Effects of Increased Patient Cost Sharing on Socioeconomic Disparities in Health Care

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BACKGROUND: Increasing patient cost sharing is a commonly employed mechanism to contain health care expenditures.

OBJECTIVE: To explore whether the impact of increases in prescription drug copayments differs between high- and low-income areas.

DESIGN: Using a database of 6 million enrollees with employer-sponsored health insurance, econometric models were used to examine the relationship between changes in drug copayments and adherence with medications for the treatment of diabetes mellitus (DM) and congestive heart failure (CHF).

SUBJECTS: Individuals 18 years of age and older meeting prespecified diagnostic criteria for DM or CHF were included.

MEASUREMENTS: Median household income in the patient's ZIP code of residence from the 2000 Census was used as the measure of income. Adherence was measured by medication possession ratio: the proportion of days on which a patient had a medication available.

RESULTS: Patients in low-income areas were more sensitive to copayment changes than patients in high- or middle-income areas. The relationship between income and price sensitivity was particularly strong for CHF patients. Above the lowest income category, price responsiveness to copayment rates was not consistently related to income.

CONCLUSIONS: The relationship between medication adherence and income may account for a portion of the observed disparities in health across socioeconomic groups. Rising copayments may worsen disparities and adversely affect health, particularly among patients living in low-income areas.

KEY WORDS: health care costs; socioeconomic factors; vulnerable populations; health insurance; pharmaceutical care.
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INTRODUCTION

Considerable research has revealed substantial disparities in health and access to health care services across socioeconomic groups in the United States. Individuals in higher-income groups have greater life expectancy and better self-reported health.[1] These dissimilarities may reflect differences in utilization of health care services. For example, low-income individuals are less likely to use recommended medications and procedures.[2–6]

Increases in patient cost sharing at the point of service for important medical interventions may play a role in these disparities. Specifically, copayments for generic drugs have increased dramatically over the past 5 years.[7] A large body of literature documents that increases in out-of-pocket costs reduce the likelihood that patients will utilize health care services, including those considered important for management of chronic disease.[8–10]

Low-income individuals may also be particularly sensitive to higher cost sharing, yet several international studies do not support this view, and a recent review concludes "there is little evidence to support this contention."[11–13] Other investigations have examined the impact of cost sharing on drug utilization controlling for income, but they have not specifically reported the effect of income on utilization decisions.[8,14,15]

Our objective was to extend the research on out-of-pocket expenditures and adherence by assessing how the relationship between copayments and prescription drug use varies across income classes in the United States. We focused on a privately insured population because much of the increases in copayments have occurred in this group and the existing literature has yet to address this population. Moreover, we specifically studied 2 important clinical areas: diabetes mellitus (DM) and congestive heart failure (CHF), important chronic diseases targeted by many disease management programs.

METHODS

Data Source

The source of data was the MarketScan Commercial Claims and Encounters Database, representing the health care experience of large firms in the United States (Thomson Healthcare). Patients were selected from employers contributing data from 2001 through the third quarter of 2004.

Patient Selection

Patients 18 years of age and older with DM or CHF were included in the sample. For DM, a patient had to have at least 2 face-to-face encounters with different dates of service in an ambulatory setting or nonacute inpatient setting with a diabetes diagnosis (250.xx, 357.2, 362.0, 366.41, 648.0) or 1 face-to-face encounter in an acute inpatient setting or emergency department setting with a diabetes diagnosis (or was assigned to DRG 294 or 295). This is equivalent to the Healthcare Effectiveness Data and Information Set diagnostic criteria for DM.

For CHF, a patient had to have at least 2 outpatient claims with a primary or secondary diagnosis code of heart failure (ICD-9-CM 428.xx) or 1 emergency department visit with a primary diagnosis of heart failure or 1 inpatient admission with a diagnosis code of heart failure.

For both diseases, the study period was the first quarter of 2002 to the third quarter 2004. Within that window, the first date that a patient met the inclusion criteria was the disease-specific index date. Patients were followed from the index date through December 2004 or until they disenrolled. Data from 2001 were used to identify comorbidities, define the sample, and assess prior fills within a medication class for those who filled prescriptions in 2001. Patients had to be continuously enrolled for at least 1 year before the disease-specific index date. If disenrollment occurred during the study time frame, the patient was followed through the end of their last full quarter of enrollment.

