

Cancer Screening before and after Switching to a High-Deductible Health Plan

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Background: Health plans with high deductibles could lead patients to avoid preventive care, such as cancer screening.

Objective: To determine the effect of membership in a high-deductible health plan on cervical, breast, and colorectal cancer screening.

Design: Before–after comparison between groups.

Setting: A high-deductible health plan and an HMO in Massachusetts. The high-deductible health plan fully covered mammography, Papanicolaou tests, and fecal occult blood testing (FOBT) but not colonoscopy, flexible sigmoidoscopy, or double-contrast barium enema (DCBE).

Participants: 3169 high-deductible health plan members and 27 022 HMO members (who served as controls).

Measurements: Change in the proportions of patients undergoing breast, cervical, and colorectal cancer screening.

Results: Cancer screening in the high-deductible health plan group was unchanged from baseline to follow-up (adjusted ratios of change, 1.04 [95% CI, 0.91 to 1.19] for breast cancer, 1.04 [CI,

0.92 to 1.17] for cervical cancer, and 1.02 [CI, 0.89 to 1.16] for colorectal cancer). High-deductible health plan members had colonoscopy, flexible sigmoidoscopy, and DCBE less often (ratio of change, 0.73 [CI, 0.56 to 0.95]) and FOBT more often (ratio of change, 1.16 [CI, 1.01 to 1.33]) than HMO members.

Limitations: Population screening frequency was probably underestimated because the study could not assess screening before the baseline year. The study may have included people ineligible for screening because of previous colectomy, mastectomy, or hysterectomy. The findings are limited to a population with relatively high socioeconomic status, which is typical of employed, commercially insured populations.

Conclusion: Members of a high-deductible health plan did not seem to change their use of breast, cervical, and colorectal cancer screening when tests were fully covered. However, members may have substituted a fully covered screening test (FOBT) for tests subject to the deductible (colonoscopy, flexible sigmoidoscopy, and DCBE).

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Detection and treatment of early-stage breast, cervical, and colorectal cancer have been shown to improve cancer-related mortality (1–3), and leading physician organizations and national expert panels recommend routine screening (4–11). However, recent trends toward increased patient cost-sharing have raised concerns that utilization of necessary health services, such as cancer screening, could decline (12–16).

The cost-sharing arrangements found in high-deductible health plans are among the most extreme in the current health care marketplace. High-deductible plans have low monthly premiums, but most services are subject to deductibles averaging \$3300 to \$3900 per year for family plans (17). Although they constitute a relatively low proportion of private health insurance, high-deductible health plans have experienced rapid growth over the past 5 years; the percentage of employers offering high-deductible health plans increased by 150% between 2005 and 2007, and membership has shown similar increases (17).

Previous research (18–26) suggests that cost-sharing reduces the use of medical services, including cancer screening, in public and private fee-for-service systems as well as in HMOs (18, 19, 26–30). As a result, many high-deductible health plans exclude appropriate screening services from the deductible to reduce financial barriers to these beneficial services (31). It is unclear, however, whether enrollees understand these nuances in benefit de-

sign or whether rates of screening will decrease along with overall utilization. To date, few rigorous studies have examined the association between high-deductible health plans and cancer screening.

Harvard Pilgrim Health Care began offering a high-deductible health plan after March 2002. We sought to determine the association between switching to a high-deductible health plan and changes in rates of breast, cervical, and colorectal cancer screening.

METHODS

Harvard Pilgrim Health Care is a health plan serving approximately 900 000 individuals in Massachusetts, Maine, and New Hampshire who are enrolled primarily through employer-sponsored plans. On 1 March 2002, Harvard Pilgrim Health Care began offering a high-deductible health plan with annual deductibles ranging

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Context

Patients enrolled in high-deductible health plans might avoid routine preventive care.

Contribution

This study found that patients transitioning into a high-deductible health plan did not seem to forgo fully covered cancer screening. They did, however, seem to substitute use of a fully covered test (FOBT) for ones subject to the deductible (such as colonoscopy).

Caution

The study was based on claims data, which were not validated by chart review.

