Screening Mammography for Free: Impact of Eliminating Cost Sharing on Cancer Screening Rates

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Objectives. To study the impact of eliminating cost sharing for screening mammography on mammography rates in a large Medicare Advantage (MA) health plan which in 2010 eliminated cost sharing in anticipation of the Affordable Care Act mandate.

Study Setting. Large MA health maintenance organization offering individual-subscriber MA insurance and employer-supplemented group MA insurance.

Study Design. We investigated the impact on breast cancer screening of a policy that eliminated a \$20 copayment for screening mammography in 2010 among 53,188 women continuously enrolled from 2007 to 2012 in an individual-subscriber MA plan, compared with 42,473 women with employer-supplemented group MA insurance in the same health maintenance organization who had full screening coverage during this period. We used differences-in-differences analysis to study the impact of cost-sharing elimination on mammography rates.

Principal Findings. Annual screening rates declined over time for both groups, with similar trends pre-2010 and a slower decline after 2010 among women whose copayments were eliminated. Among women aged 65–74 years in the individual-subscriber MA plan, 44.9 percent received screening in 2009 compared with 40.9 percent in 2012, while 49.5 percent of women in the employer-supplemented MA plan received screening in 2009 compared with 44.1 percent in 2012, that is, a difference-in-difference effect of 1.4 percentage points less decline in screening among women experiencing the cost-sharing elimination. Effects were concentrated among women without recent screening. There were no differences by neighborhood socioeconomic status or race/ethnicity.

Conclusions. Eliminating cost sharing for screening mammography was associated with modestly lower decline in screening rates among women with previously low screening adherence.

Key Words. Cost sharing, mammography, Affordable Care Act

In order to increase preventive care use by Americans, the Patient Protection and Affordable Care Act (ACA) mandated the elimination of cost sharing for preventive services strongly recommended by the U.S. Preventive Services Task Force (USPSTF) beginning in 2011 (US Preventive Services Task Force 2008, 2009a). These insurance reforms were based on a number of studies that demonstrate lower use of health care services associated with greater patient cost sharing (Newhouse et al. 1981; Selby, Fireman, and Swain 1996; Goldman et al. 2004; Chernew, Rosen, and Fendrick 2007; Goldman, Joyce, and Zheng 2007; Chandra, Gruber, and McKnight 2010; Karaca-Mandic et al. 2012), and the effectiveness of preventive services in improving population health.

A major provision of the ACA preventive service mandate was full coverage of screening for breast and colorectal cancer among Medicare beneficiaries, that is, free screening. This provision is important because although breast and colorectal cancer are among the leading causes of deaths in the United States and screening for both cancers are generally well-accepted goals of public health (despite recent controversies about the effectiveness of screening mammography; Miller et al. 2014), many elderly Americans do not receive age-appropriate breast and colorectal cancer screening (Centers for Disease Control and Prevention 2012, 2013). Moreover, in breast cancer, even relatively low patient copayments for screening mammography have been associated with suboptimal rates of age-appropriate screening among female Medicare beneficiaries (Blustein 1995; Trivedi, Rakowski, and Ayanian 2008).

Understanding the magnitude of patient response to the elimination of cost sharing for cancer screening has important implications for population health and for successfully crafting health care policies intended to stimulate utilization of similar high value services. We, therefore, investigated the impact on screening rates of a policy implemented by a large Medicare Advantage (MA) health maintenance organization (HMO) plan

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in 2010, which eliminated cost sharing for screening mammography. In anticipation of the ACA mandate that became effective in 2011, this health plan implemented free preventive care policies for all of its beneficiaries in 2010, 1 year before the ACA deadline. Using a cohort of beneficiaries continuously enrolled from 2007 to 2012 (3 years before and 3 years after the policy change), we studied the impact of an elimination of cost sharing for screening mammography on women with positive copayments before 2010 compared with a control group of women in the same HMO with employer-supplemented MA insurance who had free screening mammography throughout the entire study period.