Because some patients in these disease categories were not given prescriptions for the target medications, we focused our adherence analysis on those with evidence that medication was prescribed. Specifically, patients had to have at least 1 prescription fill for a glucose lowering medication (for DM) or a heart disease medication (for CHF) at any point after the index date to be retained in the patient sample. Analysis was conducted separately for each medication class after the first medication fill in that class. This resulted in 29,764 patients with DM on any oral antidiabetic medication and 13,081 patients with CHF on any heart disease medication.

Medication Adherence

Adherence to medications was measured using the medication possession ratio (MPR), which is a measure of the percentage of days during each calendar quarter with prescription drugs on hand in a medication class. To calculate the MPR, each day in a quarter was evaluated as "covered" or "not covered" by a prescription fill or refill. If all days were "covered" by a prescription, then adherence was 100%. This MPR algorithm is similar to the adherence measure described by Bryson et al.[16] Our adherence measure also assumes that if a patient filled a prescription for a new drug in a class or a new dose, the remaining supply from the previous prescription was discarded. Moreover, we assumed that patients were compliant during an inpatient stay without depleting the existing days' supply.

Adherence was calculated separately for each medication class. For patients with DM, we measured adherence for 5 classes of oral hypoglycemic medications (alpha-glucosidase inhibitors, sulfonylureas, thiazolidinediones, biguanides, or meglitinides), cholesterol-lowering statins, and angiotensin-converting enzyme (ACE) inhibitors or angiotensin II receptor antagonists (ARB). Then, adherence to any oral DM medication was assessed by evaluating whether any of the 5 classes of oral medication were on hand each day, evaluating each day as covered or not by an oral DM medication. Adherence was measured as the percentage of days within a quarter that were covered by any oral DM medication. For patients with heart failure, adherence was measured for 3 classes: ACE inhibitors or ARB, beta-adrenergic blocking agents, and statins.

Explanatory Variables

The 2 focal explanatory variables were cost-sharing amounts for prescription drugs and household income. Copayment rates for prescription drugs for each year were measured using a copayment index created for each employer/plan/quarter combination. The index was based on average copayment amounts per prescription (standardized to a 30-day supply) for branded and generic drugs in each class for each employer/plan/quarter. The index aggregated the branded and generic copayments using weights, which were developed from the overall proportion of utilization of brand and generic drugs within the drug class. Weights were 60% brand name and 40% generic for all classes except statins, which was dominated by brand name drugs. The copay index reflects the retail/mail order mix and prescriptions whose prices were below the copay. The correlation between our copay index and copay rates available from plan design booklets (available for only about half of our sample) exceeds .95.

Household Income

Because actual household income levels were not available for patients, the median household income in the patient's ZIP code of residence from the 2000 U.S. Census was used as measure of income, as is the case in studies of a similar design.[8]

Other Explanatory Variables

Sociodemographic variables included female gender, age in years, U.S. Census region (Northeast, North Central and West, with South as the reference category), and residence in an urban area. An indicator for employee status (versus spouse/dependent) was also included.

The type of health plan was controlled for using a set of binary variables corresponding to health maintenance organization, point of service plan, preferred provider organization, capitated point of service plan, or comprehensive plan.

Indications of the severity of the condition for CHF were reflected by the presence of an acute myocardial infarction (AMI), an inpatient admission, or the presence of other cardiovascular conditions (angioplasty, coronary artery bypass graft, ischemic heart disease, atherosclerosis, angina) in the 12 months before the observation quarter. In addition, the stage of CHF, using the Disease Staging[17]-coded classification for heart failure, was also indicated. There are 4 stages of CHF: 3.01 (CHF), 3.02 (with azotemia or hyponatremia), 3.04 (with respiratory failure), and 3.05 (with shock). Stage 3.03, with low ejection fraction, cannot be supported using administrative data.

Disease staging was also used to distinguish type 2 DM. There are 3 stages of type 2 DM: 1—without local or systemic

complications, 2—localized complications (e.g., neuropathy, retinopathy), and 3—general or systemic complications (e.g., sepsis, renal failure).

For both diseases, the presence of common mental health comorbidities (anxiety, depression, or dementia) in the 12 months before the observation quarter was indicated. Concurrent use of aldosterone antagonist (aldactone), diuretics, or calcium channel blockers were included in the CHF models.

