Varying Pharmacy Benefits With Clinical Status: The Case of Cholesterol-lowering Therapy

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Objective: To determine whether a pharmacy benefit that varies copayments for cholesterol-lowering (CL) therapy according to expected therapeutic benefit would improve compliance and reduce use of other services.

Methods: Using claims data from 88 health plans, we studied 62 274 patients aged 20 years and older who initiated CL therapy between 1997 and 2001. We examined the association between copayments and compliance in the year after initiation of therapy, and the association between compliance and subsequent hospital and emergency department (ED) use for up to 4 years after initiation.

Results: The fraction of fully compliant patients fell by 6 to 10 percentage points when copayments increased from $10 to $20, depending on patient risk ($P < .05$). Full compliance was associated with 357 fewer hospitalizations annually per 1000 high-risk patients ($P < .01$) and 168 fewer ED visits ($P < .01$) compared with patients not in full compliance. For patients at low risk, full compliance was associated with 42 fewer hospitalizations ($P = .02$) and 21 fewer ED visits ($P = .22$). Using these results, we simulated a policy that eliminated copayments for high- and medium-risk patients but raised them (from $10 to $22) for low-risk patients. Based on a national sample of 6.3 million adults on CL therapy, this policy would avert 79 837 hospitalizations and 31 411 ED admissions annually.

Conclusion: Although many obstacles exist, varying copayments for CL therapy by therapeutic need would reduce hospitalizations and ED use—with total savings of more than $1 billion annually.

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Prescription drugs have been shown to be very cost-effective treatments for chronic illness; they forestall complications, reduce attendant medical utilization, and make patients more productive.[1,2] But with recent increases in pharmacy spending, benefit managers have adopted policies designed to reduce use of pharmaceuticals. Usually, these policies involve increasing patient copayments for brand medications, sometime to as much as $50 for a 1-month supply. Although several studies have shown that these measures substantially reduce health plan payments and overall drug spending,[3-5] they may adversely affect the health of plan enrollees.

A more promising approach links the patient copayment to therapeutic benefit. First advocated by Fendrick et al,[6] such plans offer reduced copayments for patients who are most likely to benefit from a drug or class of drugs, as determined by using the best available clinical evidence. Patients for whom the therapeutic benefit is modest—or the evidence is mixed—face higher copayments. By linking copayments with individual clinical need, plans can encourage cost-effective care without unpopular utilization controls such as prior authorization.

Cholesterol-lowering (CL) drugs, the most commonly prescribed class of medications in the United States, are well suited for a benefit-based–copayment (BBC) scheme. First, patients prescribed these medications often have difficulty adhering.[7-11] Second, clinical studies (the Long-Term Intervention with Pravastatin in Ischemic Disease study, the Cholesterol and Recurrent Events study, the Scandinavian Simvastatin Survival Study, the West of Scotland Coronary Prevention Study [WOSCOPS], the Air Force/Texas Coronary Atherosclerosis Prevention Study, the Heart Protection Study) have demonstrated the efficacy of CL drugs in preventing coronary heart disease (CHD). In addition, CL drugs have well-established dose-response curves such that a patient using a suboptimal dose will benefit less from therapy than a patient who fully complies. Finally, there is sufficient clinical evidence to determine the patient-specific medical benefits. Although CL drugs are beneficial for patients with average cholesterol levels, they are more effective in reducing cardiac events and mortality for those at high CHD risk.[12]

In this paper, we modeled a BBC for CL therapy wherein copayments are allowed to vary by clinical status. We found that eliminating copayments for patients

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with high CHD risk—and raising them for low-risk patients to offset the higher cost to plans—would reduce hospitalizations and emergency department (ED) visits overall among the privately insured and Medicare-insured populations on CL therapy.

METHODS

First, we examined the relationship between copayments and compliance. Second, we examined how compliance is associated with subsequent use of expensive services (ie, hospitalizations, EDs). The salient details are discussed below; a technical appendix providing more information is available from the authors.