Implication

Transition into a high-deductible health plan does not appear to be associated with avoidance of routine cancer screening.

—The Editors

from \$500 to \$2000 for individuals and \$1000 to \$4000 for families. Members of family plans also have an individual deductible equal to half their family deductible. Full coverage begins for members when they exceed their individual deductible or, for family members, when the family's combined expenses exceed the family deductible. Most institutional services (such as emergency department care and hospitalizations) and advanced imaging procedures are subject to the deductible. When a member of a high-deductible health plan spends less than the deductible, the member is billed directly for all services subject to the deductible.

A \$20 copayment applies to most outpatient visits, including routine physical examinations, urgent care visits, and specialist consultations. These copayments are independent of the member's deductible status and must be paid regardless of whether the member has exceeded the deductible spending level. However, for the high-deductible health plan enrollees we studied, first-dollar coverage (and thus exclusion from the deductible) is provided for most preventive services, including Papanicolaou (Pap) tests, mammography, and fecal occult blood testing (FOBT). Colonoscopy, flexible sigmoidoscopy, and double-contrast barium enemas (DCBEs) are exceptions that are subject to the deductible.

Employers purchasing the high-deductible health plans may opt to combine them with a health care reimbursement account from Harvard Pilgrim Health Care. This allows an employer to place an employee's money into an account used to pay for that employees' out-of-pocket health expenses.

Members of the traditional HMO plans we studied had outpatient copayments ranging from \$5 to \$25 and first-dollar coverage for all of the above preventive services.

Sample

We drew our sample from a previously established cohort of Harvard Pilgrim Health Care members enrolled through Massachusetts employers that exclusively offered Harvard Pilgrim Health Care plans (25). We included members from employers who purchased plans directly from Harvard Pilgrim Health Care as well as those who purchased Harvard Pilgrim Health Care plans from independent brokers (association plans). From this population, we selected members who were continuously enrolled for at least 2 years at any time between 1 March 2001 and 30 June 2005.

We defined 2 cohorts of interest: a high-deductible health plan group and a control group. The high-deductible health plan group included members who were enrolled in traditional HMO plans during a 1-year baseline period and then experienced an employer-mandated switch to a high-deductible health plan. We defined the index date as the date of this switch. We followed these members for 1 additional year while they were enrolled in high-deductible health plans. For each member who switched into a high-deductible plan, we identified up to 8 contemporaneous HMO members who were enrolled in the traditional HMO plan for the same 1-year baseline and follow-up periods without a switch. These control members were randomly matched to each high-deductible health plan member on the basis of adult or child status and membership in an association plan. We assigned matched HMO members and high-deductible health plan members the same index date and thus the same baseline and follow-up period. Only HMO members whose employers did not offer them an option to switch to a high-deductible health plan or any other Harvard Pilgrim plan type were selected as controls. Members from both study groups therefore could not self-select their health plan. The earliest and latest possible index dates were 1 March 2002 and 30 June 2004, respectively. The last date of follow-up was 30 June 2005.

We excluded members whose employers offered health plans from other insurance providers and members with accounts that were part of nongroup, Medicare, or integrated federal employee HMO plans.

From our high-deductible health plan and control cohorts, we identified members 21 to 64 years of age and eligible for breast, cervical, and colorectal cancer screening in the baseline and follow-up years on the basis of insurance claims criteria in the 2006 Healthcare Effectiveness Data and Information Set specifications (32–34). We excluded members age 65 years or older because they would be eligible for cancer screening coverage through Medicare and excluded 555 high-deductible health plan members whose plan contained different financial incentives than the main high-deductible health plan cohort, in that all cancer screening tests were subject to the deductible. Because including these members did not substantively alter our results, we present results only from the main high-

deductible health plan group with consistent cancer screening coverage. We also excluded 66 members with missing census data or missing data regarding enrollment in an individual or family plan. Our final study cohort comprised 3169 high-deductible health plan and 27 022 HMO members.

