

Does Patient Cost Sharing Matter? Its Impact on Recommended Versus Controversial Cancer Screening Services

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Objectives: To examine whether there are differential impacts of patient cost sharing and health plan organizational characteristics on the use of a recommended cancer screening service (mammography) versus a controversial cancer screening service (prostate cancer screening [PCS]).

Study Design: Observational cohort using the 1996 Medical Expenditure Panel Survey.

Patients and Methods: A nationally representative sample of privately insured individuals was examined. Outcome measures were the receipt of mammography and PCS. Logistic regression was used to assess the impact of patient cost sharing and health plan organizational characteristics on the receipt of mammography and PCS, controlling for other covariates.

Results: Patient cost sharing and gatekeeper requirements were strong predictors of PCS but were statistically insignificant predictors of mammography. Men in health plans with a copayment over \$10 (odds ratio [OR] = 0.38, 95% confidence interval [CI] = 0.19-0.78) or with deductibles over \$250 (OR = 0.38, 95% CI = 0.23-0.62) were significantly less likely to receive PCS than men in plans with no or lower copayments and deductibles. Men in gatekeeper plans were less likely to receive PCS than those without gatekeepers (OR = 0.48, 95% CI = 0.29-0.81).

Conclusions: We found the impact of cost sharing on utilization is different between mammography and PCS. Prostate cancer screening utilization appears to respond to financial incentives while mammography utilization does not. The use of copayments, deductibles, and gatekeepers may discourage controversial services but may not have an adverse effect on more recommended services. These findings have implications for the design of insurance benefits and plan organizational structure.

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It has long been recognized that health insurance reduces the effective price of medical services that patients face and may thereby result in overutilization of services. An increasing number of health insurers have adopted patient cost sharing mechanisms to curb utilization and to control the rising costs of healthcare. Numerous studies have attempted to assess the impact of such cost sharing strategies on the use of a wide range of medical services, including physician visits and hospital admissions, office-based medical care, mental health services, emergency department use, preventive care, vision care, dental care, and chiropractic

services.¹⁻¹² Findings from the RAND studies and others based on community data are generally consistent with economic theory predicting that patient cost sharing reduces the use of medical services.

Although earlier research has improved our knowledge of whether and to what extent cost sharing influences the use of health services, it is also important to evaluate whether its effect differs for the use of recommended versus controversial medical services. A meaningful inquiry is *how* patient cost sharing influences the use of healthcare: does cost sharing improve consumption efficiency by reducing the use of inappropriate services or does it create another dimension of distortion by reducing the use of appropriate services?

Despite its importance, literature on this topic is very limited. Only a few studies have examined whether the influence of cost sharing differs for the use of appropriate and inappropriate care. Siu et al analyzed data from the RAND Health Insurance Experiment (HIE) to determine whether cost sharing disproportionately reduces inappropriate hospital admissions and hospital stay.¹³ These authors found that cost sharing decreased both inappropriate, as well as appropriate hospital use. Foxman and colleagues, also using the data from the RAND HIE, found that the impact of cost sharing on inappropriate and appropriate antibiotic use was similar.¹⁴

Rather than analyzing the appropriate and inappropriate use of services, the objective of this study was to examine whether there is a differential impact of cost sharing on the use of recommended and controversial

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cancer screening services. We used data from the 1996 Medical Expenditure Panel Survey (MEPS) to analyze mammography and prostate cancer screening (PCS) utilization. Mammography is a widely recommended screening test because of substantial evidence that it is associated with reduced breast cancer mortality.¹⁵ In contrast, PCS is more controversial, with no consensus about its efficacy or recommendations.^{15,16} The analysis of mammography and PCS provides an interesting comparison as to whether the impact of cost sharing differs between recommended and controversial cancer preventive services. We hypothesized that patients (and possibly providers) would be more cost conscious in their decisions to use (or encourage) controversial services as compared with recommended services. Our study adds to the literature by extending this line of research to preventive services and by updating the empirical evidence using a more recent dataset that approximates today's healthcare environment.

