaceutical-specific spending for County A; the NCMS claims data from County B did not allow us to disaggregate total spending into drug and non-drug spending. The appendix shows the detailed patient-level and quarterly-level data for each subgroup of patients (i.e., hypertension patients in County A, diabetes patients in County B, and so on). Since there are 3 categories of patients (patients with hypertension only, patients with diabetes only, and all sampled patients combined) and 3 categories of location (both counties, County A, County B), there are 9 tables summarizing the quarterly expenditures data. The appendix also reports the 9 tables of visit-level spending and socio-demographic data for all the patients in our linked clinical sample.

For each group of patients and for each county, we compare mean outcomes before and after the intervention using a T test of difference in means. The intervention is examined at two time points: June 2010 for SEML, and January 2011 for DEML. The appendix tables summarize these results. Panel B of each appendix table reports a pre-post comparison of patient-level clinical data for each patient sub-sample.

4.2 Empirical specifications

For the intervention County A, we used interrupted times series analysis to examine the potential impact of the policy intervention on trends in pharmaceutical spending (total drug spending and out-of-pocket drug spending) as well as all spending. Unfortunately we do not have pharmaceutical spending for County B, only total spending and total out-of-pocket drug spending. For these last two spending variables, we used

[16] These rural areas of China do not routinely measure glycated hemoglobin, a bio-marker of long-term glycemic control.

difference-in-difference analysis, with patients in County B serving as a comparison group for patients in County A.

For both the interrupted time series and the difference-in-difference analyses, we account for the sequential structure of the policy implementation by dividing the study period into three segments. First, we divided: (1) pre-SEML, 2009 Q1 through 2010 Q2; (2) post-SEML-pre-DEML, 2010 Q3 and Q4; and (3) post-DEML, 2011 Q1 through 2011 Q3. Then we ran separate analyses for each of the periods 1-2, 2-3, and 1-3. For the interrupted time series specifications, period 1-2 is intended to capture SEML effects; period 2-3 captures the additional impact of DEML after the implementation of SEML ; and 1-3, the combined effect of SEML+DEML relative to the baseline (no SEML and no DEML) period. For example, columns 1, 2, and 3 of Table 3 analyze County A trends in total pharmaceutical spending for these three periods. The next three columns of Table 3 examine trends in out-of-pocket pharmaceutical spending for the same three periods.

Our general difference-in-difference regression specification is as follows:

$$y_{it} = \lambda_t + \alpha_i + \beta_{EML}(treatedEML_{it}) + \gamma(inpat_{it}) + u_{it}$$

where y_{it} represents the outcome of interest for individual *i* during quarter *t*, such as the natural log of out-of-pocket medical spending; λ_t are quarter fixed effects; α_i are individual patient fixed effects; $inpat_{it}$ is a dummy variable indicating if patients *i* was hospitalized during quarter *t*; and u_{it} are the idiosyncratic errors. The treatment variable $treatedEML_{it}$ takes one of three forms: $treatedSEML_{it}$ is equal to 1 for all patients *i* in County A (treated) in the quarter SEML was fully implemented (2010 Q3) and every quarter thereafter; $treatedDEML_{it}$ equals 1 for all patients *i* in County A in the quarter DEML was implemented (2011 Q1) and every quarter thereafter. In the third specification, $treatedEML_{it}$ is set to 1 for all patients *i* in County A in the quarter SEML was fully implemented (2010 Q3), and differs from the first specification by the inclusion of all data instead of periods 1 and 2 only. For the DID specification, period 1-2 is intended to capture SEML effects; period 2-3 captures DEML conditional on SEML relative to DEML alone; and 1-3 the combined effect of SEML+DEML relative to DEML alone (with the pre-period defined as no SEML and no DEML).

All of the expenditure dependent variables were analyzed as the natural log of spending, using robust standard errors. We first analyzed spending only at township health centers (the SEML providers), and then spending at all providers (including village clinics, county hospitals, and other providers not subject to SEML at the time of this study).

5. Results

The model predicts that enhanced access from reduced co-payments may improve clinical outcomes by alleviating out-of-pocket burden. An advantage of our data compared to all previous studies of EML in China is that we have patient-level clinical measures with which to study the association of clinical metrics with reduction of co-payments (DEML). At baseline, we find that these patients in rural China exhibit poor control of their chronic disease, highlighting the importance of improvement chronic disease management (Table 2 Panel B). The average measurements of SBP and DBP were above the clinical thresholds for diagnosis of hypertension (SBP $\geq$ 140 mmHg, DBP $\geq$ 90 mmHg) in both the pre- and post-periods, signifying uncontrolled hypertension.[17] Similarly, average reported fasting plasma glucose was well above the clinical threshold for diagnosis of diabetes of $\geq$ 7.0 mmol per liter (FPG $\geq$ 126 mg/dl) recommended by both the American Diabetes Association and the World Health Organization (Inzucchi 2012; Yang et al. 2010). Average levels above this clinical threshold signify poor control of diabetes (hyperglycemia).

However, there was improvement in reported mean level of control over the period of this study (Table 2 Panel B). Considering the full sample of hypertension and diabetes patients in both counties, average SBP was 147.73 mm/Hg in the period from January 2009 through the end of May 2010 period (pre-period hereafter), and 143.62 in the period from June 2010 to May 2011 (post-period hereafter), exhibiting a statistically significant mean difference of -4.12. Over the same period, average diastolic BP declined from 91.75 to 89.37, a statistically significant mean difference of -2.37; and average fasting plasma glucose declined slightly from 8.25 to 7.92 mmol/Liter.

These average measures mask significant heterogeneity. Focusing only on the hypertension patients, we see that blood pressure control was even poorer than the average of the entire sample at baseline.[18] The reported improvement in blood pressure control was greater in County B.[19]

For diagnosed diabetes patients, fasting plasma glucose indicated quite poor control of blood glucose levels (e.g. mean fasting glucose of 7.83 in County A and 9.29 in County B in the post-period), with a small improvement in County B and no significant improvement in County A.

Figure 1 shows that pharmaceutical spending appears to spike when SEML was first implemented in County A (between March and June 2010), probably because providers were eager to sell off inventory of non-EML drugs before the June 2010 deadline for selling only EML drugs. This spending "spike," conceptually similar to the "Ashenfelter dip" found prior to job training programs, is important to recognize when evaluating the impact of the program on prescribing behavior and patient utilization.

5.1 Interrupted time series analyses

The empirical results are consistent with our theoretical predictions that EML may not have an empirically significant effect given ambiguities in the parameters such as physician agency, income effects, and the presence of complements and/or substitutes. First, we find empirical evidence that SEML had virtually no longer-term effect on

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[18] Considering all 571 hypertension patients in both counties, average SBP was 152.06 mm/Hg in the pre-period, and 147.31 in the post-period, exhibiting a statistically significant mean difference of -4.75. Over the same period, average DBP declined from 93.97 to 91.13, a statistically significant mean difference of -2.84 (Appendix Table 4).

[19] Among the 312 hypertension patients in County A, average SBP declined slightly from 151.47 in the pre period to 150.22 in the post period, a statistically significant (P=0.04) mean difference of -1.25. Average DBP was relatively constant (93.33 in the pre-period and 92.59 in the post-period). Among the 259 hypertension patients in County B (with observations for 243 patients), average SBP declined from 152.76 to 143.86, a statistically significant mean difference of -8.91. Average DBP declined from 94.74 in the pre-period and 89.40 in the post-period (mean difference of -5.34).

pharmaceutical spending or out-of-pocket drug expenditures. Table 3 presents the results of the interrupted times series analysis of County A patients' pharmaceutical expenditures and out-of-pocket pharmaceutical expenditures at township health centers (THCs). As for all the tables that follow, panel A displays results for hypertension patients, panel B for diabetes patients. While there are transient changes in pharmaceutical spending for some time periods or patient populations, the overall effect of EML on drug expenditures is virtually nil.

For patients with hypertension, there seems to be no break in trend from either SEML or DEML implementation in County A. On the other hand, Panel B reveals that for diabetes patients, SEML and DEML are associated with short-term reductions in drug expenditures and out-of-pocket drug spending at THCs. These appear to be discontinuities followed by continued growth in spending.

Table 4 displays the same interrupted times series analyses applied to pharmaceutical expenditures at all providers, to see to what extent any changes in spending at SEML providers is offset by spending at other providers. We see that for hypertension patients, SEML was associated with an *increase* in pharmaceutical spending and out-of-pocket spending in the intermediate term (Table 4 columns 3 and 6) at all providers, even though there was no increase in spending at THCs (Table 3). These results are consistent with some patients being referred away from THC primary care to hospitals for outpatient treatment, where EML did not apply and spending levels tend to be higher. For diabetes patients, SEML does not appear associated with any change in trend, and the short-term decrease in drug spending and out-of-pocket drug spending associated with DEML is of lower magnitude when estimated in terms of spending at all providers (Table 4) rather than spending only at THCs (Table 3). This pattern, again, is consistent with patient referral (or self-referral) to non-EML providers, which partially offsets the transitory reductions in spending when only EML providers are considered. In all cases, an inpatient admission is associated with significantly higher spending.

5.2 Difference-in-difference analyses

Second, the empirical results—particularly for diabetic patients—show some support for the theoretical prediction of strategic provider response dampened by income effects. Table 5 summarizes results for spending and visits at THCs. Once again, hypertension patients show no statistically significant impact of SEML or SEML+DEML. For diabetes patients, however, SEML is associated with an *increase* in short-term total expenditures, with no impact on out-of-pocket spending. This finding of increased expenditures covered by insurance at THCs is consistent with SEML causing providers to induce demand along other dimensions to retain revenue, while constrained by demand to some extent, so that out-of-pocket spending did not increase. This result is also consistent with a fee reduction (SEML) increasing quantity in the presence of large income effects.

For diabetes patients, DEML implemented after SEML is associated with lower total and out-of-pocket expenditures than implementation of DEML alone. These results are consistent with expanded insurance increasing spending more when there are no supply-side constraints (County B's continued fee-for-service with drug mark-up revenues) compared to when the insurance expansion is accompanied by supply-side constraints (County A's SEML). But this evidence is also consistent with DEML in combination with SEML lowering total spending at THCs at least in part because it enabled or encouraged patients to utilize higher-level providers (particularly if SEML providers ceased providing drugs that certain patients preferred). Table 6 corroborates this latter view: when diabetes patients' expenditures at all providers are taken into account, *treatedDEML* is no longer statistically significant: there was no decrease in total spending at all providers after DEML was implemented alongside SEML. So the combination of supply- and demand-side EML in County A did not reduce spending so much as shift spending to different mix of providers.

The estimated impact on out-of-pocket spending of diabetes patients is similar. The difference-in-difference results for utilization suggest that these increases and subsequent decreases in relative spending played out in part through changes in the number of visits per quarter at township health centers. SEML was also associated with an increase in visits for both hypertension and diabetes patients over the longer-term, consistent with increasing referrals to hospitals for some patients, and a shift to registration revenue and other non-drug services at THCs. These results are all consistent with our theoretical predictions with substitution effects.

In sum, our analyses show no evidence of differential impact of SEML or SEML+DEML on expenditures at all providers, or out-of-pocket spending at all providers. This means that although spending per visit at SEML providers may have declined (relative to providers still retaining drug margins), the number of visits at SEML providers increased, and there was no decrease in overall resource use or on patient out-of-pocket burden, when taking account of their utilization at all levels of providers. So the SEML providers referred patients to other providers -- or patients self-referred away from SEML providers -- in such a way that the overall spending by patients originally treated at SEML providers did not decline. In fact, overall, in the longer-term -- i.e., using all 33 months of our panel data -- EML is not statistically significant in changing expenditures or out-of-pocket expenditures for either diabetes or hypertension patients at THCs or all providers. Table 7 shows that the only significant longer-term impact seems to have been a slight increase in the number of visits these chronically ill patients had, and the increase in visits was larger in magnitude for THCs than for higher-level hospitals.

Theory predicts that SEML providers will strategically substitute into non-drug sources of revenue such as registration fees for more frequent visits; such a behavioral response lowers spending per visit but does not necessarily lower overall spending. SEML providers also have financial incentives to refer more complicated patients to other providers (such as county hospitals) and substitute into on-the-job leisure, which would mechanically entail a short-term increase in visits because what would have been one visit automatically turns into two visits. These results highlight that per-visit spending is a misleading measure of policy impact.

Combining our empirical results with findings from interviews with local providers and officials in rural Shandong, we conclude that much work remains to be done to improve the incentive structure in support of quality chronic disease management in rural China. The essential medications policy is far from a panacea. As theory would predict, providers have engaged in strategic response, diluting the impact of SEML.