For breast cancer screening, we included women 40 to 64 years of age who had not had bilateral mastectomy; 1592 high-deductible health plan and 12 678 HMO members met these criteria. For cervical cancer screening, we included women 21 to 64 years of age unless they had had hysterectomy with no residual cervix; 2375 high-deductible health plan and 20 714 HMO members met these criteria. For colorectal cancer screening, we included men and women 50 to 64 years of age unless they had had total colectomy or received a diagnosis of colorectal cancer during the baseline or follow-up period (surveillance rather than screening colonoscopy would be indicated for such members); 1668 high-deductible health plan and 12 629 HMO members met these criteria.

The study was approved by the Harvard Pilgrim Health Care Institutional Review Board.

Assessment of Cancer Screening Status

To assess cancer screening, we obtained all medical service and pharmacy claims for our study groups from Harvard Pilgrim Health Care's claims database. We selected claims for breast, cervical, and colorectal cancer screening by using the International Classification of Diseases, 9th Revision, Clinical Modification codes listed in the 2006 Healthcare Effectiveness Data and Information Set technical specifications (32–34), as well as codes specific to Harvard Pilgrim Health Care.

For breast cancer screening, our outcome was the percentage of women who had mammography at least once at baseline and follow-up. Current guidelines recommend that women older than 50 years should have mammography every year (35), although the U.S. Preventive Services Task Force allows for screening every 2 years for all women older than 40 years (8).

For cervical cancer screening, our outcome was the percentage of women who received at least 1 Pap test during baseline and follow-up. Current guidelines (35) recommend that women age 21 to 65 years have a Pap test at least every 3 years and women at high risk and those younger than age 30 years receive screening annually.

Our colorectal cancer screening outcome was the percentage of adults who received FOBT, flexible sigmoidoscopy, DCBE, or colonoscopy during the 1-year periods of interest. We also examined changes in FOBT and colonoscopy individually and an aggregate of colonoscopy, flexible sigmoidoscopy, and DCBE. Agencies and specialty societies agree (4–7) that colorectal cancer screening for persons 50 years of age and older should include FOBT every year with or without flexible sigmoidoscopy, DCBE every 4 to 5 years, or colonoscopy every 10 years. If a member had

more than 1 colorectal cancer screening test in a study period, we considered the first test to be that member's screening test; 7.8% of high-deductible health plan members and 9.6% of HMO members had more than 1 test in the baseline period, and 6.8% of high-deductible health plan members and 7.8% of HMO members had more than 1 test in the follow-up period.

We could not specifically track the number of FOBT cards that each member submitted; however, the majority of claims for FOBT (>90%) were filed under Current Procedural Terminology code 82270, which requires testing of 3 completed, consecutive FOBT samples (36).

Covariates

To estimate comorbid conditions for all individuals, we computed chronic disease scores on the basis of pharmacy claims filed during the member's baseline year (37, 38). In predicting future health service utilization, the chronic disease score performs similarly to models using diagnostic or procedural data (37, 39). It has performed as well as or better than the ambulatory care groups model based on International Classification of Diseases, 9th Revision, Clinical Modification codes in HMO settings, predicting 50% to 60% of variation in health care utilization, costs, and mortality (37).

To derive proxy measures of socioeconomic status, we linked members' most recent residential addresses to their 2000 U.S. Census block group (40), a subdivision of census tracts containing an average of 1000 individuals. We used previously established categorical variables of neighborhood education levels and poverty status (41) and a dichotomous variable indicating residence in a predominantly black neighborhood ($\geq 66\%$ black residents). Other covariates included age, individual versus family plans (both assessed at the index date), sex, employer size (measured by number of employees), and whether members were in association plans. We presumed that a given employer's association status does not change and that employer size remains constant from baseline to follow-up, despite the potential for small year-to-year fluctuations.

Statistical Analysis

We compared the baseline characteristics of our study groups by using chi-square tests, *t* tests, and Poisson or quantile regression (42). We used logistic regression to model the independent effect of high-deductible health plan membership on cancer screening after controlling for age, sex, employer size, index date, socioeconomic status, residence in a predominantly black neighborhood, association status, individual versus family plan, and illness. We included the index date in models to control for secular trends in cancer screening. We used generalized estimating equations (43, 44) to examine changes in the rate of screening while adjusting for the correlation in an individual's receipt of screening between the baseline and follow-up periods. All analyses were performed by using SAS, version 9.1 (SAS Institute, Cary, North Carolina).