This study also contributes to the literature on cancer screening utilization by examining the association between a comprehensive set of health plan characteristics. Most of the other studies that have investigated the association between plan characteristics and cancer screening have used broad categories of insurance (eg, managed care vs fee-for-service plans or health maintenance organizations (HMOs) vs non-HMOs).¹⁷⁻¹⁹ More recent studies have shown that the distinctions between these broad plan classifications are blurring and what may be most important predictors are specific characteristics of the plan.²⁰⁻²² In this study, we examine several specific plan characteristics, including patient cost sharing (eg, copayments, deductibles, and coinsurance rates), as well as organizational characteristics such as having a defined provider network and requirements for the use of gatekeepers.

Our study provides interesting empirical evidence on how cost sharing influences the use of preventive care and has policy implications for practice and insurance benefit design. To our knowledge this is the first study to analyze the association between cost sharing and PCS utilization. It is also the first to investigate whether there is a differential impact of cost sharing on the use of 1 strongly recommended screening service versus a more controversial cancer screening procedure.

METHODS

Data Sources

The primary data source for this study was from the 1996 MEPS-Household Component (HC). MEPS is an ongoing survey sponsored by the Agency for Healthcare Research and Quality and is designed to provide nation-

ally representative data on the demographic characteristics, health status, healthcare use, access to care and insurance status of the US civilian, noninstitutionalized population.²³ The Health Insurance Plan Abstraction (HIPA) component of the 1996 MEPS contains detailed information on the private insurance plans obtained from health plan booklets. Despite its age, the potential to analyze detailed health insurance data collected directly from plan documentation linked to individual characteristics and healthcare utilization information makes the 1996 MEPS data the most comprehensive data currently available for the purposes of this study.

The secondary data used for this analysis included the 1995 National Health Interview Survey (NHIS). Individuals' physician visit information in 1995 was linked to 1996 MEPS to allow us to examine the association between physician visits and the use of cancer screening procedures over a 2-year period. The linkage between these 2 datasets is made possible because the 1996 MEPS sample is drawn from a subset of respondents to the 1995 NHIS.

Sample

Our study sample included privately insured adults from the MEPS-HC who were linked to HIPA (unweighted, $n = 13\,534$).

Dependent Variables

We examined a widely recommended preventive service, mammography, and a more controversial preventive service, PCS. In 1996, the US Preventive Services Task Force (USPSTF) strongly recommended routine screening for breast cancer with mammography every 1-2 years for women between the ages of 50-69, and suggested that screening for women aged 70-75 may be reasonable because of high burden of suffering from breast cancer despite limited evidence supporting screening for this age group. Most concur that screening mammography every 1-2 years in women aged 50 and over can reduce breast cancer mortality.²⁴ We therefore examined the self-reported receipt of mammography screening within the past 2 years for women aged 50 and older, without a prior history of breast cancer.

Routine screening for prostate cancer is not recommended by the USPSTF. Other organizations, however, recommend prostate cancer screening, including the American Cancer Society, the American Urological Association, and others. These organizations suggest that men without a family history of prostate cancer undergo an annual prostate specific antigen screening over the age of 50.²⁴⁻²⁶ We examined the self-reported receipt of prostate cancer screening within the past 2

years for men ages 50 and older, without a prior history of prostate cancer.

Independent Variables

Predictors of mammography and PCS examined in this study include characteristics of patients, providers, and health plans. The primary independent variables of interest for this study were patient cost sharing and organizational characteristics of a health plan (Table 1). Since a number of patient and provider characteristics have already been identified in the literature as being associated with the utilization of cancer screening services, they are controlled for in our model as well. Patient cost sharing measures included in our model were copayment, deductible, and coinsurance. Health plan organizational characteristics included measures of a defined provider network, gatekeeper requirements, and the use of cost-containment procedures. The measures of patient cost sharing and cost containment strategies were based on health plan booklet data. Information on provider network and gatekeeper requirements was available through both plan booklets and self-report data. Measures from both self-reported and plan documentation for network and gatekeeping requirements were used because perceptions of plan characteristics may have more influence on the behavior of healthcare utilization than the actual plan characteristics.²⁷

We examined the impact of insurance coverage on screening utilization rather than the impact of the price for screening per se. It is assumed that patient behavior regarding the utilization of PCS will follow the normal price responses: utilization will go up as price perceived by the patient decreases. Therefore, we examined the specific sources of patient financial contribution dictated by their health plan: copayment, deductible, and co-insurance on the utilization rather than overall total financial contribution. This will permit inferences to be made about specific financial aspects of health plan policy stipulations with mammography and PCS utilization.