Sample

We assembled a dataset of pharmacy and medical claims from 1997 to 2002 from 88 health plans and 25 employers. We restricted our attention to the 62 774 adults (age ≥20 years) who initiated CL therapy. Initiation of therapy was defined as the absence of any pharmacy claim in the same therapeutic class in the prior 6 months. To be eligible for our sample, a patient had to be continuously enrolled for at least 1 year before and after initiating therapy. For each prescription, we observed the fill date, type and dose of CL drug, total days supplied, patient out-of-pocket expense, and payments made by all third-party payers. We constructed the average daily price for each individual by dividing the total out-of-pocket expenses for CL agents by the total days supplied. All prices were inflated to 2004 dollars using the medical services consumer price index.

Compliance

We measured compliance using the medication possession ratio (MPR). We computed the total days supplied of CL medications purchased over the subsequent 12 months (or 12 prescriptions) to compute the percentage of compliant days for each individual in the sample. Standard practice is to assign patients to compliance classes based on the MPR or proportion of days covered.[7,8,10,11,13-15] Using the MPR, we classified patients into 10 categories (1 = MPR less than 10%, 2 = MPR between 10% and 19%, and so on). Days spent in the hospital were assumed to be compliant days.

Copayments and Compliance. We estimated an ordered logit model to account for our polychotomous measure of compliance (1 through 10) and its natural ordering. Explanatory variables included age, sex, marital status, median household income in the patient's zip code, number of 30-day equivalent prescriptions for non-CL therapy, health conditions, and the patient's average out-of-pocket expense (ie, copayment) for a 30-day supply of CL therapy. The model included interactions between the average copayment and risk factors for major coronary events (eg, age, sex, diabetes, heart disease). In this way, the model allowed the effects of copayments to vary with each patient's clinical status. The model also included a set of binary indicators for the health plan and year. We used the estimates from the model to predict the impact on compliance when copayments are doubled. For ease of reporting, we grouped patients into 3 compliance categories: fully compliant (MPR ≥ 80%); partially compliant (MPR between 20% and 79%), and noncompliant (MPR < 20%).

Compliance and Service Use. We also estimated the impact of compliance in prior years on the number of hospitalizations and ED visits and the number of cardiovascular-related hospitalizations and ED admissions. WOSCOPS indicated that the greatest benefits of reduced morbidity were achieved in patients who took more than 75% of their medications.[16] Wei et al also found that compliance above 80% reduced the recurrence of myocardial infarction in a 6-year follow-up study.[17] Thus, we regressed annual utilization at time (t) on a binary indicator for full compliance (MPR ≥ 80%) over the previous years (t - n), where n = 1 to 4. We used full compliance averaged over multiple years rather than just the prior year to capture the cumulative effects of compliance. Models using the previous year's full compliance yielded similar results. The model included the demographic variables and binary indicators for health plan and year as described above, as well as individual random effects to capture unobserved heterogeneity across patients.

Risk Groups

We classified patients into 3 CHD risk groups using information available in medical claims. All patients were assigned a risk score based on age, sex, and comorbid conditions, and then were grouped by tercile into groups at high, medium, or low risk for CHD. Risk associated with age and sex was assigned based on the Framingham point system; patients with existing diabetes, myocardial infarction, ischemic heart disease, angina, atherosclerosis, or vascular disease were automatically assigned to the high-risk group. Sensitivity analysis using several other risk classification schemes—including a modified Framingham point system using smoking, blood pressure, and cholesterol levels from national data—yielded similar results.