Outpatient physician copayments can affect utilization of prescription drugs[18]; consequently, the office visit copayment amount was included in the models.

Time was included in the models in several ways. For all patients, indicator variables for each calendar quarter were included to account for variations in secular trends. Patients were also divided into 2 groups, "new" and "continuing" patients for each medication class, to account for time trends. New patients were those with a first-observed prescription fill in a medication class within the study time frame and had at least a 1-year clean period without a prescription. Continuing or prevalent patients had a prescription filled in a medication class in the year before the study time frame. Consumption patterns may differ for those who previously received a prescription and those commencing use of the medication for the first time, so 2 time variables were included for new patients. The first was an indicator variable for the first (index) quarter, as consumption and adherence may be high in the first quarter of medication use. The second was the logarithm of the amount of elapsed time since the index quarter was measured to account for changing patterns of adherence as time progresses.[19]

Multivariate Modeling

The results are based on a multivariate linear regression model with patient random effects and employer fixed effects, estimated separately for each disease and drug class. To estimate the effects of copayments in areas with different income levels, fully interactive models across 4 income levels were estimated. The income thresholds were: under $30,000, $30,000 to $42,000, $42,000 to $62,000, and more than $62,000. These represented the 20th, 50th, and 80th percentiles of ZIP code–level median household income within the study sample.

Standard errors were adjusted for clustering by patient over time using robust standard errors to decrease the effects of specification errors or unknown heteroscedasticity. Various model specifications were tested including logit models for adherence of greater than or equal to 80%. The results were robust to these specifications.

Using the linear specification, the effects on adherence of changes in cost sharing were identified over time. Specifically, all time-invariant, unobserved employer traits were absorbed in the fixed effect. Any general trends are captured in the time variable. Inference is based on whether adherence changed after an increase in copayment rates and if those changes varied by household income. Because employers changed copayments at different points in time, the employers with stable copayment rates during any period served as controls for those that changed copayment rates.

The sensitivity of adherence to price was measured by calculating the price elasticity. This measure, standard in economics, is computed as the percent change in use (MPR) divided by the percent change in price. For example, if a 10% increase in price resulted in a 5% decrease in adherence, the elasticity would be −0.5.

Table 1. Patient Characteristics in the Index Quarter

Characteristic	Diabetes, *n*=29,764	Heart failure, *n*=13,081
Female (%)	44.4	44.5
Age in years (SD)	53.1 (7.83)	56.5 (8.16)
Census region (%)		
North East	21.1	26.4
North Central	16.9	16.6
South	57.5	52.7
West	4.5	4.3
Urban area (%)	74.2	75.2
Household income ($\times 10^3$) (SD)	$45.52 (16.58)	$45.03 (16.4)
Employee (%)	68.4	67.1
Type of health plan (%)		
Comprehensive	12.3	18.4
Health maintenance organization	7.4	5.4
Point of service	29.6	28.6
Preferred provider organization	38.2	37.8
Point of service (Capitated)	12.5	9.8
Comorbid conditions (%)		
Depression	21.2	30.5
Anxiety	7.6	13.4
Dementia	0.3	1.6
Disease severity (disease staging)		
Type 2 Diabetes stage 2 (%)	23.0	
Type 2 Diabetes stage 3 (%)	2.6	
Heart failure stage 3.02 (%)		5.1
Heart failure stage 3.04 (%)		6.2
Heart failure stage 3.05 (%)		1.2
Heart failure severity		
Inpatient admission (last 12 months) (%)		32.8
AMI (last 12 months) (%)		8.3
Other cardiac conditions (last 12 months) (%)		16.7
Aldactone use (%)		8.3
Diuretic use (%)		55.5
Calcium channel blocker use (%)		27.0
Prescription drug copayment index (SD)*	$14.80 (4.80)	$14.99 (4.85)
Brand name drug copayment (SD)*	$19.25 (6.34)	$19.53 (6.48)
Generic drug copayment (SD)*	$8.12 (3.10)	$8.19 (3.08)
Office visit copayment (SD)	$14.86 (6.34)	$14.38 (6.80)

Source of Data: 2001–2004 MarketScan Database
**Per 30-day supply*

RESULTS

A total of 29,764 DM and 13,081 CHF patients met eligibility criteria (Table 1). Among the DM patients, the average age was 53 years, and 44.4% were female. Almost 70% were employees (versus spouses/dependents), 57.5% resided in the South, and the average annual household income (by ZIP code) was about $45,000. Depression was prevalent, with almost a quarter of the DM patients having a diagnosis of depression.