METHODS

Setting

Kaiser Permanente Northern California provides comprehensive medical care and prescription drug insurance to Medicare beneficiaries through its MA HMO. We analyzed a natural experiment that occurred in its individual-subscriber MA plan between 2007 and 2012, in which cost sharing for screening mammography was eliminated among beneficiaries. In 2010, members of this plan were provided full coverage for screening mammography (thereby eliminating the \$20 copayment for plan members), which reflected the plan's voluntary early compliance with the ACA as part of a negotiation between CMS and Kaiser. A comparison group of beneficiaries who received insurance through an employer-supplemented Kaiser group MA plan had full coverage for screening mammography during this entire period. Both beneficiaries in the individual-subscriber and employer-supplemented group MA plan received care in the same health care delivery system.

Population

The study population included all women aged 65 years and above with individual-subscriber or employer-supplemented MA insurance provided through Kaiser who were continuously enrolled from 2006 to 2012. We also excluded women with a cancer diagnosis during this period using Centers for Medicare and Medicaid Services Hierarchical Condition Categories (HCCs).

Study Design

We compared screening mammography rates during 2007–2012 for two groups of women: those with individual MA insurance who faced a \$20 copayment for screening mammography prior to 2010 and full coverage thereafter, versus women with employer-supplemented MA insurance who received full coverage for screening mammography during the entire study period. We used a difference-in-difference study design, which estimated the effect of reducing copayments for screening mammography from \$20 to \$0 by comparing rates in these two groups before and after 2010.

Importantly, in late 2009, the USPSTF revised its breast cancer screening guidelines to recommend biennial only rather than annual or biennial screening for women aged 50–74 years, as well as withdrew its recommendation for routine screening for women above 75 years (because of insufficient evidence to assess the balance of benefits and harms) (U.S. Preventive Services Task Force 2009b). We, therefore, stratified our analysis by current age (defined in January of each year): women aged 65–74 years and those 75 years and above. We also separately computed trends in both annual and biennial rates of screening mammography.

Statistical Analysis

Our binary dependent variable was a screening mammogram performed in a given year or in the previous 2 years, used to analyze trends in annual and biennial rates of screening mammography, respectively. Because characteristics that are associated with screening mammography could differ between women in the individual subscriber versus employer-supplemented MA plan, we used propensity score methods to weight women according to the probability that she received individual-subscriber rather than employer-supplemented insurance. Specifically, we used a multivariate logistic model of plan choice (individual-subscriber insurance, yes or no) as a function of patient age, race/ethnicity, neighborhood socioeconomic status (SES, binary indicator based on 2000 U.S. Census block groups, defined as low socioeconomic status if at least 20 percent residents have household incomes below the federal poverty line or at least 25 percent of residents aged 25 years or older have less than a high-school education) (Krieger and Gordon 1999; Hsu et al. 2006), HCC risk score, and indicator for each medical center within the delivery system (one of central structural variables in the system). This estimation resulted in a patient-level propensity score for individual-subscriber insurance, and we

computed propensity score weights equal to the inverse of the probability of being in the observed group (inverse probability weights).

We analyzed the effect of full coverage for screening mammography on annual (and biennial) mammography rates by estimating a multivariable linear regression with an individual-subscriber MA plan fixed effect, interaction terms between individual-subscriber MA plan (i.e., treatment group) and a pre-/postperiod indicator, and calendar year, weighted using inverse probability of treatment weights derived from the estimated propensity scores. Standard errors were clustered at the person level. The difference-in-difference effect of full coverage for screening mammography is reflected in the interaction between membership in the individual-subscriber MA plan and the pre-/postperiod indicator. The difference-in-difference study design minimizes possible bias caused by time-stable unobservable plan-level factors, such as fixed patient characteristics, that are associated with plan choice and overall screening mammography rates in any given year. We applied inverse probability of treatment weights using propensity scores to the model to balance the observed characteristics between the two groups (Austin 2011). We stratified our model by age (65–74 years, 75 years and above) since USPSTF screening mammography guideline changes during this period may have affected age groups differently and because the impact of cost sharing on screening mammography may differ according to age. Beneficiary age was determined by age as of January each year.

We also examined whether the elimination of cost sharing induced new women to undergo screening mammography, that is, women who previously were not adherent to the recommendation for regular screening. Specifically, we created a time-changing indicator for minimal adherence, defined as the absence of mammography within the past 2 years. For example, a woman in 2009 who had screening mammography in 2006, but not in 2007 or 2008, was classified as nonadherent in the previous 2 years. We then included a three-way interaction term, that is, screening adherence, treatment group, and pre-/postindicator, in the model described earlier. Finally, we determined whether the effect of eliminating cost sharing for mammography varied according to race (by including a three-way interaction between race, treatment group, and pre-/postindicator) and according to neighborhood SES (by including a three-way interaction between high/low neighborhood SES, treatment group, and pre-/postindicator). We used *STATA version 13* for statistical analysis. The study was approved by the institutional review boards at the Massachusetts General Hospital and the Kaiser Foundation Research Institute.