Benefit Scenarios

We used estimates from both the compliance and service-use models to estimate the impact of 2 alterna-

tive BBC designs relative to a base case of a $10 copayment for all patients (the modal copayment). We derived the predictions by first estimating compliance using our copayment and compliance model, and then predicting hospitalizations and ED visits with the compliance and service-use models. The first scenario was chosen to keep total pharmacy payments unchanged. Patients at high and medium risk had no copayments while copayments for low-risk individuals were increased from $10 to $22. In the second scenario, medium- and high-risk patients received the medication for free, while low-risk patients still paid $10. The estimates were computed assuming 6.3 million privately insured or Medicare-insured adults on CL therapy in the United States, as calculated using the 1999-2000 National Health and Nutrition Examination Survey. Medicare patients were included in anticipation of the forthcoming Part D drug benefit; dual eligibles with Medicaid coverage were not included because they pay little or nothing for prescription drugs.

RESULTS

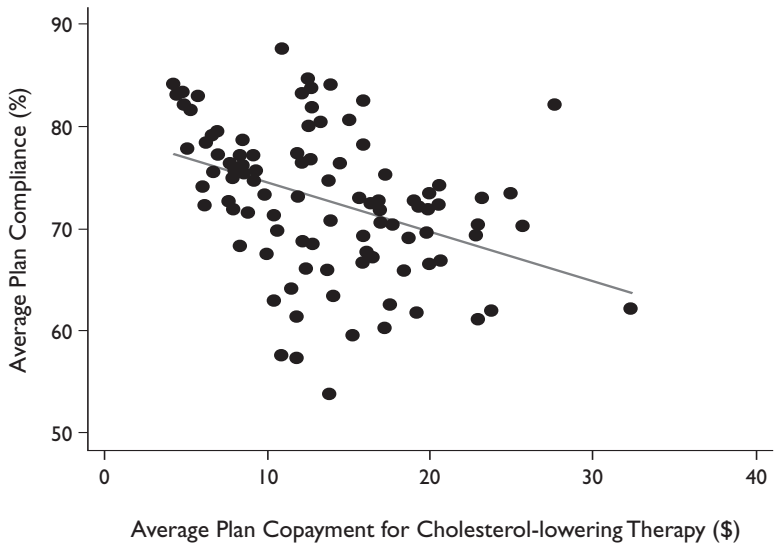
Table 1 shows the characteristics of the sample by CHD risk. By construction, individuals at higher CHD risk were older and sicker; those with a prior history of diabetes or heart disease automatically were assigned to the highest risk group. High- and medium-risk patients paid $9 on average for a 30-day supply of their CL medications, compared with $14 for low-risk patients. In part, this difference reflected lower prices paid by elderly beneficiaries coupled with greater use of mail-order pharmacies. High-risk patients also were the most compliant, filling prescriptions for 281 days per

Table 1. Characteristics of Privately Insured Patients Who Initiated Lipid-lowering Therapy Between 1997 and 2001*

	CHD Risk					
	Low (n = 21 249)		Medium (n = 21 335)		High (n = 20 190)	
Characteristic	Mean	SD	Mean	SD	Mean	SD
Demographics						
Age, y	49	7	70	6	66	11
Male, %	67		47		59	
Married, %	38		30		30	
Median household income, $	30 563	7167	29 406	5794	29 137	5705
Health conditions at start of therapy						
Heart disease, %	0		0		69	
Diabetes, %	0		0		48	
Hypertension, %	19		33		42	
Lipid disorder, %	19		22		21	
No. of other conditions	0.34	0.68	0.52	0.86	0.76	1.04
No. of 30-day–equivalent non–cholesterol-lowering scrips during the follow-up year	23	23	36	28	55	36
Prescription information						
Days supplied (per prescription)	49	26	61	31	62	31
Copayment, $	14	9	9	7	9	7
Compliance						
Annual compliance, days	245	116	273	109	281	105
Fully compliant, %	49		61		63	
Partially compliant, %	38		30		29	
Noncompliant, %	13		9		8	
Annual utilization (per 1000 statin users)						
No. of hospitalizations	0.15	0.6	0.38	1.58	0.74	2.12
No. of circulatory-related hospitalizations	0.06	0.31	0.13	0.56	0.34	0.91
No. of ED visits	0.11	0.54	0.24	0.68	0.46	1.02
No. of circulatory-related ED visits	0.02	0.14	0.04	0.25	0.11	0.45