Although not all screening tests are recommended yearly, the proportions of age-appropriate members receiving cancer screening nevertheless should be similar in the high-deductible health plan and control groups if member- and employer-level characteristics are similar. For colorectal screening in particular, because members older than 50 years of age may have received previous screening with colonoscopy, flexible sigmoidoscopy, or DCBE, we performed a sensitivity analysis by restricting our sample to members who were less likely to have had previous colorectal cancer screening. Our analysis examined the frequency of screening during the baseline period among high-deductible health plan and HMO members who were age 50 years at the beginning of the baseline period. We also examined the frequency of screening during the follow-up period among the subset of this population who were not screened during the baseline period and among members who were 50 years of age at the beginning of the follow-up period. To understand differences in cancer screening among men and women, we stratified the colorectal cancer screening analyses by sex. Because not all expert panels recommend breast cancer screening between 40 and 50 years of age, we also performed a sensitivity analysis after excluding this age group.

Role of the Funding Source

The study was supported by a faculty grant funded by the Harvard Pilgrim Health Care Foundation. The funding source had no role in the study design, conduct, analysis, or decisions about manuscript submission.

RESULTS

Baseline Characteristics

Table 1 shows the baseline characteristics of the cohorts that were eligible for breast, cervical, and colorectal cancer screening. We found no clinically significant differences between high-deductible health plan and HMO members in any of the 3 cohorts with regard to percentages in family or association plans, distributions of the chronic disease score, or measures of socioeconomic status. Most members across the cohorts were employed at small or mid-sized companies.

The average age of participants who were eligible for breast cancer screening was approximately 51 years. Among participants eligible for cervical cancer screening, the average age was approximately 46 years in the high-deductible health plan group and 44 years in the control group ($P < 0.001$). The average age of participants who were eligible for colorectal cancer screening was 56 years,

Table 1. Baseline Characteristics

Characteristic	Eligible for Breast Cancer Screening			Eligible for Cervical Cancer Screening		
	High-Deductible Health Plan Group (n = 1592)	Control Group (n = 12 678)	P Value	High-Deductible Health Plan Group (n = 2375)	Control Group (n = 20 714)	P Value
Mean age on index date (SD), y	51.7 (6.4)	51.1 (6.4)	<0.001	45.6 (10.5)	44.0 (10.4)	<0.001
Women, n (%)	1592 (100)	12 680 (100)	1.0	2375 (100)	20 714 (100)	1.0
In family plan, n (%)	812 (51.0)	7437 (58.7)	<0.001	1325 (55.8)	12 642 (61.0)	<0.001
In association plan, n (%)	870 (54.7)	7150 (56.4)	0.185	1217 (51.2)	11 725 (56.6)	<0.001
Mean outpatient visits per 1000 member-years (SD), n	4.4 (5.5)	5.2 (6.6)	<0.001	4.4 (5.9)	5.0 (6.6)	<0.001
Employer size, n (%)			<0.001			<0.001
2–50 employees	1222 (76.8)	8791 (69.3)		1797 (75.7)	14 603 (70.5)	
51–250 employees	344 (21.6)	1067 (8.4)		536 (22.6)	1612 (7.8)	
251–999 employees	10 (0.6)	1518 (12.0)		13 (0.6)	2383 (11.5)	
≥1000 employees	16 (1.0)	1302 (10.3)		29 (1.2)	2116 (10.2)	
Chronic disease score						
Mean (SD)	1421.4 (1518.3)	1558.9 (1677.4)	<0.001	1403.2 (1350.0)	1517.4 (1466.8)	<0.001
25th percentile (healthiest)	653.4	653.4	1.0	658.1	658.1	1.0
Median	895.9	895.9	1.0	895.9	895.9	1.0
75th percentile	1580.5	1842.0	<0.001	1575.8	1635.1	0.25
Neighborhood, n (%)						
Residents below poverty level			0.013			0.002
<5%	922 (57.9)	7686 (60.6)		1346 (56.7)	12 255 (59.2)	
5%–9.9%	417 (26.2)	3134 (24.7)		631 (26.6)	5211 (25.2)	
10%–19.9%	204 (12.8)	1366 (10.8)		317 (13.4)	2356 (11.4)	
≥20%	49 (3.1)	492 (3.9)		81 (3.4)	892 (4.3)	
>66% black residents	5 (0.31)	84 (0.66)	0.096	6 (0.25)	141 (0.68)	0.013
Residents with less than high school education			0.76			0.099
<15%	1284 (80.7)	10 281 (81.1)		1902 (80.1)	16 366 (79.0)	
15%–24.9%	207 (13.0)	1577 (12.4)		326 (13.7)	2818 (13.6)	
25%–39.9%	73 (4.6)	625 (4.9)		107 (4.5)	1192 (5.8)	
≥40%	28 (1.8)	195 (1.5)		40 (1.7)	338 (1.6)	