We tested several alternative measures to describe patient financial contribution provisions in health plans. Sensitivity analysis of the alternative definitions found little difference in the key estimations. The cut-off points for these categorical variables were based on prevailing dollar amounts for copayment and deductible as well as the sample distribution to ensure enough observations in each category.

Other independent variables included were age (age group 50-69 vs other), years of education (continuous), race/ethnicity (African American, White, and Hispanic), self-report health status (poor, fair, good, very good,

excellent), a weighted comorbidity index, having had at least 1 physician visit in the past 2 years, having had a cholesterol check in the past 5 years, specialty of usual source of care (USC—internal medicine, family practice or general practice, other specialty, and no USC), and census region of residency (Northeast, Midwest, South, West).

Statistical Analyses

Chi-square tests were used to examine the bivariate relationships between predictors and the use of mammography and PCS. Logistic regression was used to examine the effect of the independent variables on the 2 types of cancer screening services. All analyses were conducted using person level sampling weights to reflect the US civilian, noninstitutionalized population and using variance estimation variables to obtain correct standard errors and confidence intervals that take into account the complex sample design of MEPS (Stata 7.0, Stata Corporation, College Station, Tex.).

Independent variables for the regression models were selected based on theory, testing hypotheses, and statistical significance. The Hosmer-Lemeshow goodness-of-fit test was used to check whether the model's estimates fit the data at an acceptable level.²⁸ The adjusted Wald test was used to assess the significance of patient cost sharing and organizational plan characteristics in predicting the use of mammography and PCS. We conducted sensitivity analyses using alternative definitions of key variables and different models to ensure the robustness of our results.

Although selection bias has been a concern in observational studies that examine the association between health plan characteristics and utilization, recent studies conclude that there is no sufficient evidence of selection bias.^{29,30} Plan selection is possible only when a choice of health plans is available so individuals can choose a "best" health plan according to their preferences and/or expectations of healthcare utilization patterns. Although it is commonly assumed that most individuals can self select into health plans, MEPS data show that only about half of employed individuals have a choice of health plans. To explore the potential of selection bias, we also compared sample characteristics between different types of health plans. We did not find health status, a commonly assumed source of selection bias, to be significantly different between managed care and nonmanaged care enrollees. A more detailed analysis of selection bias can be found in the work by Phillips et al and Tye and colleagues, in which the authors concluded the impact of selection bias in models analyzing cancer screening utilization is minimal.^{20,21}

Table 1. Measures of Patient Cost Sharing and Organizational Characteristics of Health Plans

Measures of patient cost sharing	<p>Copayment This variable was based on the amount of copayments for physician office visits reported in the health plan booklets. Minimum copayment amounts across all possible plans were used for individuals with multiple plans. "No copayment" was coded if copayment was not described as part of the physician office payment type. Among those with a copayment, 2 levels were examined: low (\$1-10), and high (\$11+).</p> <p>Deductibles This variable was based on individual deductibles for physician office visits described in the plan booklets. "No deductible" was coded for those who reported zero deductible. Among those with a deductible, 2 levels were examined: low (\$1-250), and high (\$251+).</p> <p>Coinsurance rate This variable was based on a MEPS variable that represents the percent total costs covered by the insurance plan after any deductibles have been met and before any maximums take effect. In some cases, the original MEPS variable converts copayments into percentages and counts copayment as part of "the coinsurance rate." To avoid double counting the effect of copayment, we reconstructed this variable to obtain a "pure" coinsurance rate representing the percent of total costs paid by the patient for a doctor visit. Among those with coinsurance, 2 levels were examined: low (1%-19%), and high (20%-100%).</p>
Measures of health plan organizational characteristics	<p>Whether there is a defined provider network Respondents were considered being in a plan with a defined provider network if any of the following was true:</p> <ol style="list-style-type: none"> 1) According to the plan booklets, respondents were in any type of managed care plan, including preferred provider organization, exclusive provider organization, HMO, or HMO with point of service option. 2) Respondents self-reported being in an HMO, or being in a gatekeeper plan, or there is a book or list of doctors associated with the plan. <p>Use of gatekeeper Respondents were considered to be in a gatekeeper plan if any of the following was true:</p> <ol style="list-style-type: none"> 1) According to the plan booklets, a primary care doctor referral is required in order to see a specialist. 2) Respondents self reported being in an HMO, or being in a gatekeeper plan. <p>Use of cost-containment procedures This variable was created by summing MEPS variables that indicated the use of 8 different cost-containment procedures by the plan: pre-admission certification, pre-admission testing, utilization/concurrent review, nonemergency weekend admission, penalty for out-of-network emergency room, second surgical opinion, outpatient surgery incentives, and/or other cost-containment strategies. The score indicates the intensity of cost-containment procedures imposed by the health plan, with 0 representing none and a higher value representing a more intensive use of cost management by the plan. Based on its distribution, this variable was categorized into 3 levels: none, some (scores 1-3), high (scores 4+).</p>