RESULTS

Patient Characteristics

Our sample included 42,473 women with employer-supplemented insurance who had full coverage for screening mammography from 2007 to 2012 and 53,188 women with individual-subscriber insurance who faced \$20 copayments for screening mammography from 2007 to 2009 and had full coverage from 2010 to 2012. Compared with women with employer-supplemented insurance, those with individual-subscriber insurance were slightly older, lived in poorer neighborhoods, and were more likely to be white and healthier (Table 1).

Rates of Screening Mammography

Across age groups, annual unadjusted screening mammography rates were greater among women with employer-supplemented insurance compared with women with individual-subscriber insurance, both during 2007–2009

Table 1: Characteristics of the Study Population

<i>Screening Mammography Coverage</i>	<i>Employer-Supplemented Insurance (N = 42,473); Full Coverage 2007–2012</i>	<i>Individual-Subscriber Insurance (N = 53,188) \$20 Copayment 2007–2009; Full Coverage 2010–2012</i>	<i>p-value</i>
Age (at start of study period)			
Mean	73.2	73.6	<.0001
Age 65–74, No. (%)	26,351 (62.0)	31,817 (59.8)	<.0001
Age 75+, No. (%)	16,122 (38.0)	21,371 (40.2)	
Neighborhood SES			
Nonlow, No. (%)	33,893 (79.8)	41,130 (77.3)	<.0001
Low, No. (%)	7,005 (16.5)	9,289 (17.5)	
Unknown, No. (%)	1,575 (3.7)	2,769 (5.2)	
Race/ethnicity			
White, No. (%)	30,141 (71.0)	39,480 (74.2)	<.0001
Black, No. (%)	3,382 (8.0)	1,789 (3.4)	
Hispanic, No. (%)	3,888 (9.2)	5,954 (11.2)	
Asian, No. (%)	4,734 (11.2)	5,575 (10.5)	
Other, No. (%)	328 (0.8)	390 (0.7)	
CMS-Hierarchical Condition Category score (at start of study period)			
Mean	0.70	0.67	<.0001

Notes. Individuals were continuously enrolled in a large Medicare Advantage health maintenance organization.
CMS, Centers for Medicare and Medicaid Services; SES, socioeconomic status.

when individual subscribers faced \$20 copayments and after 2010 when both groups received full coverage (Figure 1). Trends in unadjusted annual screening mammography rates were comparable in the preperiod for both groups of women ($p = .38$). Among women aged 65–74 years with individual-subscriber insurance, 44.9 percent received screening mammography in 2009 compared with 40.9 percent in 2012 (difference -4.0 percentage points, $p < .0001$). Among women with employer-supplemented insurance, screening rates were 49.5 percent in 2009 compared with 44.1 percent in 2012 (difference -5.4 percentage points, $p < .0001$), implying an unadjusted difference-in-difference change in screening mammography rates of 1.4 percentage points between 2009 and 2012, $p < .001$. Annual screening mammog-

Figure 1: Trends in Annual Screening Mammography before and after the Elimination of Mammography Cost Sharing, According to Age of Women

Notes. Dotted line denotes year in which policy eliminating cost sharing for screening mammography went into effect for patients with individual-subscriber insurance compared with employer-supplemented insurance (ESI) in which cost sharing was always zero. Prepolicy trends were similar for all patients ($p = .384$).

raphy rates were lower among women with older age; for example, among women with employer-supplemented insurance, annual rates among women aged 65–74 years in 2009 were 50.3 percent, 38.2 percent among those aged 75–84 years, and 16.6 percent among those above 85 years ($p < .001$).

In difference-in-difference multivariable analyses, the elimination of cost sharing for screening mammography was associated with a slightly lower decline in annual but not biennial screening rates (Table 2). The elimination of cost sharing was associated with an adjusted slower decline in annual screening mammography rates of 1.2 percentage points (95% CI: 0.8–1.6), with similar effects seen among women ages 65–74 years and 75+ years.