CHD indicates coronary heart disease; ED, emergency department.
*Shown are summary statistics for 62 774 privately insured patients who initiated statin therapy from 1997 to 2001. Heart disease includes a diagnosis of a myocardial infarction, ischemic heart disease, angina, atherosclerosis, or vascular disease. Compliance measures are based on the number of days prescriptions are supplied in the year after initiation of therapy. *Fully compliant* means filling prescriptions to cover at least 80% of the year, *partially compliant* means filling prescriptions to cover 20% to 79% of the year, and *noncompliant* means filling prescriptions to cover less than 20% of the year. Utilization statistics come from follow-up of the subset of 7231 patients who initiated statin therapy in 1997 or 1998 and who were subsequently followed from 1999 to 2002. Higher risk patients had more comorbidity, were more compliant, and used more services.

Figure 1. Relationship Between Average Copayments and Average Compliance in Health Plans*



*Average copayment for each plan-year is for a 30-day supply of cholesterol-lowering therapy.

year (77% of total days) compared with 245 days (67%) for those at low risk of CHD. Higher risk also was associated with more hospitalizations and ED visits. In sum, higher risk patients had more comorbidity and were more compliant—perhaps due to lower copayments—but they also used more services.

Figure 1 depicts the relationship between copayments and compliance at the plan level. Each data point shows the average copayment and average compliance for a given year in plans with at least 50 beneficiaries receiving CL therapy (n = 99 plan-years). There is a large, inverse relationship between copayments and compliance. For each $10 rise in copayments, average compliance in a plan-year falls by 5 percentage points ($P < .01$).

Figure 2 shows the predicted effects of doubling copayments based on our ordered logit model, which adjusts the copayment response for individual characteristics. About 60% of patients at high and medium risk for CHD fully complied (MPR > 80%) with CL therapy when faced with a $10 copayment, compared with 52% of patients at low risk for CHD. Compliance fell in all risk groups when copayments doubled from $10 to $20 ($P < .05$ for all risk groups). After controlling for individual characteristics, there was no strong differential by risk group in the size of the response; full compliance dropped by 6 to 10 percentage points.

Having established a relationship between copayments and compliance, the question arises whether compliance is associated with use of medical services. **Table 2** shows the predicted number of hospitalizations and ED visits for different levels of compliance and CHD risk. Like WOSCOPS[16] and Wei et al,[17] we focused on the effects of full compliance. Better compliance has less impact on use of medical care for those at low risk for CHD than for those at high risk. For each 1000 CL users at high risk of CHD, there would be 643 hospitalizations and 413 ED visits per year among those who fully complied with drug therapy in prior years. Those rates increased to 1000 and 581, respectively, for partial compliers and noncompliers. The medium-risk CL users showed similar patterns. In contrast, the number of hospitalizations and ED visits among the groups at low risk of CHD decreased only modestly with full compliance. These findings suggest that lowering copayments for those at high risk for CHD and raising copayments for those at low risk could reduce aggregate medical-care utilization and expenditures.

Table 3 shows the effects on the sample of 6.3 million CL users of 2 designs for BBCs. The base case is a $10 copayment for all patients. Under scenario 1, high- and medium-risk patients faced no copayment and low-risk patients had copayments of $22. Compared with the base case, full compliance increased 9 percentage points among the high-risk group (62% to 71%) and 10 percentage points among the medium-risk group (59% to 69%), and decreased from 52% to 44% among the low-risk group. There was no change in aggregate health plan payments for drugs because reduced use by the low-risk group was offset by increased use by the high-risk group. The high- and medium-risk groups had no out-of-pocket payments, but out-of-pocket payments by the low-risk group increased $280 million (from $272 million to $552 million). This scenario averted 79 837 hospitalizations overall, even after accounting for an additional 10 406 hospitalizations among the low-risk group. Similarly, ED use was reduced in aggregate by 31 411. Scenario 2 eliminated copayments for high- and medium-risk patients with no change in copayments for low-risk patients. This benefit increased prescription drug spending by health plans ($486 million) and lowered spending by patients ($311 million). Scenario 2 resulted in 90 243 fewer hospitalizations and 36 493 fewer ED admissions compared with the base case.