and approximately half of the members in each group were female (53.4% of the high-deductible health plan group and 51.5% of the control group; $P = 0.22$).

High-deductible health plan members made fewer baseline outpatient visits than HMO members in all 3 cancer screening cohorts ($P < 0.001$ for each comparison); no statistically or clinically significant changes in the number of outpatient visits occurred between baseline and follow-up (data not shown). Uptake of health reimbursement accounts was low among members of nonassociation high-deductible health plans (2.2%). We could not measure the prevalence of employer health reimbursement accounts among members whose employers purchased association plans but expect it to be low, given that all such employers have fewer than 10 employees.

Cancer Screening

Table 2 shows changes in cancer screening. The high-deductible health plan group and the control group had similar proportions of patients undergoing breast cancer screening at baseline (60.1% vs. 60.9%; $P = 0.54$); however, lower proportions of the high-deductible health plan group had cervical cancer screening (58.5% vs. 62.2%; $P < 0.001$) and colorectal cancer screening (36.6% vs. 40.4%; $P = 0.003$). The proportion of patients who were screened for breast cancer increased from baseline to fol-

low-up in the high-deductible health plan group (60.1% to 63.3%; $P = 0.058$) and in the control group (60.9% to 63.1%; $P < 0.001$) but remained almost unchanged for cervical and colorectal cancer in both groups.

After controlling for age, sex, employer size, index date, socioeconomic status, association status, individual versus family plans, and illness, we observed no significant changes in cancer screening in the high-deductible health plan group compared with the control group. For example, the ratio of change in breast cancer screening from baseline to follow-up in the high-deductible health plan group compared with HMO members was 1.04 (95% CI, 0.91 to 1.19). Sensitivity analysis among women 50 to 63 years of age revealed a similar trend (ratio of change, 1.13 [CI, 0.95 to 1.35]).

The frequency of colorectal cancer screening also did not change from baseline to follow-up among eligible high-deductible health plan members compared with HMO members (ratio of change, 1.02 [CI, 0.89 to 1.16]). However, the high-deductible health plan group had a lower relative rate of colonoscopy (ratio of change, 0.73 [CI, 0.55 to 0.96]) and a higher relative rate of FOBT (ratio of change, 1.16 [CI, 1.01 to 1.33]) than the control group. Sensitivity analysis on members less likely to have received previous colorectal cancer screening revealed similar trends, although the CIs were wider because these groups were small (data not shown).

Colorectal Cancer Screening by Sex

Table 2 also shows stratification of use of colorectal cancer screening by sex. Men had lower baseline use of colorectal cancer screening than women in both the high-deductible health plan and control groups, but the ratios of change for overall testing from baseline to follow-up did not differ (0.99 [CI, 0.80 to 1.22] for men and 1.04 [CI, 0.87 to 1.24] for women). Statistically significant changes occurred in the use of colonoscopy (ratio of change, 0.62 [CI, 0.42 to 0.93]) and FOBT (ratio of change, 1.19 [CI, 1.00 to 1.43]) among women in high-deductible health plans but not among men in those same plans (ratios of change, 0.85 [CI, 0.58 to 1.26] for colonoscopy and 1.11 [CI, 0.89 to 1.39] for FOBT).