Effect of Cost-Sharing Elimination among Women with and without Recent Mammography

Cost-sharing effects were concentrated among women who had not recently received screening mammography. For example, among women without mammography screening within the prior 2 years, cost-sharing elimination was associated with 1.7 percentage point less decline in screening among nonemployer-supplemented insured compared with employer-supplemented insured (95% CI: 0.8–2.5, Table 3), whereas women who had received recent screening had little or no change in screening associated with the cost-sharing

Table 2: Adjusted Effect of Eliminating Cost Sharing for Screening Mammography on Annual and Biennial Screening Rates

<i>Mammography Frequency</i>	<i>Age 65 and Older</i>		<i>Age 65–74</i>		<i>Age 75+</i>	
	<i>Difference- in-Difference Effect (Percentage Points)</i>	<i>95% CI</i>	<i>Difference-in- Difference Effect (Percentage Points)</i>	<i>95% CI</i>	<i>Difference-in- Difference Effect (Percentage Points)</i>	<i>95% CI</i>
Annual	1.2	0.8–1.6	1.2	0.5–1.9	1.2	0.5–1.9
Biennial	0.2	–0.3 to 0.6	–0.07	–0.8 to 0.6	0.4	–0.5 to 1.3

Notes. Difference-in-difference estimates are from a multivariate linear regression model that adjusted for an interaction between Medicare Advantage plan type and indicator for period of cost-sharing elimination (post-2010) and year indicators and incorporated inverse probability weighting using propensity score (score based on age, race/ethnicity, neighborhood SES, hierarchical condition category score, and indicator for medical center). Stratified analysis by age group was based on age defined as of January each year. Standard errors were clustered at the person level.

Table 3: Adjusted Effect of Eliminating Cost Sharing for Screening Mammography on Annual Screening Rates of Women with and without Prior Screening Mammography in the Prior Two Years

	Unadjusted Pre-2010 Screening Rates (%)	Unadjusted Post-2010 Screening Rates (%)	p-value for Pre-/ Post difference	Adjusted Difference-in- Difference Effect, Percentage Points (95% CI)
Women without any screening mammogram in prior 2 years				
Employer-supplemented insurance	22.8	13.7	<.001	1.7 (0.8–2.5)
Individual-subscriber insurance	19.8	12.0	<.001	
p-value for difference between two groups	<.001	<.001		
Women with any screening mammogram in prior 2 years				
Employer-supplemented insurance	49.9	42.5	<.001	–0.1 (–0.6 to 0.5)
Individual-subscriber insurance	45.6	39.2	<.001	
p-value for difference between two groups	<.001	<.001		

Notes. Difference-in-difference estimates are from a multivariate linear regression model of annual screening mammography rates with an interaction between Medicare Advantage plan type, indicator for period of cost-sharing elimination (post-2010), and a time-changing indicator for whether a woman received screening mammography in the prior 2 years and adjusted for year indicators. The model incorporated inverse probability weighting using propensity score (score based on age, race/ethnicity, neighborhood SES, hierarchical condition category score, and indicator for medical center). The triple interaction term reflects comparisons of difference-in-difference estimates between subgroups of women with or without screening mammogram in the prior 2 years; for example, women previously nonadherent to the screening regimen had less of a change in mammography rates (0.8 percentage points less) over time compared with women previously adherent to the screening regimen.

elimination (difference-in-difference effect of -0.1 percentage points, 95% CI: -0.6 to 0.5).

Effect of Cost-Sharing Elimination According to Race and Neighborhood SES

Cost-sharing elimination did not have a statistically significant effect on screening rates among women living in neighborhoods with low compared with high SES (difference-in-difference effect 1.7 percentage points in low SES vs. 1.2 in high SES, $p = .33$ for difference; Table 4). Compared with white women, the effect of cost-sharing elimination was not statistically significantly different for women who were Black, Hispanic, or Asian (difference-in-difference effect 1.4 percentage points vs. 1.2 for whites, $p = .55$).