Among CHF patients, the distribution of baseline characteristics was similar to that of DM patients with few notable exceptions. CHF patients were more likely to be older (56.5 years) and had a higher prevalence of depression,

anxiety, and dementia. Proxy measures for CHF severity showed that about 33% had an inpatient admission and approximately 8% had an AMI in the past 12 months.

The mean prescription drug copayment index was approximately $15 per 30-day supply. Mean copayments were $19 for brand name drugs and $8 for generic drugs per 30-day supply. Changes in the copay index, which identify our effects, ranged from $0 to about $13.00, with an average change of about $4.50 for employers that changed copays.

The percentage of new users was slightly higher for CHF than for DM, about 60% in each medication class.

Medication Adherence

For DM, the average quarterly adherence was 74% for oral hypoglycemic medications, 66% for statins, and 72% for ACEs/ARBs. CHF patients had an average quarterly adherence of 67% for beta-blockers, 67% for statins, and 68% for ACEs/ARBs (Table 2).

Adherence Models by Income

For each medication class, the multivariate results suggest that individuals in high-income areas were consistently more adherent than individuals in low-income areas (Fig. 1). The magnitude of this relationship varied by disease and drug class. The ratio of high-income to low-income adherence for antidiabetic medications (1.08) and for ACEs/ARBs (1.10 for DM and 1.05 for CHF patients) was smaller than the comparable ratio for other drug classes. Adherence to statins was particularly sensitive to income, with DM patients in the highest-income group being more than 20% more adherent than those in the lowest-income category ($p<.01$). Similarly, in high-income areas, CHF patients were more than 30% more adherent to statins than their counterparts in low-income areas ($p<.01$). CHF patients in high-income areas were also substantially more adherent to beta-blockers than CHF patients in low-income areas.

Elasticity by Income

Our analysis revealed an inverse relationship between copayments and adherence. Across the entire population, we found elasticities ranging from −0.029 to −0.054 (Fig. 2). This implies

Table 2. Average Quarterly Adherence by Medication Class

Medication class	Number	Average quarterly adherence (%)*	Percent new users
Diabetes			
Oral antidiabetic medications	29,764	74.44 (34.63)	46.8
ACE or ARB	18,601	72.21 (36.78)	51.9
Statins	16,582	66.03 (38.97)	58.3
Congestive heart failure			
Beta-blockers	9,427	67.07 (38.93)	61.7
ACE or ARB	10,456	67.75 (39.09)	58.0
Statins	7,521	66.54 (38.88)	62.2

**Across all quarters following the index date for the medication class. The index date for the medication class was January 2002 for continuing users and the quarter of initiation for new users. Standard deviations are in parentheses. Source of Data: 2001–2004 MarketScan Database*

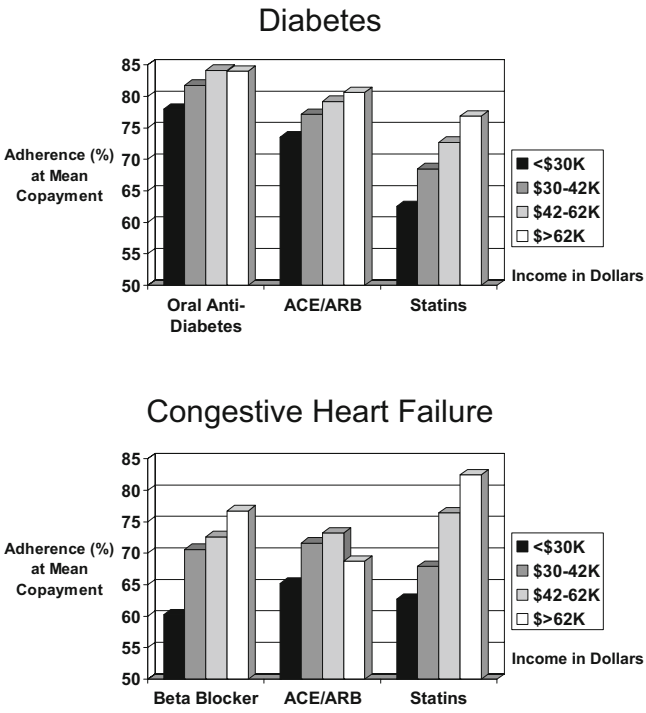

Figure 1. Adherence by income group.

that a doubling of copayments (about $14.00–15.00) would reduce adherence overall by 2.9% to 5.4%.