DISCUSSION

We found that among HMO members who were not offered a choice of employer-based health plans, transition to a high-deductible health plan was not associated with changes in recommended breast, cervical, or colorectal cancer screening compared with continuously enrolled HMO members. However, high-deductible health plan members who had first-dollar coverage of FOBT but out-of-pocket responsibility for colonoscopy experienced a substantial decline in colonoscopy and a compensatory increase in FOBT, both of which were statistically significant.

We performed a systematic search of PubMed entries dated January 2000 through February 2008 and found no

Table 1—Continued

Eligible for Colorectal Cancer Screening		
High-Deductible Health Plan Group (n = 1668)	Control Group (n = 12 629)	P Value
56.6 (3.6)	56.4 (3.6)	0.022
891 (53.4)	6499 (51.5)	0.133
786 (47.1)	6671 (52.8)	<0.001
986 (59.1)	7739 (61.3)	0.088
4.0 (5.2)	5.0 (6.2)	<0.001
		<0.001
1322 (79.3)	9215 (73.0)	
312 (18.7)	1002 (7.9)	
16 (1.0)	1234 (9.8)	
18 (1.1)	1178 (9.3)	
1588.6 (1429.1)	1833.1 (1941.7)	<0.001
895.9	895.9	1.0
1205.3	1205.3	1.0
1818.3	2127.6	<0.001
		0.008
942 (56.5)	7628 (60.4)	
470 (28.2)	3207 (25.4)	
203 (12.2)	1345 (10.7)	
53 (3.2)	449 (3.6)	
5 (0.30)	70 (0.55)	0.176
		0.66
1353 (81.1)	10 344 (81.9)	
209 (12.5)	1558 (12.3)	
78 (4.7)	558 (4.4)	
28 (1.7)	169 (1.3)	

Table 2. Cancer Screening in Baseline and Follow-up Periods*

Type of Cancer Screening	High-Deductible Health Plan Group†			Control Group‡			Ratio of Change in Cancer Screening from Baseline to Follow-up vs. Control Group (95% CI)§
	Baseline, n (%)	Follow-up, n (%)	P Value	Baseline, n (%)	Follow-up, n (%)	P Value	
Breast	956 (60.1)	1008 (63.3)	0.058	7715 (60.9)	8001 (63.1)	<0.001	1.04 (0.91–1.19)
Cervical	1389 (58.5)	1408 (59.3)	0.58	12 893 (62.2)	12 855 (62.1)	0.70	1.04 (0.92–1.17)
Colorectal	611 (36.6)	604 (36.2)	0.80	5101 (40.4)	4999 (39.6)	0.190	1.02 (0.89–1.16)
Men	246 (31.7)	239 (30.8)	0.42	2229 (36.4)	2191 (35.7)	0.78	0.99 (0.80–1.22)
Women	365 (41.0)	365 (41.0)	1.0	2872 (44.2)	2808 (43.2)	0.26	1.04 (0.87–1.24)
Colonoscopy	149 (8.9)	118 (7.1)	0.048	1153 (9.1)	1217 (9.6)	0.167	0.73 (0.55–0.96)
Men	73 (9.4)	64 (8.2)	0.42	582 (9.5)	591 (9.6)	0.78	0.85 (0.58–1.26)
Women	76 (8.5)	54 (6.1)	0.045	571 (8.8)	626 (9.6)	0.095	0.62 (0.42–0.93)
Colonoscopy, FS, and DCBE	169 (10.1)	127 (7.6)	0.011	1338 (10.6)	1335 (10.6)	0.95	0.73 (0.56–0.95)
Men	85 (10.9)	67 (8.6)	0.124	670 (10.9)	655 (10.7)	0.66	0.79 (0.54–1.14)
Women	84 (9.4)	60 (6.7)	0.037	668 (10.3)	680 (10.5)	0.73	0.68 (0.47–0.99)
FOBT	442 (26.5)	477 (28.6)	0.175	3763 (29.8)	3664 (29.0)	0.172	1.16 (1.01–1.33)
Men	161 (20.7)	172 (22.1)	0.50	1559 (25.4)	1536 (25.1)	0.63	1.11 (0.89–1.39)
Women	281 (31.5)	305 (34.2)	0.23	2204 (33.9)	2128 (32.7)	0.157	1.19 (1.00–1.43)