DISCUSSION

The ACA mandates full coverage of preventive services, including screening for breast cancer. In this study of women insured through a large MA HMO, we analyzed the impact of an earlier implementation of this ACA policy within a natural experiment that eliminated cost sharing for screening mammography (from a \$20 copayment) among women with individual-subscriber insur-

Table 4: Adjusted Effect of Eliminating Cost Sharing for Screening Mammography on Annual Screening Rates, by Neighborhood Socioeconomic Status and Race of Woman

<i>Subgroup</i>	<i>Difference-in-Difference Effect (Percentage Points)</i>	<i>95% CI</i>	<i>p-value*</i>
Neighborhood SES			
High	1.2	0.7–1.6	–
Low	1.7	0.7–2.6	.33
Race			
White	1.2	0.7–1.6	–
Black, Hispanic, or Asian	1.4	0.7–2.2	.55

Notes. * p -values reflect comparisons of difference-in-difference estimates between categories within each subgroup (e.g., high vs. low neighborhood SES) from the three-way interaction. Difference-in-difference estimates are from a multivariate linear regression model of annual screening mammography rates with an interaction between Medicare Advantage plan type, indicator for period of cost-sharing elimination (post-2010), and various subgroups (SES and race), and adjusted for year indicators. The model incorporated inverse probability weighting using propensity score (score based on age, race/ethnicity, neighborhood SES, hierarchical condition category score, and indicator for medical center). Black, Hispanic, and Asian women were combined to increase sample size.

ance compared with a control group of women within the same delivery system who had full coverage for screening mammography through employer-supplemented insurance during the entire study period. Understanding the effects of this policy is important not only because breast cancer is the second leading cause of death among women but because increases in screening mammography cost sharing have been associated with reduced screening rates (Trivedi, Rakowski, and Ayanian 2008) and because free preventive care and value-based insurance design (Chernew, Rosen, and Fendrick 2007; Chernew et al. 2010; Frank et al. 2012) form two of the cornerstones of the ACA. More broadly, the ACA's mandate for full coverage of breast cancer screening reflects concerns about screening underuse, substantial cancer-associated morbidity and mortality, and the billions of dollars spent on cancer care (Mariotto et al. 2011). While there has been some controversy about degree of benefits associated with screening mammography, the most recent review indicates a measurable benefit of screening (Pace and Keating 2014).

We found that free screening mammography had modest impact on slowing the decline in annual mammography rates among women who had not undergone screening mammography in the prior 2 years. The effect was minimal and nonsignificant among women with recent screening. In other words, full coverage for screening mammography had a slight positive impact among new women undergoing screening. Arguably, encouraging greater use by nonusers was one primary intended effect of the policy of full coverage of preventive care.

Our study evaluated the impact of eliminating cost sharing on breast cancer screening in a MA plan prior to the ACA mandate. Our study offers a number of potential contributions. First, because our analysis preceded the ACA mandate, we were able to compare breast cancer screening in a health plan that eliminated cost sharing to a comparable health plan that had full coverage through the study period. Post-ACA, such a differences-in-differences analysis would be less feasible unless plans implementing free preventive services were compared with grandfathered plans that were exempted from the mandate. Second, and related to this point, we compared MA health plans in the same delivery system, which addresses concerns about unobserved differences in providers across health plans that may be otherwise studied in a post-ACA analysis. Given that the ACA also includes a number of provisions that impact care delivery, this ability to separate the impact of cost-sharing changes from any delivery system effects is particularly important. Third, we focused on patients 65 years old and above rather than the younger, commercially insured population, which is important given that prior work suggests that

there may be greater sensitivity among older adults with relatively fixed incomes. Fourth, although narrow study periods may afford the ability to study the impact of the ACA on certain preventive services (e.g., diabetes screening), others such as cancer screening may require multiple years of observation given the infrequency of screening.