The additional $486 million health plans paid for drugs in scenario 2 should be gauged against the savings associated with reduced hospitalizations. Our data showed that the average hospitalization of a high-risk

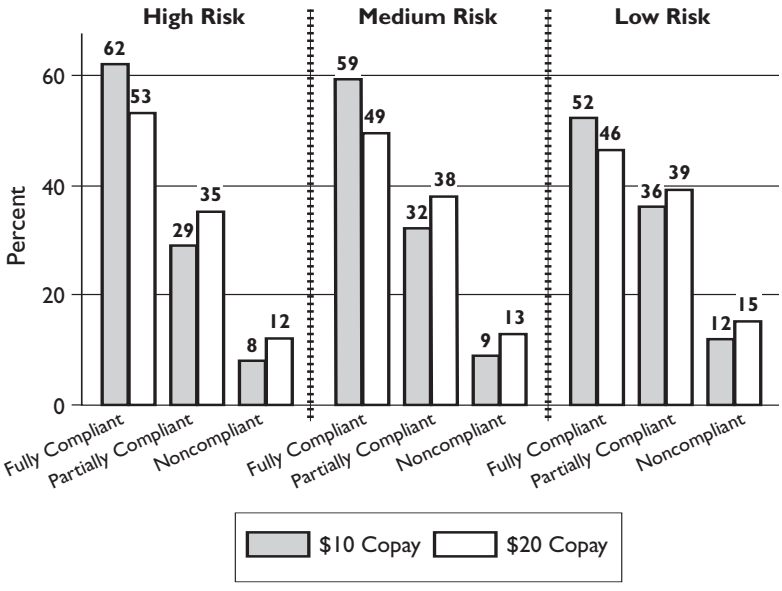
CL user cost $10 093; costs for medium- and low-risk hospitalizations were somewhat lower ($8177 and $7041, respectively). Applying these costs to the hospitalization reductions from scenario 2 yields inpatient savings of around $1 billion, not including savings from reduced ED visits.

DISCUSSION

Improving compliance with therapy is a primary goal of public health, and many interventions exist. In this study, we considered how financial incentives could be better used as a public health tool. We found that a BBC design can reduce hospitalizations and ED visits among patients initiating CL therapy. Perhaps more importantly, these benefits can be achieved without increasing a health plan's pharmacy costs. The benefits are achieved by lowering copayments for those who benefit most for treatment (ie, those at the greatest risk of a CHD event), thereby improving their compliance with treatment and reducing use of costly medical services.

Our scenarios with BBCs (Table 3) reduced the number of hospitalizations

Figure 2. Relationship Between Copayments and Compliance for Privately Insured Patients on Lipid-lowering Therapy*



*Shown are predicted compliance levels for 62 774 privately insured patients who initiated statin therapy from 1997 to 2001. Results were adjusted for demographic and health conditions shown in Table 1, as well as copayment levels and interactions of copayment with age, sex, diabetes, hypertension, heart condition, and a lipid disorder. Also included are dummy variables for the year of initiation and the health plan. *Fully compliant, partially compliant,* and *noncompliant,* and risk categories are defined as in Table 1. Predictions were made at 2 levels of copayments: $10 and $20. The figure shows that high-risk patients were more likely to comply at any copayment level; and copayments had a strong and significant effect on compliance ($P < .01$ for low risk; $P = .02$ for medium risk; and $P = .03$ for high risk).