When considering the effect of increased utilization and selective referral of patients to hospital care, patients have not seen much change in out-of-pocket spending, and overall resource use trends have not changed much. Expanding EML policies to more providers is unlikely to change trends in spending growth significantly in the short to intermediate term. Broader policy reforms addressing fee-for-service provider incentives will be important for affordably improving quality. Additional measures to improve management of patients with chronic disease will be crucial as China's population rapidly ages. We uncovered little evidence that improved health outcomes could be directly attributable to EML, although we suspect a stronger association with improved insurance. In the long run, expanded insurance coverage in China and elsewhere in the developing world represents a significant increase in the ability to pay for treatments, and thus may spur investments in technologies and novel therapies for diseases disproportionately impacting the world's poor.

5.3 Limitations

Our study was not designed to assess the broader welfare implications of China's EML policies. Since expansion of insurance coverage and DEML took place in both the counties of our study, we do not have definitive conclusions regarding the impact of these changes on our sample patients' welfare. It does appear, however, that DEML significantly reduced out-of-pocket spending burdens for at least some of these chronically ill patients, which probably contributed to the mild improvement in measured blood pressure and fasting glucose. Increased referrals of the most complicated patients to hospital-based care could potentially have contributed to improved health outcomes, but clearly also increased expenditures and travel costs for these patients relative to having their conditions managed in primary care.

When interpreting our results, several limitations of this study should be kept in mind. First, our data constitutes a relatively small sample, from just two counties in one province. Second, our study focuses on patients with chronic disease and is not designed to provide a comprehensive evaluation of the EML policy.

Nevertheless, our study does provide a strong study design compared to the previous literature, with patient-level panel data integrating claims and clinical records. Further studies using patient-level panel data should be a high priority for evaluating the overall impact of China's health reforms.

6. Conclusion

Imperfect physician agency has long been faulted as one of the drivers of escalating health care expenditures. Policymakers are justifiably concerned about the often contradictory goals of increasing access through insurance coverage expansion, and curtailing medical waste of overutilization that does not improve health. We presented a theoretical and empirical evaluation of temporally proximal supply-side and demand-side changes in the incentives to ancillary physician services (the dispensing of pharmaceuticals). Theoretically, a reduction in physician income in one service may cause providers to decrease the provision of the service if a substitute is available, and the margin on the substitute becomes relatively more profitable given the fee reduction in service one. However, physician agency may temper the reduction in services, if such services are necessary for patient health, and large income effects for the physicians may lead to "volume offset behavior" that reduces the magnitude of predicted response. Moreover, the loosening of patient demand constraints concurrent with the supply-side incentive change may counteract the effect of the fee reduction. As a result, the total effect of both supply- and demand-side changes in incentives may cancel each other, so as to result in very little change in the status quo in physician service volumes.

Taking this theoretical framework to data, we analyze the impact of China's EML policy that incorporated both a supply-side and demand-side component to the dispensation of pharmaceuticals. On the one hand, the policy reduced provider incentive to prescribe drugs by imposing a zero mark-up requirement on physician dispensed pharmaceuticals at government-owned primary care providers. On the other, it also increased patient demand for certain pharmaceuticals by reducing patient out-of-pocket expenditures. Consistent with our theoretical predictions, we obtained the following empirical results: First, we find empirical evidence that SEML had virtually no longer-term effect on pharmaceutical spending or out-of-pocket drug expenditures. However, the empirical results do show some support for the theoretical prediction that in County A there would be a slower increase in overall spending associated with reduced patient cost sharing (DEML), because County A had greater supply-side constraint (SEML+DEML) than County B (just DEML).

Our study provides several policy recommendations. First, it is important to consider provider income effects and overall health care spending when evaluating the impact of a given margin change, rather on focusing on the provision of services which experienced a fee change. Policymakers should consider the impact on substitute services, as well as substitute providers. Second, not all patient groups will display identical changes to service utilization. In our study, for example, we find that hypertensive and diabetic patients often exhibited differing responses to the EML policy. Third, a mere quantification of service volume changes due to alterations in supply or demand will not provide the full picture of the welfare effects of a new policy. It is recommended, although admittedly difficult, to consider the concomitant health outcomes of the policy change. Finally, in the specific context of China's EML policy, heterogeneity in the policy implementation may present challenges to policymakers to interpret the external validity of documented policy effects. As nations face pressures from health care cost escalation, health policymakers will likely continue to struggle with difficult tradeoffs between access and cost. Our study shows that this tradeoff is likely to be context-specific, and may involve a complex interaction between supply- and demand-side incentives.

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Appendix

China's Health System and Burden of Chronic Disease

Over the past decade, China has expanded risk pooling through wide but shallow coverage that is gradually deepened over time to achieve universal coverage with a robust benefit package; this approach has been called "equal access by 2012 and universal coverage by 2020" (Yip, Wagstaff et al. 2009). The voluntary government-subsidized insurance programs for rural residents -- the New Cooperative Medical Scheme (NCMS) -- and for non-employed urban residents have lower premiums and less generous benefit packages than the mandatory and longer-standing insurance programs for urban employees and government workers (Eggleston 2012). China's health care delivery system is composed of a mixture of private and public providers. Most hospitals, and a large share of primary care providers in both urban and rural areas, are government owned and managed.[20] Patients traditionally have been free to self-refer to any provider, although social health insurance may provide limited coverage for providers outside the given county or municipality.

Over the past quarter century, China's primary burden of disease has shifted definitively from infectious to chronic non-communicable disease (He et al 2005; Yang et al 2010). Given both the ambitious goal toward universal coverage and China's

[20] Private hospitals accounted for 6.1% of discharges and 8.2% of outpatient visits during the first 10 months of 2011. The private sector accounts for a larger share of services among primary care providers, including 18.6% of visits to community health centers (or stations). Although most township health centers are government-run, almost half of all visits to grassroots providers were to village clinics, most of which are private (Eggleston 2012).

epidemiological transition from infectious to non-communicable diseases, China's national health reforms announced in spring 2009 identified 5 arenas of reform for the 2009-2011 period,[21] of which the Essential Medications Policy (EML) is the subject of our current study.[22]

Previous literature on the impact of EML

Evidence suggests that removing drug dispensing revenues through SEML can impact the financial performance of the primary care centers and their employed physicians. For example, a survey in Hubei finds that in 2009, before EML, the average profit of health centers is 30,600 yuan, while in 2010, after EML, the average debt of health centers is 70,100 yuan (Zhang et. al., 2011).

Some studies suggest that the policy decreased prices of EML medications. For example, the price of essential medicines reportedly decreased 38% on average in Hunan province (Wu et. al. 2010) and 36% on average in Shandong Province (Yang et. al. 2012). However, some price increases have also been reported; and scarcity of supply seems to have been exacerbated when price decreases were large (Wu et. al., 2010).

Studies of utilization generally report an increase in health service utilization including drugs. According to a case study of three counties in Shandong province, the total sales volume of medicine increased 41% on average after implementation of EML (Yang et. al. 2012). EML implementation in 37 counties (or municipalities or districts) of Jiangsu Province -- covering almost 4,000 primary care providers -- has been found to be associated with a 10.4% increase in outpatient visits to primary care providers and a 26% reduction in average spending per visit (presumably compared to the areas that did not

[21]The 5 arenas of reform for 2009-2011 were accelerating expansion of basic health insurance, establishing the national essential medication list, strengthening primary health care, promoting the equalization of basic public health services, and facilitating pilot reforms of government hospitals.

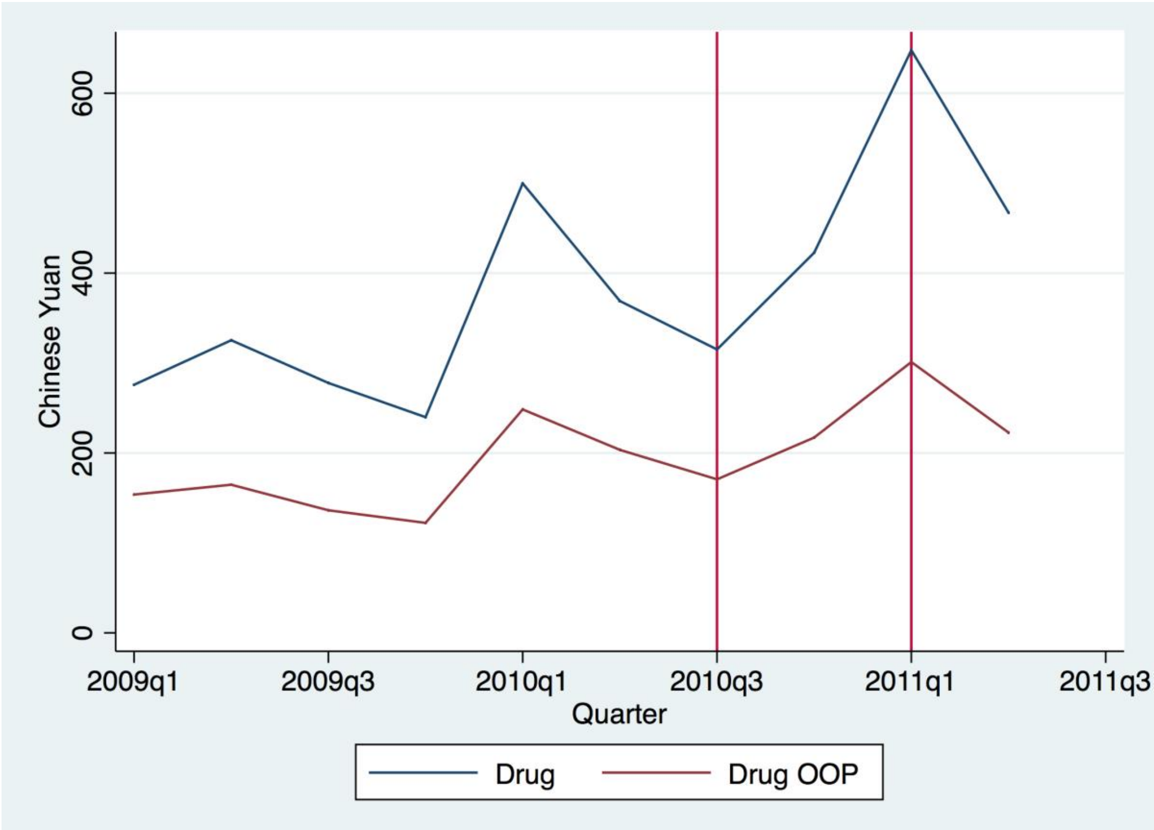
[22]Pharmaceutical prices have long been regulated in China, except from 1992 to 1996, when the Chinese government let the market set drug prices (Sun et al. 2008). Pharmaceuticals account for about half of total healthcare expenditures in China, representing 43% of expenditure per inpatient episode and 51% of expenditure per outpatient visit (ibid). This relatively large share appears in part related to physician dispensing. Indeed, if the provider margin is simply reallocated from pharmaceutical spending to providers, the distribution of healthcare expenditures across providers, pharmaceuticals and other services is much more similar to those of other middle-income countries.

implement the EML policy).[23] However, these descriptive trends cannot isolate the causality of EML's demand- and supply-side effects; these results are consistent with insurance expansion even in absence of EML.

A few studies have tried to quantify the impact of EML on overall prescribing rates and on the appropriateness of prescribing. A study of 6 community health centers in Hangzhou showed that the average number of medicines in each prescription decreased significantly from 4.8 to 3.2 (Wang et al, 2012). The average expenditure on drugs per visit decreased in Zhejiang (Jin et al, 2012), Anhui (Sun et al, 2012) and Jiangsu (Wu et. al., 2010); in Hangzhou, drug spending per visit decreased from 88.53 yuan to 65.21 yuan (Wang et al, 2012). Studies on the appropriateness of prescribing are more limited. Chen et al. (2012) found that antibiotics and hormone prescribing increased, but use of intravenous injections and infusions declined. Li Yang and colleagues' (2012) difference-in-difference analysis of 83 primary care facilities found that EML did not improve rational prescribing (as measured by prescriptions of antibiotics, hormones, or injections). Similarly, EML did not appear to reduce prescriptions of antibiotics or injections, according to analysis by Lianping Yang and colleagues (2012). Xiang and colleagues (2012) found a slight reduction in injections. Few studies established that EML slowed the increase in overall medical spending.

[23] See for example National Development and Reform Commission (2011).