The relationship between copayment and adherence was sensitive to income for most, although not all, of the medication classes (Fig. 2). Specifically, we did not see an effect for adherence to oral hypoglycemic medication among patients with DM. The findings for the other medication classes arise

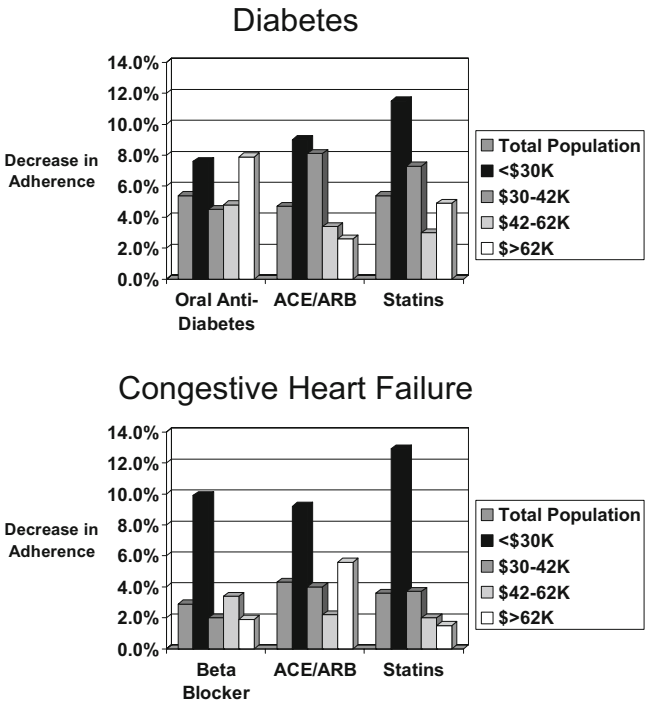

Figure 2. Percent decrease in adherence in response to 10% increase in copayment.

because patients in the lowest income areas were more sensitive to copayment increases than individuals in the other income classes. In each case, the ratio between the elasticity of the lowest income area, relative to the highest, was statistically significant at $p<.01$. We did not consistently find differences in price sensitivity between the 3 higher-income classes.

The effects for medications other than oral hypoglycemic agents were generally quite large. For example, for patients with DM, the elasticity for adherence to ACE/ARBS among patients in low-income areas was almost 3.5 times that for patients in high-income areas. The comparable ratio for statins approached 2.4. For CHF patients, the ratio of elasticities of the high-income group, relative to the lowest-income group, was almost 9 for statins, more than 5 for beta-blockers, and slightly above 1.5 for ACEs/ARBs.

The results for other covariates were generally consistent with the literature. For example, adherence rates rose with age, and for the most part, females were less adherent than males. The amount of elapsed time since the medication index date had a strong negative effect on adherence.[19] In addition, quarterly adherence rates (i.e., MPR) for continuing users were typically 6 to 13 percentage points lower than adherence rates for new users.[20]

DISCUSSION

Considerable research suggests that adherence to medications is an important driver of clinical outcomes for patients with chronic diseases. [14,20–22] In some cases, greater adherence may even result in lower total medical expenditures.[23]

We extend the available literature by quantifying how price responsiveness varies by income for certain high-value chronic medications. Specifically, these analyses demonstrate that patients in low-income areas were less adherent to recommended medications than patients in higher-income areas. Moreover, medication adherence is more likely to decline when copayments increase for individuals in low-income areas. Our findings imply that increases in patient out-of-pocket expenditures for prescription drugs, a widespread cost containment mechanism, are likely to exacerbate health disparities.

Our study has several advantages over much of the existing literature. For example, inclusion of employer-fixed effects captures any unobserved, time-invariant differences across employers that may affect adherence and be correlated with copayment rates. Moreover, by using an employer-specific copay index as opposed to a measure of the copayment rate for chosen medications, we are able to estimate the effects of copayment rates without selection bias resulting from different types of patients selecting different types of medications. Additionally, by incorporating a measure of office copayment rate, we can control for the potentially confounding effects associated with the costs of physician visits faced by patients.