Table 2. Adjusted Utilization Rates as a Function of Compliance for Privately Insured Patients Initiating Lipid-lowering Therapy*

	Risk of CHD and Compliance Level								
	High			Medium			Low		
Utilization	Full	Partial/Non	*P*	Full	Partial/Non	*P*	Full	Partial/Non	*P*
Hospitalizations									
All	643	1000	<.01	286	550	<.01	133	175	.02
Circulatory only	287	475	<.01	112	162	<.01	52	71	.05
ED visits									
All	413	581	<.01	213	295	<.01	105	126	.22
Circulatory only	102	151	<.01	37	47	.06	15	16	.88

CHD indicates coronary heart disease; ED, emergency department.
*Shown are adjusted utilization rates per 1000 patients who initiated cholesterol-lowering therapy in 1997 or 1998. The estimates come from linear regression models estimating utilization in 1999, 2000, 2001, and 2002 (n = 21 236 person-years) as a function of previous compliance (full or partial/noncompliant), and the demographic and health conditions shown in Table 1. Also included were year and health plan indicator variables. Improved compliance was associated with significant reductions in the number of hospitalizations and ED visits for all risk groups, but the largest improvements were among the high-risk and medium-risk groups.

Table 3. Outcomes Under 2 Scenarios Wherein Copayments Vary With Clinical Risk*

Outcome	Base Case ($10 Copayment)	Scenario 1		Scenario 2	
		Estimate	Difference vs Base Case	Estimate	Difference vs Base Case
Copayment (dollars per 30-day prescription)†					
High risk	10	0		0	
Medium risk	10	0		0	
Low risk	10	22		10	
Full compliance, %					
High risk	62	71	+9	71	+9
Medium risk	59	69	+9	68	+9
Low risk	52	44	−8	52	+0
Health plan pharmacy payments, $‡	4340	4370	+30	4826	+486
Out-of-pocket payments, $‡					
High risk	168	0	−168	0	−168
Medium risk	143	0	−143	0	−143
Low risk	272	552	+280	272	+0
Total	**583**	**552**	**−31**	**272**	**−311**
No. of hospitalizations					
High risk	1 350 096	1 297 189	−52 907	1 297 189	−52 907
Medium risk	597 070	559 734	−37 336	559 734	−37 336
Low risk	465 190	475 596	+10 406	465 190	+0
Total	**2 412 356**	**2 332 519**	**−79 837**	**2 322 113**	**−90 243**
No. of circulatory-related hospitalizations					
High risk	621 364	593 503	−27 861	593 503	−27 861
Medium risk	200 643	193 572	−7071	193 572	−7071
Low risk	184 801	189 157	+4356	184 801	+0
Total	**1 006 808**	**976 232**	**−30 576**	**971 876**	**−34 932**
No. of ED visits					
High risk	827 045	802 148	−24 897	802 148	−24 897
Medium risk	373 445	361 849	−11 596	361 849	−11 596
Low risk	350 804	355 886	+5082	350 804	+0
Total	**1 551 294**	**1 519 883**	**−31 411**	**1 514 801**	**−36 493**
No. of circulatory-related ED visits					
High risk	209 173	201 911	−7262	201 911	−7262
Medium risk	62 233	60 819	−1414	60 819	−1414
Low risk	47 202	47 444	+242	47 202	+0
Total	**318 608**	**310 174**	**−8434**	**309 932**	**−8676**

ED indicates emergency department.
*Shown are estimates of outcomes for the 6.3 million privately insured statin users under the base case and the 2 scenarios. The first scenario increases compliance among higher risk patients at the expense of lower risk patients. It still results in fewer hospitalizations and ED visits overall. The second scenario results in even greater reductions in hospitalizations and ED visits.
†Values used in the scenario.
‡Millions of 2004 dollars.

by approximately 80 000 to 90 000 annually and the number of ED visits by 30 000 to 35 000, resulting in net aggregate savings of more than $1 billion. These savings would largely accrue to health plans initially, but ultimately they would be passed back to beneficiaries in the form of reduced premiums (or, more realistically, premiums that do not rise annually by as much as they otherwise would have). However, these savings could be used in other ways. In particular, the savings could be used to compensate the low-risk patients (who faced higher copayments in scenario 1).