Figure 1. Spike in average drug expenditures per patient quarter before supply-side EML



Note: The upper line represents average pharmaceutical expenditures per patient quarter; the lower line represents average out-of-pocket spending on pharmaceuticals per patient quarter. The first vertical line represents implementation of supply-side EML, SEML ("zero mark-up"), in June 2010. The second vertical line shows implementation of improved insurance coverage with demand-side EML (DEML).

Table 1. Comparative Statics of Changes in Provider Margins and Patient Co-payment Rates

Comparative statics	Implications
$\frac{\partial q_1}{\partial m_1}>0$	$\frac{\partial q_1}{\partial m_1}=\frac{-U_\pi(\alpha v_{22}+U_{\pi\pi}m_2^2)}{\lvert H\rvert}>0$ A reduction in margin (fee) decreases recommended treatment quantity for that service. Note: with a labor-leisure trade-off (see equation (2')), a fee reduction could lead to an increase in recommended quantity.
$\frac{\partial q_2}{\partial m_1}\,ambiguous$	$\frac{\partial q_2}{\partial m_1}=\frac{U_\pi(\alpha v_{12}+U_{\pi\pi}m_1m_2)}{\lvert H\rvert}$ ambiguous If income effects are small ($U_{\pi\pi}\approx 0$), then unambiguous: $\frac{\partial q_2}{\partial m_1}>0$ when the two services are complements ($v_{12}>0$); $\frac{\partial q_2}{\partial m_1}<0$ when the two services are substitutes ($v_{12}<0$), e.g. strategic substitution from less profitable service 1 into more profitable service 2.
$\frac{\partial q_1}{\partial \theta_1}<0$	$\frac{\partial q_1}{\partial \theta_1}=\frac{\alpha(\alpha v_{22}+U_{\pi\pi}m_2^2)}{\lvert H\rvert}<0$ A smaller copayment increases the quantity demanded (static moral hazard), and therefore also increases the quantity that a good agent ($\alpha>0$) will recommend.
$\frac{\partial q_2}{\partial \theta_1}\,ambiguous$	$\frac{\partial q_2}{\partial \theta_1}=\frac{-\alpha(\alpha v_{12}+U_{\pi\pi}m_1m_2)}{\lvert H\rvert}$ ambiguous If income effects are small ($U_{\pi\pi}\approx 0$), then unambiguous: $\frac{\partial q_2}{\partial \theta_1}<0$ when the two services are complements ($v_{12}>0$); that is, if the two services are complements, then a decrease in copayment for service 1 increases the demand for service 2, and a good provider agent ($\alpha>0$) recommends more service 2. $\frac{\partial q_2}{\partial \theta_1}>0$ when the two services are substitutes ($v_{12}<0$). In other words, if the copayment for service 1 decreases, then the quantity of service 2 demanded decreases as patients switch from service 2 to the now more affordable service 1, and a good agent ($\alpha>0$) recommends more service 1.

Table 2. Shandong, China rural patient sample: Patient-level summary statistics

Table 2 Panel A. Patient characteristics	Full sample				County A	County B
	Mean (N=856)	Std. Dev.	Min	Max	Mean (N= 461)	Mean (N= 395)
Age	58.23771	15.22435	21	81	57.76	58.78
% Male	0.42		0	1	0.46	0.37
Education						
% <= Elementary school	0.71		0	1	0.77	0.64
% Junior High	0.24		0	1	0.17	0.32
% High School	0.04		0	1	0.04	0.04
% Vocational School	0		0	1	0	0
% College	0		0	1	0.02	0.01
Profession						
% Farmers	0.98		0	1	0.98	0.98
% Non farmers	0.02		0	1	0.02	0.02
Primary diagnosis						
% Hypertension	0.65		0	1	0.67	0.63
% Diabetes	0.35		0	1	0.33	0.37
Visits	4.82	5.76	1	57	4.74	4.91
No of pre policy visits (June 2010)	2.19	3.16	0	21	2.13	2.25
No of post policy visits (June 2010)	2.63	3.45	0	36	2.61	2.66
No of pre policy visits (Jan 2011)	3.21	4.5	0	46	3.36	3.05
No of post policy visits (Jan 2011)	1.6	2.23	0	25	1.38	1.86
Medical expenditures per quarter						
Total expenditures by patient-quarter	545.34	981.44	2	11661	634.01	445.02
Expenditures covered by NCMS	291.20	617.75	0	7138	345.70	229.53
Total out-of-pocket expenditures	254.15	399.84	2	7841	288.32	215.49
Drug expenditures per quarter	n/a				409.98	n/a
Drug spending covered by NCMS	n/a				204.89	n/a
Out-of-pocket drug expenditures	n/a				205.09	n/a

Note: n/a: not available; expenditures in RMB Yuan.

Table 2 Panel B. Pre-post comparison of patient-level clinical data

Full Sample	Pre June 2010					Post June 2010					T test		
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Mean diff	Std. error	P value
Average systolic blood pressure	738	147.73	16.81	95	200	738	143.62	16.05	95	190	-4.12	0.44	0
Average diastolic blood pressure	739	91.75	9.78	60	124	739	89.37	9.28	60	124	-2.37	0.28	0
Average fasting glucose	376	8.25	2.69	4	21	376	7.92	2.55	4	20	-0.33	0.08	0
County A, hypertension patients													
Average systolic blood pressure	289	151.47	15.03	110	190	289	150.22	16.1	100	190	-1.25	0.59	0.04
Average diastolic blood pressure	289	93.33	8.96	60	124	289	92.59	9.3	65	124	-0.74	0.42	0.08
County A, diabetes patients													
Average systolic blood pressure	93	134.19	15.86	95	185	93	133.09	15.27	95	185	-1.11	0.65	0.09
Average diastolic blood pressure	93	83.61	9.04	60	100	93	84.11	9.06	60	102	0.49	0.47	0.3
Average fasting glucose	135	7.89	1.46	5	17	135	7.83	1.52	5	17	-0.05	0.07	0.44
County B, hypertension patients													
Average systolic blood pressure	243	152.76	13.1	120	200	243	143.86	12.63	120	180	-8.91	0.79	0
Average diastolic blood pressure	243	94.74	8.89	70	120	243	89.4	8.33	65	110	-5.34	0.53	0
County B, diabetes patients													
Average systolic blood pressure	86	134.62	16.71	100	190	86	130.73	12.61	110	170	-3.88	1.59	0.02
Average diastolic blood pressure	86	85.93	8.47	70	105	86	83.9	7.68	70	100	-2.03	0.75	0.01
Average fasting glucose	118	10.12	3.18	4.21	20.6	118	9.29	3.17	4.21	19.8	-0.84	0.19	0

Table 3. County A Interrupted Times Series - Drug Out-of-pocket Expenditures at Township Health Centers (THs)

Table 3 Panel A. Hypertension Patients -- Interrupted Times Series Analysis of Drug and Drug OOP Expenditures

	2009q1 - 2010q3	2010q3 - 2011q3	2009q1 - 2011q3	2009q1 - 2010q3	2010q3 - 2011q3	2009q1 - 2011q3
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	ln_drug	ln_drug	ln_drug	ln_drugoop	ln_drugoop	ln_drugoop
quarters since 2009q1	0.0593		0.0579	0.0552		0.0542
	(0.0463)		(0.0415)	(0.0457)		(0.0411)
post-SEML	-0.351		-0.179	-0.348		-0.174
	(0.397)		(0.197)	(0.398)		(0.195)
quarters since SEML	0.104		0.0449	0.107		0.0471
	(0.231)		(0.0829)	(0.232)		(0.0822)
inpat	2.342**	2.084**	2.195**	1.851**	1.594**	1.708**
	(0.188)	(0.198)	(0.127)	(0.185)	(0.196)	(0.124)
quarters since 2010q3		0.0551			0.0515	
		(0.218)			(0.218)	
post-DEML		0.398			0.437	
		(0.273)			(0.273)	
quarters since DEML		-0.215			-0.235	
		(0.279)			(0.280)	
Observations	434	373	681	434	373	681
R-squared	0.463	0.592	0.521	0.354	0.475	0.405
Number of panel_id	196	233	283	196	233	283

Robust standard errors ir
** p<0.01, * p<0.05

Table 3 Panel B. Diabetes Patients -- Interrupted Times Series Analysis Drug and Drug OOP Expenditures

	2009q1 - 2010q3	2010q3 - 2011q3	2009q1 - 2011q3	2009q1 - 2010q3	2010q3 - 2011q3	2009q1 - 2011q3
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	ln_drug	ln_drug	ln_drug	ln_drugoop	ln_drugoop	ln_drugoop
quarters since 2009q1	0.0776		0.0707	0.0717		0.0655
	(0.0580)		(0.0559)	(0.0590)		(0.0567)
post-SEML	-0.628*		-0.0802	-0.575*		-0.0502
	(0.261)		(0.220)	(0.259)		(0.221)
quarters since SEML	0.393*		-0.0335	0.376*		-0.0361
	(0.171)		(0.0897)	(0.171)		(0.0906)
inpat	2.198**	2.132**	2.196**	1.754**	1.714**	1.752**
	(0.222)	(0.177)	(0.172)	(0.216)	(0.180)	(0.168)
quarters since 2010q3		0.647**			0.635**	
		(0.161)			(0.159)	
post-DEML		-0.875**			-0.891**	
		(0.275)			(0.275)	
quarters since DEML		-0.412*			-0.401*	
		(0.204)			(0.200)	
Observations	298	201	408	298	201	408
R-squared	0.425	0.597	0.436	0.321	0.505	0.328
Number of panel_id	109	104	134	109	104	134

Robust standard errors ir
** p<0.01, * p<0.05

Table 4. County A Interrupted Times Series - Drug Out-of-pocket Expenditures at All Providers

Table 4 Panel A. Hypertension Patients -- Interrupted Times Series Analysis of Drug and Drug OOP Expenditures at All Providers

	2009q1 - 2011q1	2010q3 - 2011q3	2009q1 - 2011q3	2009q1 - 2011q1	2010q3 - 2011q3	2009q1 - 2011q3
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	ln_drug	ln_drug	ln_drug	ln_drugoop	ln_drugoop	ln_drugoop
Quarters since 2009q1	-0.0541*		-0.0513*	-0.0559*		-0.0533*
	(0.0215)		(0.0211)	(0.0217)		(0.0213)
Post SEML	0.120		0.275*	0.118		0.277*
	(0.171)		(0.114)	(0.172)		(0.115)
Quarters since SEML	0.231*		0.103*	0.233*		0.102*
	(0.104)		(0.0407)	(0.105)		(0.0408)
inpat	2.995**	2.720**	2.810**	2.651**	2.321**	2.433**
	(0.120)	(0.130)	(0.0871)	(0.123)	(0.133)	(0.0897)
Quarters since 2010q3		0.0789			0.0825	
		(0.103)			(0.103)	
post DEML		-0.397			-0.431	
		(0.255)			(0.258)	
Quarters since DEML		0.189			0.201	
		(0.174)			(0.176)	
Constant	4.165**	4.132**	4.173**	3.818**	3.772**	3.829**
	(0.0816)	(0.158)	(0.0813)	(0.0821)	(0.158)	(0.0819)
Observations	2210	1172	2757	2210	1172	2757
R-squared	0.273	0.431	0.345	0.228	0.352	0.284
Number of panel_id	508	517	554	508	517	554

Robust standard errors i
** p<0.01, * p<0.05

Table 4 Panel B. Diabetes Patients -- Interrupted Times Series Analysis of Drug and Drug OOP Expenditures at All Providers

	2009q1 - 2011q1	2010q3 - 2011q3	2009q1 - 2011q3	2009q1 - 2011q1	2010q3 - 2011q3	2009q1 - 2011q3
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	ln_drug	ln_drug	ln_drug	ln_drugoop	ln_drugoop	ln_drugoop
Quarters since 2009q1	-0.00570		-0.0123	-0.00809		-0.0145
	(0.0290)		(0.0285)	(0.0290)		(0.0285)
Post SEML	-0.0507		0.0549	-0.0260		0.0693
	(0.221)		(0.154)	(0.223)		(0.155)
Quarters since SEML	0.161		0.0911	0.152		0.0883
	(0.149)		(0.0622)	(0.150)		(0.0624)
inpat	2.643**	2.612**	2.665**	2.357**	2.279**	2.359**
	(0.135)	(0.218)	(0.123)	(0.141)	(0.222)	(0.130)
Quarters since 2010q3		0.143			0.131	
		(0.150)			(0.150)	
post DEML		-0.781*			-0.782*	
		(0.350)			(0.355)	
Quarters since DEML		0.274			0.283	
		(0.232)			(0.234)	
Constant	4.334**	4.344**	4.372**	3.986**	4.011**	4.025**
	(0.114)	(0.243)	(0.115)	(0.114)	(0.243)	(0.115)
Observations	966	509	1191	966	509	1191
R-squared	0.272	0.312	0.295	0.227	0.255	0.246
Number of panel_id	219	218	234	219	218	234