Our study also contributes to a number of studies which analyze the impact of cost sharing on medical expenditures, prescription drug use, and to a lesser extent, use of preventive services (Newhouse et al. 1981; Burton et al. 1995; German et al. 1995; Selby, Fireman, and Swain 1996; Goldman et al. 2004; Busch et al. 2006; Chernew, Rosen, and Fendrick 2007; Goldman, Joyce, and Zheng 2007; Chandra et al. 2010; Meeker et al. 2011; Karaca-Mandic et al. 2012). Reductions in use associated with higher cost sharing are well documented, starting with the RAND Health Insurance Experiment and confirmed by numerous subsequent studies (Ayanian et al. 1993; Newhouse and Group 1993; Blustein 1995; Hsu et al. 2006). Our study adds to prior research by exploring the effect of elimination of cost sharing for screening mammography within a health plan, rather than studying the effects on utilization of differences in cost sharing across plans or increases in cost sharing within plans. Studies that rely on differences in cost sharing across plans to identify the effect of cost sharing on utilization may be confounded by unobserved patient differences across plans (Friedman et al. 2002; Varghese et al. 2005; Trivedi, Rakowski, and Ayanian 2008). Studies that rely on changes in cost sharing within plans address some of these issues, but evidence of decreased utilization associated with cost-sharing increases may not necessarily imply a symmetric increase in utilization following cost-sharing reductions. For example, behavioral economics research suggests that patients may not consider dollar gains (from lower cost sharing for screening mammography) as equivalent to dollar losses (from higher cost sharing) (Kahneman and Tversky 1979; Tversky and Kahneman 1981). Increases in cost sharing for the same group of individuals within a health plan may therefore lead to declines in utilization, whereas decreases in cost sharing may not. Our finding that cost-sharing elimination resulted in at most a modest increase in screening mammography rates is consistent with this interpretation as is other limited evidence that the provision of free preventive care (including cancer screening) by a large American employer was not associated with increases in preventive care use (Busch et al. 2006) and that mammography screening rates did not increase in the 2 years after Medicare introduced its reimbursement benefit of screening mammography (Breen et al. 1997).

Our finding that the elimination of cost sharing had a small effect on screening mammography rates in a large MA population has important implications for the ACA's mandated full coverage of cancer screening and other preventive services. Although existing non-Medicare commercial health plans (i.e., "grandfathered plans") have to date been exempted from mandated full coverage of preventive services, our findings highlight the uncertainty as to whether mandatory extension of full coverage for screening mammography alone could substantially improve screening rates (Hsu et al. 2010). These findings, however, are consistent with a more supportive role in which clinically thoughtful insurance coverage policies contribute to the larger effort to improve care.

One limitation of our study was that women were not randomly assigned to full coverage for screening mammography. Although we analyzed the impact of eliminating screening mammography copayments in a difference-in-difference analysis within plans, baseline rates were higher in employer-supplemented insurance plans and there may be unobserved confounding trends within plans, though our analytic approach was robust to effects of any time-stable unobserved plan-level factors. In addition, changes in USPSTF breast cancer screening guidelines that occurred during our study period may have led to overall declines in breast cancer screening. However, not only did our study design exploit the differential relevancy of the guidelines across age groups, but the elimination of cost sharing in the individual-subscriber plan would have been expected to mitigate screening declines relative to the employer-supplemented plan in which cost sharing did not change. Nonetheless, it is still possible that the guideline change affected plans differentially, which may confound our results. Our study sample also consisted of women insured by a large regional MA-HMO with relatively higher rates of screening at baseline and centrally administered mechanisms for encouraging screening (e.g., telephone, postcard, and email reminders when mammography is due). The effects of eliminating cost sharing for screening mammography could be more muted in other populations, though this could be offset by potentially larger magnitudes of ACA-mandated cost-sharing reductions in other settings. They could also differ for other types of preventive care than mammography. Finally, our study focused on changes in screening rates and did not attempt to assess individual risks or changes in survival or quality-adjusted life years.

In summary, we found that the elimination of cost sharing for screening mammography among women insured by a large MA health plan was associated with a small increase in screening rates relative to women in the same plan with no cost sharing at baseline, with effects concentrated among women who did not have prior screening mammography.

ACKNOWLEDGMENTS

Joint Acknowledgment/Disclosure Statement: The authors report funding from the National Institutes of Health (Dr. Jena, NIH Early Independence Award, grant 1DP5OD017897-01; and Dr. Hsu, grant R01CA164023).

Disclosures: The authors have the following conflicts of interest to report: Huang and Fireman work for Kaiser Permanente, which offers Medicare Advantage plans. Chernew is also a partner in VBID Health, which assists purchasers in designing health care benefits packages. Newhouse is a director for Aetna, which offers Medicare Advantage plans. Hsu has consulted for Kaiser Permanente, which offers Medicare Advantage plans.

Disclaimers: None.

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SUPPORTING INFORMATION

Additional supporting information may be found in the online version of this article:

Appendix SA1: Author Matrix.

Figure S1. Trends in Biennial Screening Mammography before and after the Elimination of Mammography Cost Sharing, According to Age of Women.