The magnitude of our elasticity findings, averaged over all income groups, is toward the low end reported in the available literature. Other studies that have used MPR as the outcome measure have shown elasticities ranging from −0.026 to −0.176.[8,14,15,24–27] Our results are consistent with other studies that use other measures of effect size. For example, in a recent study of commercially insured patients with CHF, Cole et al. found that a $10 increase in copayments was associated with a 2.6% decrease in MPR for ACE inhibitors and a 1.8% decrease for beta-blockers.[21] Adjusting our numbers to a $10.00 change yields comparable estimates of 2.9% and 1.9%, respectively. Two recent studies estimated the effects of cost sharing for patients on diabetes medications and found much stronger results than what we report (Roblin et al. showed that a greater than $10 increase in copayment for a 30-day supply of oral hypoglycemic medications resulted in an 18.5% reduction in daily adherence; Goldman et al. found that a 100% increase in copayment for oral "antidiabetics" [roughly $6–12 increase] resulted in a 25% reduction in utilization).[8,33]

There are several limitations to our work. First, we do not observe actual household income but instead follow other literature that uses ZIP code–based income measures[8,15]. Krieger et al. report more than 50 existing studies that used ZIP code income to proxy for individual income.[28] Existing literature examining income and health status gradients suggests that results using income at the ZIP code level are similar to those using income at the narrow census tract or census block level, but the magnitude of the findings may differ if actual household income were observed. For this reason, we interpret our findings as pertaining only to differences in income at the area level but recognize that a substantial portion of our findings may reflect the household level income effects (as opposed to the area-level effect).

Unfortunately, like other studies, we cannot separate area-level versus household-level income effects. Our estimates will also capture the effects of omitted-area traits if they are correlated with the responsiveness to price (as opposed to the level of adherence) but still present an accurate picture of how price changes affect individuals in low-income areas differentially than those in high-income areas. Moreover, because individuals in our sample work for large employers, they may have higher-than-average income in the low-income areas. If so, this may dampen our findings, and the effects reported for the lower-income areas may be underestimated. Nevertheless, these results demonstrate that price sensitivity is likely related to income and increasing copayments likely exacerbate disparities.

Second, we do not observe clinical outcomes. For this reason, we cannot project the clinical effects of the diminished adherence that we observed. Third, we examine only 2 clinical areas and only evaluate workers employed by relatively large firms participating in the MarketScan database, all of which have some form of prescription drug coverage. Because these data are not nationally representative, we cannot be certain whether these results are generalizable to other populations.

Finally, we assumed the same initial mix of medication use in high- and low-income areas, generating the same price index across areas. If individuals in low-income areas used more generics, their true price change would be lower than we assume (because generics had a slower price increase). Thus, the demand change we observe would reflect a response to a smaller price increase, and the elasticity would be higher than we report. People in high-income areas would face a more rapid increase in prices than we report, and so their true elasticity would be smaller than we report. Our conclusions of greater response in low-income areas would be even stronger if we constructed income-specific price indices.

From the provider perspective, the impact of rising cost sharing in low-income areas and probably on low-income individuals may be important. At a minimum, the practitioner

needs to be cognizant of the amount of cost sharing faced by patients and the potential for increasing cost sharing to reduce adherence among lower-income patients. Adherence for those patients may need to be monitored more closely, and prescription choice may need to reflect the issues related to adherence.

The finding that increases in cost sharing may worsen socioeconomic health disparities illustrates the difficulty in balancing the desire to control costs with the desire to eliminate inequities. "Across the board" increases in copayment rates will have their greatest effect on lower-income individuals, not only because they will feel the greatest economic burden but also because worsening adherence may lead to relatively larger adverse clinical effects.

One approach to address this concern, referred to as value-based insurance design (VBID), has been proposed.[29–31] VBID argues that copayments for high benefit services, such as medications essential for treatment of chronic disease, be kept low. Programs reducing patient copayments for chronic conditions have already been successfully introduced for individuals with DM and asthma.[32] Such targeted copayment relief will help shield low-income patients from the deleterious clinical effects of rising copayment rates. As cost pressures continue, more research is needed to distinguish between high- and low-value services and to design systems that ensure that barriers to access, financial or nonfinancial, can be directed toward services of less clinical importance.

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