Robust standard errors i
** p<0.01, * p<0.05

Table 5. Difference-in-Difference Analysis of EML Impact on Expenditures and Visits at Township Health Centers

Table 5 Panel A. Hypertension Patients

VARIABLES	(1) ln_total	(2) ln_total	(3) ln_total	(4) ln_oop	(5) ln_oop	(6) ln_oop	(7) ln_vsts	(8) ln_vsts	(9) ln_vsts
treatedSEML	-0.170		-0.126	-0.180		-0.138	-0.00321		0.0348
	(0.113)		(0.0943)	(0.108)		(0.0917)	(0.0680)		(0.0579)
treatedDEML		0.195			0.269			-0.0102	
		(0.268)			(0.263)			(0.144)	
inpat	2.402**	2.496**	2.476**	1.898**	1.898**	1.916**	0.187**	0.314**	0.209**
	(0.142)	(0.145)	(0.0925)	(0.130)	(0.139)	(0.0857)	(0.0552)	(0.0752)	(0.0402)
Observations	936	603	1406	936	603	1406	936	603	1406
R-squared	0.459	0.616	0.556	0.359	0.485	0.440	0.020	0.072	0.034
Number of panel_id	427	400	550	427	400	550	427	400	550

Robust standard errors
in parentheses
** p<0.01, * p<0.05

Table 5 Panel B. Diabetes Patients

VARIABLES	(1) ln_total	(2) ln_total	(3) ln_total	(4) ln_oop	(5) ln_oop	(6) ln_oop	(7) ln_vsts	(8) ln_vsts	(9) ln_vsts
treatedSEML	0.282*		0.0912	0.233		0.0585	0.271**		0.181**
	(0.139)		(0.130)	(0.135)		(0.126)	(0.0724)		(0.0570)
treatedDEML		-1.041**			-0.974**			-0.450**	
		(0.290)			(0.283)			(0.154)	
inpat	2.057**	2.110**	2.131**	1.624**	1.559**	1.666**	0.289**	0.241	0.267**
	(0.156)	(0.235)	(0.132)	(0.136)	(0.179)	(0.112)	(0.0811)	(0.140)	(0.0602)
Observations	703	345	958	703	345	958	703	345	958
R-squared	0.318	0.453	0.355	0.238	0.353	0.268	0.063	0.138	0.050
Number of panel_id	250	202	290	250	202	290	250	202	290

Robust standard errors
in parentheses
** p<0.01, * p<0.05

Table 6. Difference-in-Difference Analysis of EML Impact on Expenditures and Visits at All Providers

Table 6 Panel A. Hypertension Patients

	2009q1-2010q3	2010q3-2011q2	2009q1-2011q3	2009q1-2010q3	2010q3-2011q2	2009q1-2011q3	2009q1-2010q3	2010q3-2011q2	2009q1-2011q3
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	ln_total	ln_total	ln_total	ln_oop	ln_oop	ln_oop	ln_vsts	ln_vsts	ln_vsts
treatedSEML	0.0690		0.109	-0.0137		0.0403	0.0876*		0.121**
	(0.0675)		(0.0566)	(0.0679)		(0.0570)	(0.0417)		(0.0355)
inpat	3.315**	3.103**	3.196**	2.944**	2.672**	2.795**	0.154**	0.211**	0.135**
	(0.0923)	(0.104)	(0.0662)	(0.0949)	(0.110)	(0.0684)	(0.0584)	(0.0700)	(0.0425)
treatedDEML		0.0435			0.128			0.0198	
		(0.115)			(0.117)			(0.0818)	
Observations	4062	2100	5590	4062	2100	5590	4063	2101	5592
R-squared	0.365	0.486	0.417	0.310	0.400	0.345	0.004	0.009	0.006
Number of panel_id	923	910	987	923	910	987	923	910	987

Robust standard errors
in parentheses
** p<0.01, * p<0.05

Table 6 Panel B. Diabetes Patients

	2009q1-2010q3	2010q3-2011q2	2009q1-2011q3	2009q1-2010q3	2010q3-2011q2	2009q1-2011q3	2009q1-2010q3	2010q3-2011q2	2009q1-2011q3
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	ln_total	ln_total	ln_total	ln_oop	ln_oop	ln_oop	ln_vsts	ln_vsts	ln_vsts
treatedSEML	0.0484		0.0744	-0.0361		-0.000336	0.141*		0.198**
	(0.0947)		(0.0797)	(0.0963)		(0.0812)	(0.0606)		(0.0517)
inpat	2.890**	3.034**	2.962**	2.619**	2.672**	2.660**	0.252**	0.0365	0.190**
	(0.121)	(0.149)	(0.101)	(0.124)	(0.156)	(0.103)	(0.0765)	(0.110)	(0.0599)
treatedDEML		-0.119			-0.0401			-0.0353	
		(0.184)			(0.186)			(0.125)	
Observations	1883	945	2567	1883	945	2567	1883	945	2567
R-squared	0.342	0.430	0.378	0.299	0.360	0.324	0.013	0.001	0.013
Number of panel_id	411	404	434	411	404	434	411	404	434

Robust standard errors
in parentheses
** p<0.01, * p<0.05

Table 7. Impact of EML on Expenditures and Visits (by Patient Quarter) - All Patients, All Providers (including non-THCs

	2009q1-2010q3	2010q3-2011q2	2009q1-2011q3	2009q1-2010q3	2010q3-2011q2	2009q1-2011q3	2009q1-2010q3	2010q3-2011q2	2009q1-2011q3
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	ln_total	ln_total	ln_total	ln_oop	ln_oop	ln_oop	ln_vsts	ln_vsts	ln_vsts
treatedSEML	0.0177		0.0705	-0.0650		0.000562	0.0717*		0.119**
	(0.0517)		(0.0432)	(0.0521)		(0.0437)	(0.0319)		(0.0271)
inpat	3.175**	3.052**	3.123**	2.835**	2.649**	2.754**	0.173**	0.182**	0.148**
	(0.0686)	(0.0803)	(0.0514)	(0.0702)	(0.0840)	(0.0529)	(0.0431)	(0.0547)	(0.0317)
treatedDEML		0.0465			0.129			0.0210	
		(0.0899)			(0.0910)			(0.0623)	
Observations	6860	3563	9459	6860	3563	9459	6861	3564	9461
R-squared	0.360	0.476	0.413	0.308	0.396	0.346	0.005	0.007	0.007
Number of panel_id	1560	1551	1674	1560	1551	1674	1560	1551	1674

Robust standard errors
in parentheses
** p<0.01, * p<0.05

Appendix Table 1. Summary statistics by quarter: Both counties, all patients.

A. Quarter-level data summary

	Obs	Mean	Std. Dev.	Min	Max	% of obs with non-zero
Total expenditures by patient-quarter	2449	545.34	981.44	2	11661	100.00%
Expenditures covered by NCMS	2449	291.20	617.75	0	7138	99.96%
Total out-of-pocket expenditures	2449	254.15	399.84	2	7841	100.00%

B. Pre-post comparison of patient-level clinical data

	Pre June 2010					**Post June 2010**					**T test**		
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Mean diff	Std. error	P value
Average systolic BP	738	147.73	16.81	95	200	738	143.62	16.05	95	190	-4.12	0.44	0.00
Average diastolic BP	739	91.75	9.78	60	124	739	89.37	9.28	60	124	-2.37	0.28	0.00
Average fasting glucose	376	8.25	2.69	4	21	376	7.92	2.55	4	20	-0.33	0.08	0.00

C. Pre-post comparison of quarter-level data

	Pre June 2010					**Post June 2010**					**T test**		
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Mean diff	Std. error	P value
Total expenditures by patient-quarter	1254	437.06	839.60	2	9585	1195	658.98	1099.94	3	11661	221.92	39.43	0.00
Expenditures covered by NCMS	1254	220.62	528.84	0	6101	1195	365.26	691.52	1	7138	144.64	24.81	0.00
Total out-of-pocket expenditures	1254	216.44	329.61	2	3484	1195	293.72	459.02	2	7841	77.28	16.09	0.00

	Pre Jan 2011					**Post Jan 2011**					**T test**		
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Mean diff	Std. error	P value
Total expenditure per visit	1699	455.22	897.11	2	9585	750	749.50	1124.06	3	11661	294.28	42.62	0.00
Expenditures covered by NCMS	1699	227.93	551.54	0	6101	750	434.51	726.63	1	7138	206.58	26.76	0.00
Total out-of-pocket expenditures	1699	227.29	369.18	1.5	5026	750	314.99	456.27	2	7841	87.70	17.44	0.00

Appendix Table 2. Summary statistics by quarter: County A, all patients.

A. Quarter-level summary data

	Obs	Mean	Std. Dev.	Min	Max	% of obs with non-zero
Total expenditures by patient-quarter	1300	634.01	1015.01	2	11661	100.00%
Expenditures covered by NCMS	1300	345.70	635.31	0	6101	99.92%
Total out-of-pocket expenditures	1300	288.32	417.22	2	7841	100.00%
Drug expenditures per quarter	1300	409.98	659.16	0	6807	86.46%
Drug spending covered by NCMS	1300	204.89	371.33	0	3640	86.46%
Out-of-pocket drug expenditures	1300	205.09	302.01	0	3167	86.46%

B. Pre-post comparison of patient-level data

	Pre June 2010					**Post June 2010**					**T test**		
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Mean diff	Std. error	P value
Average systolic BP	390	147.39	17.55	95	190	390	146.07	17.40	95	190	-1.32	0.47	0.0056
Average diastolic BP	391	91.00	9.95	60	124	391	90.46	9.87	60	124	-0.54	0.33	0.11
Average fasting glucose	194	7.54	1.69	5	17	194	7.50	1.74	4.5	17.5	-0.05	0.05	0.33

C. Pre-post comparison of quarter-level data

	Pre June 2010					**Post June 2010**					**T test**		
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Mean diff	Std. error	P value
Total expenditures by patient-quarter	652	512.82	888.45	2	9585.05	648	755.95	1115.58	4	11660.7	243.133	55.92	0.00
Expenditures covered by NCMS	652	268.05	565.83	0	6101.04	648	423.83	689.95	1	5581.45	155.781	34.99	0.00
Total out-of-pocket expenditures	652	244.78	341.82	1.5	3484.01	648	332.13	477.59	3	7841.09	87.3517	23.02	0.00
Drug expenditures per quarter	652	334.47	621.31	0	6807	648	485.95	687.32	0	5409	151.48	36.34	0.00
Drug spending covered by NCMS	652	160.48	343.02	0	3640	648	249.57	393.01	0	3245	89.09	20.46	0.00
Out-of-pocket drug expenditures	652	173.99	293.43	0	3167	648	236.38	307.47	0	2241	62.39	16.67	0.00

	Pre Jan 2011					**Post Jan 2011**					**T test**		
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Mean diff	Std. error	P value
Total expenditure by patient-quarter	910	534.82	941.71	2	9585.05	390	865.47	1136.35	4	11660.7	330.647	60.77	0.00
Expenditures covered by NCMS	910	280.23	600.54	0	6101.04	390	498.45	686.76	1	5180.34	218.22	37.99	0.00
Total out-of-pocket expenditures	910	254.59	359.75	1.5	3484.01	390	367.02	519.60	3	7841.09	112.427	25.07	0.00
Drug expenditures per quarter	910	344.94	628.42	0	6807	390	561.72	703.65	0	5347	216.77	39.45	0.00
Drug spending covered by NCMS	910	165.00	349.52	0	3640	390	297.98	403.19	0	3105	132.99	22.18	0.00
Out-of-pocket drug expenditures	910	179.95	293.79	0	3167	390	263.74	313.00	0	2241	83.79	18.14	0.00

Appendix Table 3. Summary statistics by quarter: County B, all patients.