The effects we saw are qualitatively similar to the benefits of compliance reported elsewhere and anecdotal evidence from the private sector.[13,18-20] The Pitney

Bowes company lowered cost-sharing for diabetes and asthma medications to increase access and compliance. Overall spending among these employees fell by about 12%, primarily due to large reductions in ED use and hospitalizations.

Several issues need to be addressed before implementing a BBC design. First, our study only looked at patients who had already initiated therapy. Changing copayments also would affect the number of patients who start therapy. However, it is clear that lower copayments for high-risk patients also would be likely to improve initiation rates, with an attendant improvement in population health. On the other hand, higher copayments for low-risk patients would adversely affect initiation. Because the benefits of CL therapy are attenuated for this risk group, a lower rate of initiation of therapy may not be a large problem.

Second, the relevant risk groups need to be refined. We experimented with many different risk classifications and benefit designs. Some were less complex (eg, low and high risk based on disease only). Others were more complicated, including estimated 10-year CHD risk using the Framingham point system and data from the 1999-2000 National Health and Nutrition Examination Survey. In all cases, we found that BBC designs could improve aggregate health outcomes without raising health plan pharmacy payments.

Third, by charging more to patients in relatively better health, a BBC design could attract patients in worse health and discourage those in better health. In reality, such concerns are likely to be modest. Most firms offer their employees a choice of medical plans, but a single drug benefit. Thus, selection is largely determined by the generosity of the medical plan. Nonetheless, BBC plans need to be careful about penalizing healthy behavior. Patients with elevated cholesterol who do not have other risk factors do not want to be told that their drugs are expensive because they are so healthy. One way to offset these incentives is to reward low-risk members who take preventive measures, such as by offering them financial or other rewards if they have their cholesterol monitored regularly and stay under a target level for low-density lipoprotein cholesterol.

Finally, not all classes of drugs are amenable to a BBC design. Clearly, information is needed on how treatment efficacy differs across patients, and these data must be inexpensive to collect. Cholesterol-lowering therapy is a useful prototype because CHD risk and cholesterol levels are easily monitored and reported at low cost. However, if risk stratification required an expensive genetic test or medical procedure, the cost savings from a BBC design might not justify the collection of the clinical information (and would certainly alienate patients if it was done solely for the purposes of determining copayments).

One limitation of this study is that the relationships observed here among compliance, copayments, and service use may not reflect true causal effects. For example, patients who develop new comorbid conditions may be reluctant to continue their medications, and they also are more likely to be hospitalized. This situation would induce a spurious negative correlation between hospital use and compliance. Our use of longitudinal data with a lagged compliance measure mitigates some of this concern. Furthermore, the relationship between compliance and copayments remained strong even at the plan level (Figure 1). Poor compliance often can be attributed to perceived ineffectiveness, side effects, high costs, and simple forgetfulness. Although a BBC design directly addresses the cost issue, it indirectly signals to a patient the importance of long-term drug therapies to treat conditions with few or no physical symptoms.

CONCLUSION

The challenge for the healthcare system is to make patients more sensitive to the cost of treatment without encouraging them to forego cost-effective care. Health plans increasingly recognize the need to differentiate coverage based on demonstrated value. For example, some health plans have eliminated copayments for some generic drugs, while others now assign drugs to tiers based on their cost effectiveness. The problem with these approaches is that clinical efficacy of any drug varies across patients.

We showed that strategically reducing copayments for patients who are most at risk can improve overall compliance and reduce use of other expensive services. In an era of consumer-directed healthcare and improved information technology, tailoring copayments to a patient's expected therapeutic benefit can increase the clinical and economic efficacy of prescription medications.

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