RESULTS

Sample characteristics and bivariate associations between health plan characteristics and the use of cancer screening services are reported in **Table 2**. Overall, 76% of our study population received mammography and 76% received PCS within the past 2 years. Bivariate analyses indicated that patient cost sharing measures such as copayment and deductible were significantly associated with the use of PCS but not with the use of mammography. Men who were in plans with a lower degree of patient cost sharing (ie, no or low

copayments, no or low deductibles) were significantly more likely to report receiving PCS than men in plans that required a greater degree of patient cost sharing ($P < .01$, $P = .02$ for copayments and deductibles, respectively).

Organizational characteristics of a health plan such as having a defined provider network and gatekeeper requirements were significantly associated with the use of mammography but not with the use of PCS. Women who were in plans with a defined provider network and gatekeepers were more likely to receive mammography than women in plans without a provider network (82%

vs 70%, $P < .01$) or gatekeepers (82% vs 72%, $P < .01$). Men who were in plans with a defined provider network or gatekeeper requirements were generally less likely to receive PCS than men in plans without a provider network (75% vs 77%, $P = .18$) or gatekeepers (75% vs 76%, $P = .72$), but the associations were not statistically significant in the bivariate analyses. Cost-containment measures and types of health plan were not statistically associated with the use of mammography and PCS.

Predictors of Mammography and PCS Utilization

The results of our multivariate regression analyses are presented in **Table 3**. None of patient cost sharing and health plan organizational measures were significant predictors of mammography utilization, after controlling for all covariates. In contrast, copayments, deductibles, and health plan requirements of gatekeepers were significant predictors of PCS utilization. Men in plans with a “high” copayment were significantly less likely to receive PCS (odds ratio [OR] = 0.38, 95% confidence interval [CI] =0.19-0.78, $P < .01$) than men in plans with no or “low” copayment. Men in plans with a “high” deductible were significantly less likely to receive PCS (OR = 0.38, 95% CI = 0.23-0.62, $P < .01$) compared with men in plans with zero or “low” deductibles. Men in gatekeeper plans were significantly less likely to receive PCS (OR = 0.48, 95% CI = 0.29-0.81, $P < .01$) than men in plans without gatekeepers.

Other significant predictors for mammography included age 50-69 (OR = 2.37, 95% CI = 1.59-3.53, $P < .01$), better self-report health status (OR = 1.21, 95% CI = 1.02-1.44, $P < .05$), having had at least 1 physician visit in the past 2 years (OR = 7.04, 95% CI = 1.42-

34.81, $P < .05$), having had a cholesterol check in the past 5 years (OR = 7.79, 95% CI = 4.29-14.16, $P < .01$), and USC provider being internal medicine (OR = 2.70, 95% CI = 1.21-6.04, $P < .01$).