A. Quarter-level data summary

	Obs	Mean	Std. Dev.	Min	Max	% of obs with non-zero
Total expenditures by quarter	1149	445.02	932.35	3	11064	100.00%
Expenditures covered by NCMS	1149	229.53	591.51	0.28	7138	100.00%
Total out-of-pocket expenditures	1149	215.49	375.66	2	5026	100.00%

B. Pre-post comparison of patient-quarter-level data

	Pre June 2010					**Post June 2010**					**T test**		
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Mean diff	Std. error	P value
Average systolic BP	348	148.11	15.97	100	200	348	140.86	13.91	110	180	-7.25	0.72	0.00
Average diastolic BP	348	92.59	9.52	70	120	348	88.15	8.42	65	110	-4.43	0.43	0.00
Average fasting glucose	182	9.01	3.28	4	21	182	8.38	3.14	4	20	-0.62	0.15	0.00

C. Pre-post comparison of quarter-level data

	Pre June 2010					**Post June 2010**					**T test**		
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Mean diff	Std. error	P value
Total expenditures by patient-quarter	602	355.01	775.69	3	7312	547	544.09	1070.82	3	11064	189.09	54.81	0.00
Expenditures covered by NCMS	602	169.26	480.83	0	4855	547	295.87	687.57	1	7138	126.61	34.76	0.00
Total out-of-pocket expenditures	602	185.75	313.26	2	3016	547	248.22	432.03	2	5026	62.47	22.12	0.00

(All data by quarter)	**Pre Jan 2011**					**Post Jan 2011**					**T test**		
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Mean diff	Std. error	P value
Total expenditures by patient-quarter	789	363.42	833.95	3	7548	360	623.87	1098.41	3	11064	260.45	58.82	0.00
Expenditures covered by NCMS	789	167.61	482.36	0	4855	360	365.24	762.40	1	7138	197.62	37.18	0.00
Total out-of-pocket expenditures	789	195.81	377.55	2	5026	360	258.63	368.34	2	3926	62.82	23.83	0.00

Appendix Table 4. Summary statistics by quarter: Both counties, hypertension patients.

A. Quarter-level data summary

	Obs	Mean	Std. Dev.	Min	Max	% of obs with non-zero
Total expenditures	1418	634.67	1103.43	2	11661	100.00%
Expenditures covered by NCMS	1418	353.08	697.91	0.28	7138	100.00%
Total out-of-pocket expenditures	1418	281.59	449.81	2	7841	100.00%

B. Pre-post comparison of patient-quarter-level data

	Pre June 2010					**Post June 2010**					**T test**		
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Mean diff	Std. error	P value
Average systolic BP	532	152.06	14.71	110	200	532	147.31	14.93	100	190	-4.75	0.51	0.00
Average diastolic BP	532	93.97	8.96	60	124	532	91.13	9.00	65	124	-2.84	0.35	0.00

C. Pre-post comparison of quarter-level data

	Pre June 2010					**Post June 2010**					**T test**		
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Mean diff	Std. error	P value
Total expenditures by patient-quarter	695	460.75	885.06	2	9585	723	801.86	1256.80	3	11661	341.12	57.93	0.00
Expenditures covered by NCMS	695	241.04	568.56	0	6101	723	460.78	788.37	1	7138	219.74	36.63	0.00
Total out-of-pocket expenditures	695	219.70	332.88	2	3484	723	341.08	532.30	2	7841	121.38	23.68	0.00

	Pre Jan 2011					**Post Jan 2011**					**T test**		
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Mean diff	Std. error	P value
Total expenditures by patient-quarter	946	498.52	991.08	2	9585	472	907.55	1257.16	3	11661	409.03	61.25	0.00
Expenditures covered by NCMS	946	259.80	616.64	0	6101	472	540.04	806.21	1	7138	280.24	38.63	0.00
Total out-of-pocket expenditures	946	238.72	400.31	2	5026	472	367.51	525.44	2	7841	128.79	25.13	0.00

Appendix Table 5. Summary statistics by quarter: Both counties, diabetes patients.

A. Quarter-level summary data

	Obs	Mean	Std. Dev.	Min	Max	% of obs with non-zero
Total expenditures	947	420.55	759.14	3	5996	100.00%
Expenditures covered by NCMS	947	205.56	471.85	0	3663	99.90%
Total out-of-pocket expenditures	947	214.99	309.59	2	2420	100.00%

B. Pre-post comparison of patient-quarter-level data

	Pre June 2010					**Post June 2010**					**T test**		
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Mean diff	Std. error	P value
Average systolic BP	179	134.40	16.23	95	190	179	131.96	14.07	95	185	-2.44	0.84	0.00
Average diastolic BP	179	84.73	8.82	60	105	179	84.01	8.40	60	102	-0.72	0.45	0.11
Average fasting glucose	253	8.93	2.66	4.21	20.6	253	8.51	2.54	4.21	19.8	-0.42	0.10	0.00

C. Pre-post comparison of quarter-level data

	Pre June 2010					**Post June 2010**					**T test**		
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Mean diff	Std. error	P value
Total expenditures by patient-quarter	512	413.83	787.89	3	5996	435	428.46	724.67	5	4617	14.63	49.52	0.77
Expenditures covered by NCMS	512	198.43	477.53	0	3663	435	213.95	465.49	1	2880	15.53	30.78	0.61
Total out-of-pocket expenditures	512	215.40	331.73	2	2421	435	214.50	281.68	4	2162	-0.90	20.20	0.96

	Pre Jan 2011					**Post Jan 2011**					**T test**		
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Mean diff	Std. error	P value
Total expenditures by patient-quarter	693	401.95	750.79	3	5996	254	471.29	780.71	5	4413	69.34	55.67	0.21
Expenditures covered by NCMS	693	188.38	450.58	0	3663	254	252.42	523.62	1	2880	64.04	34.57	0.06
Total out-of-pocket expenditures	693	213.56	320.30	2	2421	254	218.87	278.81	4	1894	5.31	22.72	0.82

Appendix Table 6. Summary statistics by quarter: County A, hypertension patients.

A. Quarter-level summary data

	Obs	Mean	Std. Dev.	Min	Max	% of obs with non-zero
Total expenditures	781	720.82	1116.73	2	11661	100.00%
Expenditures covered by NCMS	781	407.22	697.04	1	6101	100.00%
Total out-of-pocket expenditures	781	313.59	466.57	2	7841	100.00%
Drug expenditures per quarter	781	458.16	714.35	0	6807	88.51%
Drug spending covered by NCMS	781	238.76	404.33	0	3640	88.51%
Out-of-pocket drug expenditures	781	219.40	324.19	0	3167	88.51%

B. Pre-post comparison of patient-quarter-level data

	Pre June 2010					**Post June 2010**					**T test**		
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Mean diff	Std. error	P value
Average systolic BP	289	151.47	15.03	110	190	289	150.22	16.10	100	190	-1.25	0.59	0.04
Average diastolic BP	289	93.33	8.96	60	124	289	92.59	9.30	65	124	-0.74	0.42	0.08

C. Pre-post comparison of quarter-level data

	Pre June 2010					**Post June 2010**					**T test**		
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Mean diff	Std. error	P value
Total expenditures by patient-quarter	370	521.17	889.09	2	9585.05	411	900.55	1262.03	4	11660.68	379.39	78.92	0.00
Expenditures covered by NCMS	370	280.13	573.37	0.5	6101.04	411	521.64	775.09	1	5581.45	241.51	49.23	0.00
Total out-of-pocket expenditures	370	241.04	333.42	1.5	3484.01	411	378.91	552.31	3	7841.09	137.88	33.09	0.00
Drug expenditures	370	340.31	644.72	0	6807	411	564.25	756.89	0	5408.88	223.94	50.59	0.00
Drug spending covered by NCMS	370	169.02	355.34	0	3640	411	301.55	434.78	0	3245.33	132.54	28.60	0.00
Out-of-pocket drug expenditures	370	171.29	304.36	0	3167	411	262.70	335.57	0	2241.26	91.41	23.02	0.00

	Pre Jan 2011					**Post Jan 2011**					**T test**		
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Mean diff	Std. error	P value
Total expenditures by patient-quarter	519	574.12	1022.49	2	9585.05	262	1011.41	1234.67	10.9	11660.68	437.28	83.23	0.00
Expenditures covered by NCMS	519	313.36	659.21	0.5	6101.04	262	593.16	733.03	2.48	5180.34	279.79	51.90	0.00
Total out-of-pocket expenditures	519	260.76	380.02	1.5	3484.01	262	418.25	589.40	6.84	7841.09	157.49	34.93	0.00
Drug expenditures	519	363.63	682.03	0	6806.95	262	645.42	740.84	0	5346.72	281.80	53.22	0.00
Drug spending covered by NCMS	519	182.30	381.62	0	3640.17	262	350.61	425.02	0	3105.46	168.31	30.06	0.00
Out-of-pocket drug expenditures	519	181.32	314.86	0	3166.78	262	294.81	329.76	0	2241.26	113.49	24.25	0.00

Appendix Table 7. Summary statistics by quarter: County A, diabetes patients.

A. Quarter-level summary data

	Obs	Mean	Std. Dev.	Min	Max	% of obs with non-zero
Total expenditures	486	516.67	843.14	3.8	5996.15	100.00%
Expenditures covered by NCMS	486	260.52	528.97	0	3663.12	99.79%
Total out-of-pocket expenditures	486	256.16	333.84	3	2420.91	100.00%
Drug expenditures	486	345.07	571.90	0	4282.95	82.92%
Drug spending covered by NCMS	486	157.24	315.64	0	2569.77	82.92%
Out-of-pocket drug expenditures	486	187.83	270.30	0	1734.60	82.92%

B. Pre-post comparison of patient-quarter-level data

	Pre June 2010					**Post June 2010**					**T test**		
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Mean diff	Std. error	P value
Average systolic BP	93	134.19	15.86	95	185	93	133.09	15.27	95	185	-1.11	0.65	0.09
Average diastolic BP	93	83.61	9.04	60	100	93	84.11	9.06	60	102	0.49	0.47	0.30
Average fasting glucose	135	7.89	1.46	5	17	135	7.83	1.52	5	17	-0.05	0.07	0.44

C. Pre-post comparison of quarter-level data

	Pre June 2010					**Post June 2010**					**T test**		
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Mean diff	Std. error	P value
Total expenditures by patient-quarter	262	520.92	915.94	3.8	5996.15	224	511.70	751.10	10	4412.62	-9.22	76.80	0.90
Expenditures covered by NCMS	262	263.64	573.47	0	3663.12	224	256.87	472.90	2.5	2518.46	-6.77	48.19	0.89
Total out-of-pocket expenditures	262	257.28	363.49	3	2420.91	224	254.84	296.22	7	1894.16	-2.45	30.41	0.94
Drug expenditures	262	336.68	608.00	0	4282.95	224	354.87	527.74	0	3115.73	18.19	52.09	0.73
Drug spending covered by NCMS	262	154.59	336.24	0	2569.77	224	160.34	290.42	0	1527.65	5.75	28.75	0.84
Out-of-pocket drug expenditures	262	182.09	287.33	0	1734.60	224	194.53	249.38	0	1588.08	12.44	24.62	0.61

	Pre Jan 2011					**Post Jan 2011**					**T test**		
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Mean diff	Std. error	P value
Total expenditure by patient-quarter	366	497.85	841.94	3.8	5996.15	120	574.07	847.73	10	4412.62	76.22	88.72	0.39
Expenditures covered by NCMS	366	244.90	523.53	0	3663.12	120	308.16	544.71	3	2518.46	63.26	55.63	0.26
Total out-of-pocket expenditures	366	252.95	339.45	3	2420.91	120	265.92	317.31	7	1894.16	12.96	35.15	0.71
Drug expenditures	366	328.39	563.02	0	4282.95	120	395.91	597.71	0	3115.73	67.52	60.14	0.26
Drug spending covered by NCMS	366	145.90	308.18	0	2569.77	120	191.82	336.38	0	1527.65	45.92	33.17	0.17
Out-of-pocket drug expenditures	366	182.49	270.34	0	1734.60	120	204.09	270.66	0	1588.08	21.60	28.45	0.45

Appendix Table 8. Summary statistics by quarter: County B, hypertension patients.

A. Quarter-level summary data

	Obs	Mean	Std. Dev.	Min	Max	% of obs with non-zero
Total expenditures	637	529.05	1078.42	3.00	11063.52	100.00%
Expenditures covered by NCMS	637	286.70	693.78	0.28	7137.86	100.00%
Total out-of-pocket expenditures	637	242.35	425.46	2.25	5026.44	100.00%

B. Pre-post comparison of patient-quarter-level data

	Pre June 2010					**Post June 2010**					**T test**		
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Mean diff	Std. error	P value
Average systolic BP	243	152.76	13.10	120	200	243	143.86	12.63	120	180	-8.91	0.79	0.00
Average diastolic BP	243	94.74	8.89	70	120	243	89.40	8.33	65	110	-5.34	0.53	0.00

C. Pre-post comparison of quarter-level data

	Pre June 2010					**Post June 2010**					**T test**		
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Mean diff	Std. error	P value
Total expenditures by patient-quarter	325	391.96	876.74	5.00	7311.80	312	671.86	1239.93	3.00	11063.52	279.90	84.82	0.00
Expenditures covered by NCMS	325	196.55	560.59	0.28	4855.00	312	380.61	799.74	0.75	7137.86	184.07	54.54	0.00
Total out-of-pocket expenditures	325	195.41	331.11	3.00	3016.00	312	291.25	501.26	2.25	5026.44	95.83	33.53	0.00

	Pre Jan 2011					**Post Jan 2011**					**T test**		
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Mean diff	Std. error	P value
Total expenditures by patient-quarter	427	406.63	944.57	5.00	7548.36	210	777.98	1275.77	3.00	11063.52	371.35	89.76	0.00
Expenditures covered by NCMS	427	194.70	554.38	0.28	4855.00	210	473.77	886.46	0.75	7137.86	279.08	57.46	0.00
Total out-of-pocket expenditures	427	211.93	422.58	3.00	5026.44	210	304.21	425.58	2.25	3925.66	92.27	35.70	0.01

Appendix Table 9. Summary statistics by quarter: County B, diabetes patients.

A. Quarter-level summary data

	Obs	Mean	Std. Dev.	Min	Max	% of obs with non-zero
Total expenditures	461	319.21	644.66	2.60	5403.30	100.00%
Expenditures covered by NCMS	461	147.62	395.34	0.78	3601.04	100.00%
Total out-of-pocket expenditures	461	171.59	275.53	1.82	2161.92	100.00%

B. Pre-post comparison of patient-quarter-level data

	Pre June 2010					**Post June 2010**					**T test**		
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Mean diff	Std. error	P value
Average systolic BP	86	134.62	16.71	100	190	86	130.73	12.61	110	170	-3.88	1.59	0.02
Average diastolic BP	86	85.93	8.47	70	105	86	83.90	7.68	70	100	-2.03	0.75	0.01
Average fasting glucose	118	10.12	3.18	4.21	20.6	118	9.285085	3.171595	4.21	19.8	-0.84	0.19	0.00

C. Pre-post comparison of quarter-level data

	Pre June 2010					**Post June 2010**					**T test**		
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Mean diff	Std. error	P value
Total expenditures by patient-quarter	250	301.59	608.16	2.6	5403.30	211	340.08	686.28	5	4617.12	38.49	60.30	0.52
Expenditures covered by NCMS	250	130.09	337.78	0.78	3601.04	211	168.40	454.17	1.25	2879.6	38.31	36.96	0.30
Total out-of-pocket expenditures	250	171.51	289.07	1.82	1802.26	211	171.68	259.27	3.75	2161.92	0.17	25.79	0.99

	Pre Jan 2011					**Post Jan 2011**					**T test**		
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Mean diff	Std. error	P value
Total expenditures by patient-quarter	327	294.61	617.25	2.6	5403.3	134	379.25	705.95	5	3998	84.64	66.08	0.20
Expenditures covered by NCMS	327	125.13	341.29	0.78	3601.04	134	202.51	500.78	1.25	2879.6	77.38	40.43	0.06
Total out-of-pocket expenditures	327	169.48	291.68	1.82	2161.92	134	176.74	232.39	3.75	1492	7.26	28.29	0.80

Appendix Table 10. Summary statistics by visits: Both counties, all patients.

A. Summary statistics by day

	Obs	Mean	Std. Dev.	Min	Max	% of obs with non-zero
Total expenditures	4270	330.42	707.76	2	11661	100.00%
Expenditures covered by NCMS	4270	178.35	459.91	0	6101	99.95%
Total out-of-pocket expenditures	4270	152.07	272.95	1	7841	100.00%

B. Pre-post comparison of patient-day-level data

	Pre June 2010					**Post June 2010**					**T test**		
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Mean diff	Std. error	P value
Total expenditures by patient-day	1939	266.62	636.10	2	9585	2331	383.49	758.31	2	11661	116.87	21.68	0.00
Expenditures covered by NCMS	1939	135.60	408.58	0	6101	2331	213.90	495.88	0	6091	78.30	14.09	0.00
Total out-of-pocket expenditures	1939	131.01	236.99	2	3484	2331	169.59	298.52	1	7841	38.57	8.37	0.00

	Pre Jan 2011					**Post Jan 2011**					**T test**		
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Mean diff	Std. error	P value
Total expenditures by patient-day	2848	271.57	633.87	2	9585	1422	448.28	824.05	2	11661	176.71	22.82	0.00
Expenditures covered by NCMS	2848	135.97	401.33	0	6101	1422	263.20	549.48	0	6091	127.23	14.81	0.00
Total out-of-pocket expenditures	2848	135.59	244.08	2	3484	1422	185.07	320.68	1	7841	49.48	8.83	0.00

C. Patient-level data (N= 856)

	Mean	Std. Dev.	Min	Max
Age	58.23771	15.22435	21	81
% Male	0.42		0	1
Education				
% <= Elementary school	0.71		0	1
% Junior High	0.24		0	1
% High School	0.04		0	1
% Vocational School	0.00		0	1
% College	0.00		0	1
Profession				
% Farmers	0.98		0	1
% Non farmers	0.02		0	1
Primary diagnosis				

% Hypertension	0.65		0	1
% Diabetes	0.35		0	1
Visits	4.82	5.76	1	57
No of pre policy visits (June 2010)	2.19	3.16	0	21
No of post policy visits (June 2010)	2.63	3.45	0	36
No of pre policy visits (Jan 2011)	3.21	4.50	0	46
No of post policy visits (Jan 2011)	1.60	2.23	0	25

Appendix Table 11. Summary statistics by day: County A, all patients.

A. Summary statistics by day

	Obs	Mean	Std. Dev.	Min	Max	% of obs with non-zero
Total expenditures	2238	368.28	745.46	2	11661	100.00%
Expenditures covered by NCMS	2238	200.81	473.90	0	6101	99.96%
Total out-of-pocket expenditures	2238	167.48	297.48	1	7841	100.00%
Drug expenditures	2238	238.15	471.77	0	6807	85.97%
Drug spending covered by NCMS	2238	119.02	273.54	0	3640	85.92%
Out-of-pocket drug expenditures	2238	119.13	204.34	0	3167	85.97%

B. Pre-post comparison of day-level data

	Pre June 2010					**Post June 2010**					**T test**		
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Mean diff	Std. error	P value
Total expenditures by patient-day	1007	313.41	675.60	2	9585.05	1231	413.17	795.53	2	11661	99.77	31.61	0.00
Expenditures covered by NCMS	1007	165.00	436.91	0	6101.04	1231	230.10	500.41	0	5180	65.10	20.09	0.00
Total out-of-pocket expenditures	1007	148.41	248.01	1.5	3484.01	1231	183.07	331.80	1	7841	34.67	12.62	0.01
Drug expenditures	1007	202.74	458.14	0	6807	1231	267.11	480.89	0	5347	64.36	20.00	0.00
Drug spending covered by NCMS	1007	98.47	259.31	0	3640	1231	135.82	283.66	0	3105	37.36	11.60	0.00
Out-of-pocket drug expenditures	1007	104.27	205.23	0	3167	1231	131.28	202.89	0	2241	27.01	8.67	0.02

	Pre Jan 2011					**Post Jam 2011**					**T test**		
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Mean diff	Std. error	P value
Total expenditures by patient-day	1586	306.86	661.09	2	9585.05	652	517.69	902.18	2	11661	210.82	34.40	0.00
Expenditures covered by NCMS	1586	160.79	429.36	0	6101.04	652	298.15	556.31	0	5180	137.36	21.86	0.00
Total out-of-pocket expenditures	1586	146.08	240.84	1.5	3484.01	652	219.53	398.79	1	7841	73.46	13.75	0.00
Drug expenditures	1586	197.92	431.84	0	6807	652	336.00	545.20	0	5347	138.08	21.76	0.00
Drug spending covered by NCMS	1586	94.67	246.52	0	3640	652	178.24	322.79	0	3105	83.57	12.61	0.00
Out-of-pocket drug expenditures	1586	103.25	191.70	0	3167	652	157.76	227.82	0	2241	54.51	9.44	0.00

C. Patient-level data (N= 461)

	Mean	Std. Dev.	Min	Max
Age	57.76	16.37	21	80
% Male	0.46		0	1
Education				
% <= Elementary school	0.77		0	1

% Junior High	0.17		0	1
% High School	0.04		0	1
% Vocational School	0.00		0	1
% College	0.02		0	0
Profession				
% Farmers	0.98		0	1
% Non farmers	0.02		0	1
Primary diagnosis				
% Hypertension	0.67		0	1
% Diabetes	0.33		0	1
Visits	4.74	5.89	1	57
No of pre policy visits (June 2010)	2.13	3.13	0	21
No of post policy visits (June 2010)	2.61	3.53	0	36
No of pre policy visits (Jan 2011)	3.36	4.96	0	46
No of post policy visits (Jan 2011)	1.38	1.73	0	12

Appendix Table 12. Summary statistics by visits: County B, all patients.

A. Summary statistics by day

	Obs	Mean	Std. Dev.	Min	Max	% of obs with non-zero
Total expenditures	2032	288.71	661.45	2	7922	100.00%
Expenditures covered by NCMS	2032	153.61	442.79	0	6091	99.95%
Total out-of-pocket expenditures	2032	135.10	242.04	2	3016	100.00%

B. Pre-post comparison of patient-day-level data

	Pre June 2010					**Post June 2010**					**T test**		
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Mean diff	Std. error	P value
Total expenditures by patient-day	932	216.06	586.63	2	7312	1100	350.26	713.27	3	7922	134.20	29.30	0.00
Expenditures covered by NCMS	932	103.85	373.22	0	4855	1100	195.77	490.36	0	6091	91.92	19.61	0.00
Total out-of-pocket expenditures	932	112.22	223.10	2	3016	1100	154.49	255.50	2	2710	42.28	10.74	0.00

	Pre Jan 2011					**Post Jan 2011**					**T test**		
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Mean diff	Std. error	P value
Total expenditures by patient-day	1262	227.21	595.20	2	7312	770	389.50	747.14	3	7922	162.29	30.04	0.00
Expenditures covered by NCMS	1262	104.79	360.81	0	4855	770	233.61	542.24	0	6091	128.82	20.05	0.00
Total out-of-pocket expenditures	1262	122.42	247.55	2	3016	770	155.89	231.39	2	2710	33.47	11.05	0.00

C. Patient-level data (N= 395)

	Mean	Std. Dev.	Min	Max
Age	58.78	13.81	20	81
% Male	0.37		0	1
Education				
% <= Elementary school	0.64		0	1
% Junior High	0.32		0	1
% High School	0.04		0	1
% Vocational School	0.00		0	0
% College	0.01		0	1
Profession				
% Farmers	0.98		0	1
% Non farmers	0.02		0	1

Primary diagnosis				
% Hypertension	0.63		0	1
% Diabetes	0.37		0	1
Visits	4.91	5.61	1	54
No of pre policy visits (June 2010)	2.25	3.20	0	20
No of post policy visits (June 2010)	2.66	3.36	0	34
No of pre policy visits (Jan 2011)	3.05	3.91	0	29
No of post policy visits (Jan 2011)	1.86	2.67	0	25

Appendix Table 13. Summary statistics by visits: Both counties, hypertension patients.