Other significant predictors for PCS included better self-report health status (OR = 1.20, 95% CI = 1.00-1.43, $P < .05$), higher comorbidity (OR = 1.47, 95% CI = 1.17-1.85, $P < .01$), having had at least 1 physician visit in the

Table 2. Sample Characteristics and Bivariate Association between Health Plan Characteristics and the Receipt of Cancer Screening

	% of Sample Mammography Screening (women age 50+) (unweighted, n = 1826)	% of Sample Prostate Cancer Screening (men age 50+) (unweighted, n = 1496)	% Receipt of Mammography Screening (women age 50+) (unweighted, n = 1765)	% Receipt of Prostate Cancer Screening (men age 50+) (unweighted, n = 1414)
Screening rate	76	76		
Plan types				
FFS/BC/BS	17	16	83	84
PPO/EPO	36	39	83	76
HMO	29	30	81	79
HMO/POS	6	6	82	82
Other	12	9	81	82
Copayment amount for physician visit				
None	53	54	81	75*
\$1-10	40	38	83	81
\$11+	7	8	83	61
Individual deductibles for physician visit				
\$0	65	65	83	78 [†]
\$1-250	26	26	77	78
\$251+	9	9	88	67
Coinsurance rate				
0%	66	64	83	78
1%-19%	7	8	84	68
20%+	27	28	79	77
Whether having a defined provider network				
No	50	46	70*	77
Yes	50	54	82	75
Use of gatekeepers				
No	61	58	72*	76
Yes	39	42	82	75
Level of cost containment				
None	34	31	84	75
Some	59	59	80	76
High	7	10	88	73

FFS indicates fee for service; BC, Blue Cross ; BS, Blue Shield; PPO, preferred provider organization; EPO, exclusive provider organization; HMO, health maintenance organization; and POS, point of service.

*Significant at $P < .01$ level.

[†]Significant at $P < .05$ level.

Table 3. Logistic Regression: Receipt of Prostate Cancer Screening and Mammography within the Past 2 Years

Variables	Mammography Screening (Odds Ratio [95% Confidence Intervals]) (unweighted, n = 454)	Prostate Cancer Screening (Odds Ratio [95% Confidence Intervals]) (unweighted, n = 388)
Copayment amount \$11+ (vs none/\$1-\$10)	0.51 (0.15 – 1.71)	0.38 (0.19 - 0.78)*
Deductible amount \$251+ (vs \$0-\$250)	1.72 (0.35 – 8.42)	0.38 (0.23 - 0.62)*
Coinsurance rate 20%+ (vs 0-19%)	0.73 (0.31 – 1.70)	0.99 (0.65 - 1.52)
Whether defined network (vs no)	1.02 (0.63 – 1.67)	1.03 (0.56 – 1.90)
Whether gatekeeper requirement (vs no)	0.99 (0.57 – 1.72)	0.48 (0.29 - 0.81)*
Age 50-69 (vs other)	2.37 (1.59 – 3.53)*	1.04 (0.65 - 1.65)
Education (continuous)	1.06 (0.94 – 1.19)	1.08 (0.95 - 1.22)
Race/ethnicity		
African American	0.77 (0.30 - 1.96)	1.61 (0.56 - 4.65)
Hispanic	0.85 (0.38 - 1.91)	1.41 (0.57 - 3.48)
(reference: White)	1.00	1.00
Perceived health status (ordinal, 1 = poor/fair, 2 = good, 3 = very good, 4 = excellent)	1.21 (1.02 – 1.44) [†]	1.20 (1.00 - 1.43) [†]
Higher comorbidity index	0.80 (0.58 – 1.11)	1.47 (1.17 - 1.85)*
Had at least 1 physician visit in the past 2 years (versus not)	7.04 (1.42 – 34.81) [†]	5.27 (3.15 – 8.84)*
Cholesterol check within the past 5 years (versus not)	7.79 (4.29 – 14.16)*	15.18 (5.49- 41.99)*
Specialty of usual provider		
Internal medicine	2.70 (1.21 – 6.04)*	1.79 (0.59 - 5.45)
Family or general practice	1.57 (0.84 – 2.93)	1.49 (0.67 - 3.33)
Other specialties	3.16 (0.88 – 11.32) [‡]	1.59 (0.41 - 6.18)
(reference: No usual source of care)	1.00	1.00
Census Region		
Midwest	0.97 (0.39 – 2.43)	0.27 (0.08 - 0.96) [†]
South	1.16 (0.55 – 2.43)	0.49 (0.29 - 0.82)*
West	1.03 (0.30 – 3.54)	0.50 (0.20 - 1.27)
(reference: Northeast)	1.00	1.00