A. Summary statistics by day

	Obs	Mean	Std. Dev.	Min	Max	% of obs with non-zero
Total expenditures	2386	402.28	820.91	1.90	11660.68	100.00%
Expenditures covered by NCMS	2386	226.78	536.78	0.28	6101.04	100.00%
Total out-of-pocket expenditures	2386	175.50	316.38	1.42	7841.09	100.00%

B. Pre-post comparison of patient-day-level data

	Pre June 2010					Post June 2010					T test		
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Mean diff	Std. error	P value
Total expenditures by patient-day	1008	297.23	719.60	2.00	9585.05	1378	479.13	880.07	1.90	11660.68	181.91	33.83	0.00
Expenditures covered by NCMS	1008	156.37	468.00	0.28	6101.04	1378	278.29	576.72	0.48	6090.90	121.91	22.11	0.00
Total out-of-pocket expenditures	1008	140.85	260.02	1.50	3484.01	1378	200.85	349.87	1.42	7841.09	59.99	13.06	0.00

	Pre Jan 2011					Post Jan 2011					T test		
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Mean diff	Std. error	P value
Total expenditures by patient-day	1485	317.58	733.18	2.00	9585.05	901	541.89	931.72	1.90	11660.68	224.3 2	34.37	0.00
Expenditures covered by NCMS	1485	165.50	469.79	0.28	6101.04	901	327.78	619.06	0.48	6090.90	162.2 8	22.43	0.00
Total out-of-pocket expenditures	1485	152.07	275.68	1.50	3484.01	901	214.11	370.88	1.42	7841.09	62.04	13.30	0.00

C. Patient-level data (N= 571)

	Mean	Std. Dev.	Min	Max
Age	58.23	16.36	20	81
% Male	0.48		0	1
Education				
% <= Elementary school	0.69		0	1
% Junior High	0.24		0	1
% High School	0.04		0	1
% Vocational School	0.00		0	0
% College	0.02		0	1
Profession				
% Farmers	0.97		0	1
% Non farmers	0.03		0	1

Primary diagnosis				
% Hypertension	100			
% Diabetes	0			
Visits	4.18	4.82	1	45
No of pre policy visits (June 2010)	1.77	2.57	0	17
No of post policy visits (June 2010)	2.41	3.02	0	28
No of pre policy visits (Jan 2011)	2.60	3.65	0	37
No of post policy visits (Jan 2011)	1.58	2.11	0	20

Appendix Table 14. Summary statistics by visits: Both counties, diabetes patients.

A. Summary statistics by day

	Obs	Mean	Std. Dev.	Min	Max	% of obs with non-zero
Total expenditures	1745	237.02	514.30	2.00	5055.10	100.00%
Expenditures covered by NCMS	1745	116.10	328.77	0.00	3355.70	99.89%
Total out-of-pocket expenditures	1745	120.92	198.50	1.50	2352.66	100.00%

B. Pre-post comparison of patient-day-level data

	Pre June 2010					**Post June 2010**					**T test**		
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Mean diff	Std. error	P value
Total expenditures by patient-day	855	236.21	539.72	2.00	5055.10	890	237.80	488.95	2.90	4617.12	1.59	24.6 4	0.95
Expenditures covered by NCMS	855	114.54	337.20	0.00	3355.70	890	117.60	320.64	0.00	2506.00	3.06	15.7 5	0.85
Total out-of-pocket expenditures	855	121.67	213.29	1.50	2352.66	890	120.20	183.27	2.17	2161.92	-1.47	9.51	0.88

	Pre Jan 2011					**Post Jan 2011**					**T test**		
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Mean diff	Std. error	P value
Total expenditures by patient-day	1261	220.90	500.91	2.00	5055.10	484	279.03	545.97	3.40	3998.00	58.13	27.47	0.03
Expenditures covered by NCMS	1261	103.53	308.94	0.00	3355.70	484	148.86	373.90	0.00	2506.00	45.33	17.55	0.01
Total out-of-pocket expenditures	1261	117.37	202.34	1.50	2352.66	484	130.17	187.99	2.21	1492.00	12.80	10.61	0.23

C. Patient-level data (N= 285)

	Mean	Std. Dev.	Min	Max
Age	57.88	13.18	21	79
% Male	0.30		0	1
Education				
% <= Elementary school	0.74		0	1
% Junior High	0.22		0	1
% High School	0.02		0	1
% Vocational School	0.00		0	0
% College	0.01		0	1
Profession				
% Farmers	0.99		0	1
% Non farmers	0.01		0	1

Primary diagnosis				
% Hypertension	0			
% Diabetes	100			
Visits	6.12	7.12	1	57
No of pre policy visits (June 2010)	3.00	3.93	0	21
No of post policy visits (June 2010)	3.12	4.23	0	36
No of pre policy visits (Jan 2011)	4.42	5.64	0	46
No of post policy visits (Jan 2011)	1.70	2.50	0	25

Appendix Table 15. Summary statistics by visits: County A, hypertension patients.

A. Summary statistics by day

	Obs	Mean	Std. Dev.	Min	Max	% of obs with non-zero
Total expenditures	1273	442.23	851.59	1.90	11660.68	100.00%
Expenditures covered by NCMS	1273	249.84	539.78	0.48	6101.04	100.00%
Total out-of-pocket expenditures	1273	192.39	346.26	1.42	7841.09	100.00%
Drug expenditures	1273	281.09	530.86	0.00	6806.95	88.10%
Drug spending covered by NCMS	1273	146.48	310.48	0.00	3640.17	87.98%
Out-of-pocket drug expenditures	1273	134.60	225.83	0.00	3166.78	88.10%

B. Pre-post comparison of patient-day-level data

	Pre June 2010					**Post June 2010**					**T test**		
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Mean diff	Std. error	P value
Total expenditures by patient-day	541	335.85	711.81	2.00	9585.05	732	520.85	934.37	1.90	11660.68	185.00	48.02	0.00
Expenditures covered by NCMS	541	181.01	467.05	0.50	6101.04	732	300.70	582.90	0.48	5180.34	119.69	30.43	0.00
Total out-of-pocket expenditures	541	154.84	252.80	1.50	3484.01	732	220.15	399.51	1.42	7841.09	65.30	19.55	0.00
Drug expenditures	541	217.80	495.86	0.00	6806.95	732	327.86	550.99	0.00	5346.72	110.07	29.95	0.00
Drug spending covered by NCMS	541	108.88	283.09	0.00	3640.17	732	174.28	326.69	0.00	3105.46	65.40	17.51	0.00
Out-of-pocket drug expenditures	541	108.92	218.32	0.00	3166.78	732	153.59	229.53	0.00	2241.26	44.67	12.75	0.00

	Pre Jan 2011					**Post Jan 2011**					**T test**		
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Mean diff	Std. error	P value
Total expenditures by patient-day	834	357.28	748.41	2.00	9585.05	439	603.62	1000.48	1.90	11660.68	246.34	49.76	0.00
Expenditures covered by NCMS	834	195.01	492.66	0.50	6101.04	439	354.00	606.59	0.48	5180.34	159.00	31.53	0.00
Total out-of-pocket expenditures	834	162.27	263.96	1.50	3484.01	439	249.62	458.99	1.42	7841.09	87.35	20.28	0.00
Drug expenditures	834	226.29	489.61	0.00	6806.95	439	385.20	588.16	0.00	5346.72	158.91	31.00	0.00
Drug spending covered by NCMS	834	113.45	283.22	0.00	3640.17	439	209.25	348.40	0.00	3105.46	95.80	18.12	0.00
Out-of-pocket drug expenditures	834	112.84	212.02	0.00	3166.78	439	175.95	244.95	0.00	2241.26	63.11	13.20	0.00

C. Patent-level data (N= 312)

	Mean	Std. Dev.	Min	Max
Age	57.87	17.31	20	80
% Male	0.52		0	1
Education				
% <= Elementary school	0.76		0	1

% Junior High	0.17		0	1
% High School	0.05		0	1
% Vocational School	0.00		0	0
% College	0.02		0	1
Profession				
% Farmers	0.97		0	1
% Non farmers	0.03		0	1
Primary diagnosis				
% Hypertension	100			
% Diabetes	00			
Visits	4.08	4.94	1	45
No of pre policy visits (June 2010)	1.73	2.62	0	17
No of post policy visits (June 2010)	2.35	2.99	0	28
No of pre policy visits (Jan 2011)	2.67	4.02	0	37
No of post policy visits (Jan 2011)	1.41	1.73	0	12

Appendix Table 16. Summary statistics by day: County A, diabetes patients.

A. Summary statistics by day

	Obs	Mean	Std. Dev.	Min	Max	% of obs with non-zero
Total expenditures	905	277.46	575.21	2	5055.10	100.00%
Expenditures covered by NCMS	905	139.90	368.22	0	3123.41	99.89%
Total out-of-pocket expenditures	905	137.56	217.51	1.5	2352.66	100.00%
Drug expenditures	905	185.31	380.85	0	3586.91	82.76%
Drug spending covered by NCMS	905	84.44	214.32	0	1993.75	82.76%
Out-of-pocket drug expenditures	905	100.87	173.83	0	1593.16	82.76%

B. Pre-post comparison of visit-level data

	Pre June 2010					**Post June 2010**					**T test**		
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Mean diff	Std. error	P value
Total expenditures by patient-day	431	299.93	651.30	2.00	5055.10	474	257.03	495.82	2.90	3588.46	-42.89	38.28	0.26
Expenditures covered by NCMS	431	153.83	411.87	0.00	3123.41	474	127.24	323.40	0.73	2415.54	-26.59	24.51	0.28
Total out-of-pocket expenditures	431	146.10	250.14	1.50	2352.66	474	129.80	182.80	2.17	1234.77	-16.30	14.48	0.26
Drug expenditures	431	191.87	422.92	0.00	3586.91	474	179.34	338.43	0.00	2506.59	-12.53	25.36	0.62
Drug spending covered by NCMS	431	89.91	235.49	0.00	1993.75	474	79.47	193.18	0.00	1407.95	-10.44	14.27	0.46
Out-of-pocket drug expenditures	431	101.96	195.07	0.00	1593.16	474	99.87	152.18	0.00	1098.64	-2.09	11.58	0.86

	Pre Jan 2011					**Post Jan 2011**					**T test**		
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Mean diff	Std. error	P value
Total expenditures by patient-day	704	258.83	557.36	2.00	5055.10	201	342.73	630.91	3.80	3588.46	83.90	45.94	0.07
Expenditures covered by NCMS	704	127.32	351.31	0.00	3123.41	201	183.98	420.17	0.83	2415.54	56.66	29.40	0.05
Total out-of-pocket expenditures	704	131.51	216.20	1.50	2352.66	201	158.76	221.28	2.28	1234.77	27.25	17.38	0.12
Drug expenditures	704	170.73	363.42	0.00	3586.91	201	236.36	433.59	0.00	2506.59	65.64	30.40	0.03
Drug spending covered by NCMS	704	75.85	200.79	0.00	1993.75	201	114.52	254.42	0.00	1407.95	38.67	17.10	0.02
Out-of-pocket drug expenditures	704	94.88	170.00	0.00	1593.16	201	121.84	185.57	0.00	1098.64	26.97	13.88	0.05

C. Patient-level data (N= 149)

	Mean	Std. Dev.	Min	Max
Age	57.11	14.67	21	79
% Male	0.34		0	1
Education				
% <= Elementary school	0.79		0	1

% Junior High	0.17		0	1
% High School	0.01		0	1
% Vocational School	0.01		0	1
% College	0.01		0	1
Profession				
% Farmers	1.00		1	1
% Non farmers	0.00		0	0
Primary diagnosis				
% Hypertension	0			
% Diabetes	100			
Visits	6.07	7.26	1	57
No of pre policy visits (June 2010)	2.89	3.80	0	21
No of post policy visits (June 2010)	3.18	4.44	0	36
No of pre policy visits (Jan 2011)	4.72	6.22	0	46
No of post policy visits (Jan 2011)	1.35	1.76	0	11

Appendix Table 17. Summary statistics by visits: County B, hypertension patients.

A. Summary statistics by day

	Obs	Mean	Std. Dev.	Min	Max	% of obs with non-zero
Total expenditures	1113	356.59	782.24	2.80	7921.92	100.00%
Expenditures covered by NCMS	1113	200.41	532.35	0.28	6090.90	100.00%
Total out-of-pocket expenditures	1113	156.18	277.20	2.10	3016.00	100.00%

B. Pre-post comparison of patient-day-level data

	Pre June 2010					**Post June 2010**					**T test**		
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Mean diff	Std. error	P value
Total expenditures by patient-day	467	252.48	726.73	2.80	7311.80	646	431.86	812.30	3.00	7921.92	179.39	47.23	0.00
Expenditures covered by NCMS	467	127.83	467.97	0.28	4855.00	646	252.88	569.02	0.63	6090.90	125.05	32.13	0.00
Total out-of-pocket expenditures	467	124.65	267.50	2.10	3016.00	646	178.98	282.03	2.25	2709.52	54.33	16.77	0.00

	Pre Jan 2011					**Post Jan 2011**					**T test**		
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Mean diff	Std. error	P value
Total expenditures by patient-day	651	266.72	710.53	2.80	7311.80	462	483.24	858.30	3.00	7921.92	216.53	47.16	0.00
Expenditures covered by NCMS	651	127.70	436.21	0.28	4855.00	462	302.87	630.33	0.75	6090.90	175.16	31.97	0.00
Total out-of-pocket expenditures	651	139.01	289.67	2.10	3016.00	462	180.37	256.98	2.25	2709.52	41.36	16.82	0.01

C. Patient-level data (N= 259)

	Mean	Std. Dev.	Min	Max
Age	58.64	15.19	20	81
% Male	0.44		0	1
Education				
% <= Elementary school	0.61		0	1
% Junior High	0.34		0	1
% High School	0.04		0	1
% Vocational School	0.00		0	0
% College	0.02		0	1
Profession				
% Farmers	0.97		0	1
% Non farmers	0.03		0	1
Primary diagnosis				

% Hypertension	100			
% Diabetes	0			
Visits	4.30	4.69	1	33
No of pre policy visits (June 2010)	1.80	2.52	0	13
No of post policy visits (June 2010)	2.49	3.05	0	21
No of pre policy visits (Jan 2011)	2.51	3.16	0	17
No of post policy visits (Jan 2011)	1.78	2.48	0	20

Appendix Table 18. Summary statistics by visits: County B, diabetes patients.