*Significant at $P < .01$ level.[†]Significant at $P < .05$ level.[‡]Significant at $P < .10$ level.

past 2 years (OR = 5.27, 95% CI = 3.15-8.84, $P < .01$), and having had a cholesterol check in the past 5 years (OR = 15.18, 95% CI = 5.49-41.99, $P < .01$). Regional differences were also found to be significantly associated with PCS utilization. Patients residing in the Midwest (OR = 0.27, 95% CI = 0.08-0.96, $P < .05$) or residing in the South (OR = 0.49, 95% CI = 0.29-0.82, $P < .01$) were less likely than residents in the Northeast to receive PCS.

Predicted Probabilities of Cancer Screening

Adjusted predicted probabilities of mammography and PCS are presented in Table 4. In general, men facing low copayments and low deductibles were most like-

ly (87%-93%) while men facing high copayments and high deductibles were least likely (49%-67%) to receive PCS. In contrast, mammography screening rates do not appear to have a consistent pattern among different degrees of copayments and deductibles. Men enrolled in gatekeeper plans, compared to their counter partners in plans without gatekeepers, had a lower probability of receiving PCS (49%-87% vs 67%-93%) but the mammography screening rates do not differ between women in plans with and without gatekeepers.

Model Fit and Significance of Patient Cost Sharing in the Model

Our models fit reasonably well according to the

Hosmer-Lemeshow goodness-of-fit test.* The adjusted Wald tests suggest that the variables representing patient cost sharing contributed significantly to the model predicting the receipt of PCS ($P < .01$) but had a relatively less significant power in predicting the receipt of mammography screening ($P = .07$).

Sensitivity Analyses

Alternative definitions of key independent variables were analyzed to assess the sensitivity of our findings to variations in the definition and construction of plan characteristic attributes and to ensure the robustness of the results. A composite index consisting of copayment, deductible, and coinsurance characteristics was constructed so the results could be compared to the 3 independent patient cost sharing measures in our model. The use of the index was designed to capture the cumulative effect of the individual cost sharing incentives and avoid potential collinearity among the individual cost sharing measures. Values of 0, 1, and 2 were assigned to the no, low, and high levels for the individual cost sharing characteristics. An additive index was constructed by adding the values across the input variables. In addition, a multiplicative index was created to explore the interactive effect among copayment, deductible, and coinsurance. The findings using both of these cost-sharing indices were consistent with the findings of our model using the individual cost sharing measures.

Alternative measures of self- and plan booklet-reported health plan organizational characteristics were examined. The use of gatekeepers remained a statistically significant predictor of PCS utilization but a statistically insignificant predictor of mammography utilization regardless of whether the measure was constructed from enrollee self-report data only, plan booklet-report data only, or a combined measure using both self-report and plan booklet-report data.

Lastly, we conducted sensitivity analyses to examine whether the effect of higher copayments and

Table 4. Adjusted Predicted Probabilities: By Copayment/Deductible and Gatekeeper Status

% Receipt of mammography screening in the past 2 years.*		
	With gatekeeper	Without gatekeeper
Low copayment, low deductible [†]	87	87
High copayment, low deductible	78	78
Low copayment, high deductible	92	92
High copayment, high deductible	86	86
% Receipt of prostate cancer screening in the past 2 years. [‡]		
	With gatekeeper	Without gatekeeper
Low copayment, low deductible	87 ²	93
High copayment, low deductible	72	84
Low copayment, high deductible	72	84
High copayment, high deductible	49	67

*Adjusted predicted probability of screening is calculated for a woman age 50-69, White, 12 years of education, self-reported health status being good, no comorbid condition, had at least 1 doctor visit in the past 2 years, had cholesterol check in the past 5 years, usual source of care specialty as family or general medicine, residing in Northeast.

[†]Low copayment: no copayment or copayment amount of \$1-10; high copayment: \$11+. Low deductible: \$0-250; high deductible: \$251+.

[‡]Adjusted predicted probability of screening is calculated for a man age 50-69, White, 12 years of education, self-reported health status being good, no comorbid condition, had at least 1 doctor visit in the past 2 years, had cholesterol check in the past 5 years, usual source of care specialty as family or general medicine, residing in Northeast.

deductibles on PCS is attributed to patients being less likely to undergo a physician visit or a physical examination. The association between patient cost sharing and PCS utilization remains robust after we control for the “indirect” effect on PCS through reduced incentives to undergo a physician visit or a physical examination.

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DISCUSSION

To our knowledge, this is the first study to examine whether there are differential impacts of patient cost sharing on the use of recommended versus controversial screening services. Results from this study confirm our expectation that patient cost sharing potentially has a greater impact on PCS, a more controversial screening service, than on mammography, a widely accepted screening test. Another important finding is that the organizational features of the health plan may have a different impact on utilization depending on the

*P value for the logistic model predicting prostate cancer screening is 0.73. P value for the logistic model predicting mammography screening is 0.20. Both cannot reject the null hypothesis of a goodness-of-fit test and we thus conclude that the observed data fit the predicted model well.

type of cancer screening procedure considered. We found that health plan gatekeeper requirements were associated with a lower rate of PCS but were not negatively and may be positively associated with the use of mammography screening.^{20,21}

Our analyses also suggest that using specific health plan characteristics to predict the use of PCS offers advantages over the broader plan type categorizations seen in most studies. For example, HMO plans are generally associated with lower patient cost sharing (eg, lower copayment, no deductibles) but more restrictive organizational structures (eg, having defined provider networks and gatekeeper requirements). Differences in utilization for the plan categories HMOs vs non-HMOs might appear negligible if lower cost sharing encouraged, while tighter organizational mechanisms discouraged, the use of PCS.

As with previous studies, we found selected patient characteristics such as age, perceived health status, and preventive orientation to be strong predictors of screening use. Prior studies have indicated that income may influence the demand for medical services. We examined the association between family income and our outcome measures using both bivariate and multivariate regression analyses (results available upon request). However, we did not find income to be a significant predictor of utilization, and key results remained consistent in our regression models controlling for family income.

This study was subject to several limitations. First, our key variables were based on self report. Although self-reported data may be inaccurate, our key variables, when validated using a second data source, appear to be relatively accurate. For example, the agreement of the gatekeeper variable between self report and booklet report was high (85%). Although self-reported screening rates tend to be higher than the rates based on medical records,^{31,32} some studies have found that patients' recall of mammography utilization is relatively accurate.³³ The design of the MEPS provided only a composite measure of PCS and did not distinguish whether screening was performed by digital rectal examination (DRE) or prostate-specific antigen (PSA) testing. Thus, observations from this study are relevant to understanding the use of PCS in general, rather than the use of PSA or DRE separately. When possible, we utilized data from multiple sources and conducted extensive sensitivity analyses to minimize potential measurement error due to self-report.

Our cost sharing measures were based on patient cost sharing for an office-based physician visit. We were unable to directly test the impact of the actual price or out-of-pocket expenditures faced by the enrollees for

screening services, since we did not have information on the price of these screening procedures nor whether or not these screening services were covered by the plan.

Another potential limitation is generalizability of the study. Our results may be relevant to preventive services only. In addition, our study sample included only privately insured individuals, and therefore, whether the impact of cost sharing applies to the Medicare, Medicaid, and uninsured populations requires further investigation.

Finally, as with other studies, our models did not include all possible variables that we wished to examine. Physicians' practice styles and patients' attitude, knowledge, and beliefs toward screening have also been found to be positively associated with the use of PCS.^{19,34-37} We used census region to control for differences in knowledge and attitudes as prior studies suggest that knowledge and attitude may vary across communities.^{19,36} However, we were unable to directly test the influence of provider and patient preference and other key variables due to lack of data. Future data collection and linking characteristics of the patient, physician, and health plan are needed to assess the use of recommended versus controversial cancer screening from all perspectives and to investigate the interactions among such perspectives.

Despite these limitations, this study improves our understanding of the use of preventive services and how cost sharing influences the use of recommended versus controversial cancer screening services for the privately insured. We found that the use of PCS may respond to both financial and organizational plan incentives. On the other hand, the use of mammography screening does not appear to respond to financial incentives and may be encouraged by the use of primary care gatekeepers. Insurance benefits should take into account the influence of financial and plan organizational incentives on the use of different types of preventive services.

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