A. Summary statistics by day

	Obs	Mean	Std. Dev.	Min	Max	% of obs with non-zero
Total expenditures	193.45	435.51	2.40	4858.10	193.45	100.00%
Expenditures covered by NCMS	90.46	278.05	0.00	3355.70	90.46	99.88%
Total out-of-pocket expenditures	102.99	174.07	1.68	2161.92	102.99	100.00%

B. Pre-post comparison of patient-day-level data

	Pre June 2010					**Post June 2010**					**T test**		
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Mean diff	Std. error	P value
Total expenditures by patient-day	424	171.44	385.41	2.40	4858.10	416	215.88	480.67	3.40	4617.12	44.44	30.03	0.14
Expenditures covered by NCMS	424	74.60	232.26	0.72	3355.70	416	106.62	317.49	0.00	2506.00	32.02	19.17	0.10
Total out-of-pocket expenditures	424	96.83	164.37	1.68	1622.00	416	109.26	183.42	2.21	2161.92	12.43	12.01	0.30

	Pre Jan 2011					**Post Jan 2011**					**T test**		
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Mean diff	Std. error	P value
Total expenditures by patient-day	557	172.96	414.36	2.40	4858.10	283	233.78	472.55	3.40	3998.00	60.82	31.74	0.06
Expenditures covered by NCMS	557	73.46	242.13	0.72	3355.70	283	123.92	335.77	0.00	2506.00	50.46	20.24	0.01
Total out-of-pocket expenditures	557	99.50	181.95	1.68	2161.92	283	109.86	157.50	2.21	1492.00	10.37	12.71	0.41

C. Patient-level data (N= 136)

	Mean	Std. Dev.	Min	Max
Age	58.71	11.30	18	79
% Male	0.26		0	1
Education				
% <= Elementary school	0.68		0	1
% Junior High	0.28		0	1
% High School	0.04		0	1
% Vocational School	0.00		0	0
% College or above	0.00		0	0
Profession				
% Farmers	0.98		0	1
% Non-farmers	0.02		0	1
Primary diagnosis				

% Hypertension	0		0	0
% Diabetes	100		1	1
Visits	6.18	6.99	1	54
No of pre policy visits (June 2010)	3.12	4.07	0	20
No of post policy visits (June 2010)	3.06	4.00	0	34
No of pre policy visits (Jan 2011)	4.10	4.92	0	29
No of post policy visits (Jan 2011)	2.08	3.08	0	25

Appendix Table 19. County A: NCMS Reimbursement Policy (2009-2011)

<table>
<tr><th colspan="3">2009</th></tr>
<tr><td colspan="3">Out-patient</td></tr>
<tr><td>Village Clinics</td><td>(1) Family account: 30%
(2) Risk pooling account (统筹门诊)： 25%
(3) Use Chinese Herbal Medicine: 35%
(4) Use Traditional Chinese Medicine Appropriate Technology: 45%</td><td rowspan="2">For Tuberculosis (TB): 35%</td></tr>
<tr><td>County Clinics</td><td>Risk pooling account (统筹门诊): 20%</td></tr>
<tr><td colspan="3">In-patient</td></tr>
<tr><td>Village and Towns</td><td>(1) Reimbursement ratio: 45%
(2) Each hospitalization expense cannot exceed 10,000 RMB. The amount that exceeds 10,000 RMB is reimbursed by hospitals.</td><td rowspan="4">For Tuberculosis (TB):45%

Length of each stay for NCMS patient:
(1) Class II hospital: <=12 days
(2) Rehabilitation hospital: <=40days
(3) Below Class II hospital: <=9days

Each hospitalization expense for NCMS patient in Class I hospital cannot exceed 5,000 RMB.

Within the province level, no deductible for NCMS patients who have critical diseases including senile cataract, children with simple cleft lip, and congenital heart disease.</td></tr>
<tr><td>County</td><td>Reimbursement ratio:
(1) 35% if <=10,000 RMB
(2) 40% if 10,001-20,000 RMB
(3) 45% if 20,001-35000 RMB
(4) 70% if >35001 RMB</td></tr>
<tr><td rowspan="2">Above County Level</td><td>Reimbursement ratio:
(1) 30% if <=7,000 RMB
(2) 40% if 7,001-10,000 RMB
(3) 45% if 10,001-35,000 RMB
(4) 65% if >35,001 RMB</td></tr>
<tr><td>Actual reimbursement ratio:
(1) 90% of reimbursement amount (outside the county but in the city)
(2) 80% (outside the city but in the province)
(3) 70% (outside the province)</td></tr>
</table>

2010	
Out-patient	
Six critical diseases (Schizophrenia, tuberculosis, Kidney failure, Dialysis, Malignancy, Chemotherapy, Hemophilia, Organ transplant anti-rejection therapy)	(1) Below 100 RMB, same reimbursement ratio as general out-patient. (2) Above 100 RMB, reimbursement ratio 40% (3) Annual per capita ceiling: 8,000 RMB
Eleven special chronic diseases (Diabetes mellitus, Hypertension III, Sequela of apoplexy, Rheumatic arthritis, Rheumatoid arthritis, Systemic lupus, Pulmonary heart disease, Coronary heart disease, Erythematosus, Epilepsy, Aplastic anemia, Cirrhosis of the liver, Rheumatoid arthritis)	Deductible: 100 RMB (1) Above deductible, reimbursement ratio 35% (2) Annual per capita ceiling: 2,000 RMB
In-patient	
County, City and Above	Deductible: 500 RMB Reimbursement ratio at city level (1) 35% if 500-5,000 RMB (2) 40% if above 5,000 RMB Reimbursement ratio outside Tai An City: 35% if above Deductible
Direct subsidies for child birth	Township and County (1) Normal delivery: 300 RMB (2) Cesarean delivery: 400 RMB City (1) Normal Delivery: 200 RMB (2) Cesarean delivery: 300 RMB
No referral record , in NCMS hospitals outside the city but in the province	Reimbursement ratio: 60% of the required reimbursement
Annual per capita ceiling increase from 40,000 to 50,000 RMB	

2011	
Out-patient	
Village clinics and CHS (village)	Reimbursement ratio: 40%
TH and CHS (city)	Reimbursement ratio (1) General out-patient: 30% (2) **Use EML: 40%** (3) Use Traditional Chinese Medicine Appropriate Technology: 45%
Special chronic out-patient	(1) Deductible: 150 RMB, (2) Reimbursement ratio: 50% if above Deductible (3) Annual per capita ceiling: 3,000 RMB
Critical special disease out-patient	Severe psychosis, Tuberculosis: (1) Deductible: 500 RMB (2) Reimbursement ratio: 50% if above Deductible (3) Annual per capita ceiling: 10,000 RMB
	ESRD dialysis, Malignant tumors to radiotherapy and chemotherapy, Hemophilia, Organ transplant anti-row treatment: (1) No Deductible (2) Annual per capita ceiling: 20,000 RMB
In-patient	
Village and Town	(1) Deductible: 200 RMB (2) **EML (Chinese Herbal Medicine): reimbursement ratio 85% if above Deductible** **(3) EML (Others): reimbursement ratio 80% if above Deductible**
County	(1) Deductible: 400 RMB (2) Reimbursement ratio: 70% Chinese Herbal Medicine: 80%
City	(1) Deductible: 500 RMB (2) Reimbursement ratio: 45% if 500-50,000 RMB 50% if above 50,000 RMB
Province (outside city) and above	(1) Deductible 800 RMB (2) Reimbursement ratio: 45% if above Deductible
Annual per capita ceiling increases from 50,000 to 100,000 RMB	

Appendix Table 20. County B: NCMS Reimbursement Policy (2009-2011)

	2009	2010
General Out-patient		
Township health center and Village Clinics	Reimbursement ratio: (1) Western Medicine, Chinese Patent Medicine and Treatment fees: 30% (2) Chinese Herbal Medicine, Diagnostic examination: 40% (3) Traditional Chinese Medicine Appropriate Technology: 50% Annual per capita ceiling: 100 RMB	Reimbursement ratio: (1) Western Medicine, Chinese Patent Medicine, Treatment fees: 25% (2) Chinese Herbal Medicine, Diagnostic examination: 35% (3) Traditional Chinese Medicine Appropriate Technology: 45% Annual per capita ceiling: 100 RMB
Special chronic disease	Reimbursement ratio: (1) Under 100 RMB: 25% (2) Above 100 RMB: 45% Annual per capita ceiling: 5,000 RMB	Reimbursement ratio: (1) Under 100 RMB: 25% (2) Above 100 RMB: 40% Annual per capita ceiling: 8,000 RMB
General chronic disease		Reimbursement ratio: (1) Under 100 RMB: 25% (2) Above 100 RMB:35% Annual per capita ceiling: 5,000 RMB
In-patient		
Annual per capita ceiling	30,000 RMB	50,000 RMB
Class I	Deductible: 100 RMB, Reimbursement ratio: 65% if above Deductible	Deductible: 200 RMB, Reimbursement ratio: 65% if above Deductible
Class II	Deductible: 400 RMB, Reimbursement ratio: 45% if 400-10,000 RMB 50% if >10,0000 RMB	Deductible: 500 RMB, Reimbursement ratio: 40% if above Deductible
Class III (in Tai An City)	Deductible: 800 RMB, Reimbursement ratio: 30% if 800-10,000 RMB 40% if 10,000-20,000 RMB 50% if >20,000 RMB	Deductible 500 RMB, Reimbursement ratio: 35% if 500-5,000 RMB 40% if >5,000 RMB
Class III (Outside Tai An City)	Deductible: 800 RMB,	Deductible 500 RMB,

	Reimbursement Ratio: 27% if 800-10,000 RMB 36% if 10,000-20,000 RMB 45% if >20,000 RMB	Reimbursement Ratio 35% if above Deductible
Direct subsidies for child birth		Normal delivery: 300RMB Cesarean delivery: 400 RMB

2011	
General Out-patient	
Village Clinics	Reimbursement Ratio: (1) Western Medicine, Chinese Patent Medicine, Treatment fees: 40% (2) Chinese Herbal Medicine, Traditional Chinese Medicine Appropriate Technology: 50% Annual per capita ceiling: 150 RMB
Town Clinics	Reimbursement Ratio: (1) Western Medicine, Chinese Patent Medicine, Treatment fees: 25% (2) Chinese Herbal Medicine 35% Traditional Chinese Medicine Appropriate Technology: 45% (3) **EML: increase by 10%** Annual per capita ceiling: 150 RMB
Special disease Out-patient	
Special chronic diseases (**Diabetes mellitus**, Sequela of apoplexy, Rheumatic arthritis, Rheumatoid arthritis, Systemic lupus erythematosus, Epilepsy, Aplastic anemia, Cirrhosis of the liver)	**Reimbursement ratio: 50% if above 150 RMB** Annual per capita ceiling: 3,000 RMB
Critical diseases (Severe psychosis, Tuberculosis)	Reimbursement ratio: 50% if above 500 RMB Annual per capita ceiling: 10,000 RMB
General In-patient	
Class I	Deductible 200 RMB, Reimbursement ratio: 80% if above Deductible EML: 85%
Class II (County)	Deductible 500 RMB, Reimbursement ratio: 60% if above Deductible
Class III (in Tai An City)	Deductible 500 RMB, Reimbursement ratio:

	(1) 45% if 500-5,000 RMB (2) 50% if >5,000 RMB
Class III (Outside Tai An City):	Deductible 800 RMB, Reimbursement Ratio: 45% if above Deductible
Critical Disease In-patient	
Childhood leukemia, Children with congenital heart disease, Children with simple cleft lip, Severe mental illness, Breast cancer, Cervical cancer, End-stage kidney cancer, Hemophilia	Reimbursement Ratio: 70% if within the limit The amount that exceeds the limit is paid by the hospital.