* All percentages are unadjusted. DCBE = double-contrast barium enema; FOBT = fecal occult blood testing; FS = flexible sigmoidoscopy.
 † Mammography, Papanicolaou tests, and FOBT have first-dollar coverage, whereas colonoscopy, DCBE, and flexible sigmoidoscopy are subject to the deductible.
 ‡ All tests (mammography, Papanicolaou tests, FOBT, colonoscopy, DCBE, and flexible sigmoidoscopy) have first-dollar coverage.
 § Ratio adjusted using logistic regression to model the independent effect of high-deductible status on cancer screening rates, controlling for age, sex, employer size, index date, socioeconomic status, association status, individual versus family plans, and illness. The result is the adjusted ratio of the follow-up to baseline odds ratios of the high-deductible health plan group divided by the ratio of the follow-up to baseline odds ratios of the control group.

studies of the association between high-deductible health plans and cancer screening services with full cost-sharing. We therefore believe that our study is the first to examine the association between a high-deductible health plan and use of an expensive cancer screening test subject to the deductible (colonoscopy). We also believe that our study is the first to analyze substitution between recommended colorectal cancer screening techniques when levels of cost-sharing differ for those services.

Our results allay concerns that high-deductible health plans will lead to lower use of cancer screening even when these tests are fully covered. Slight increases in screening indicate that reductions in cancer screening from non-test-related cost-sharing are unlikely. Also, because copayments for outpatient visits are similar for high-deductible health plan members and HMO members, such an effect would be unlikely unless members generally avoided care because of the high-deductible health plan.

The observed changes in colorectal cancer screening tests suggest that members of the high-deductible health plan group are substituting a fully covered test (FOBT) for those subject to the deductible (colonoscopy, flexible sigmoidoscopy, and DCBE). A decrease in the latter screening tests could also have occurred if high-deductible plan members made a point of being screened before they transitioned to the high-deductible plans. However, the slightly lower use of baseline colonoscopy, flexible sigmoidoscopy, and DCBE in the high-deductible group and the increase

in FOBT leading to stable use of colorectal cancer screening in the follow-up period point more toward a substitution effect in the follow-up period.

The changes we observed in colorectal cancer screening techniques may have several important policy implications. They suggest that patients may be discussing the costs and relative benefits of services with their primary care providers, although the quality of these discussions remains uncertain. Colonoscopy is considered more sensitive and specific than FOBT for detecting cancer and large polyps; however, expert panels have concluded that comparative data on detection, risks, and costs are insufficient to recommend either test over the other for the general population (4, 5, 45). Nevertheless, the observed decrease in colonoscopy relative to FOBT may be cause for concern if it leads to a higher frequency of undetected colorectal cancer. A full exploration of the implications of such substitution would be complex, given that it must account for patient preferences, quality of life, and cost-effectiveness. However, the substitution we detected suggests that health plans should ensure that value-seeking by patients is associated with appropriate utilization and acceptable outcomes. Only 63% of U.S. employees have preventive services exempted from their deductible (31). Our results, in combination with those of other recent studies (26, 46), suggest that recommended cancer screening tests should be fully covered in the current health care environment.

Because of the specific screening techniques that we

examined, our study largely illuminates patterns of cancer screening among female high-deductible plan members. In this demographic group, we consistently found small, non-statistically significant increases in breast, cervical, and colorectal cancer screening. However, substitution of FOBT for colonoscopy was more pronounced among women in high-deductible plans than among men. Men in high-deductible health plans had an unchanged frequency of colorectal cancer screening and a smaller substitution effect than women, although differences in the substitution effect between men and women were relatively minimal. Reduced colorectal cancer detection among women due to receipt of fewer colonoscopy procedures would be a concerning outcome; we advise further study of sex differences in colorectal cancer screening and detection among high-deductible plan members.

Studies conducted during previous insurance eras have generally shown that cost-sharing for preventive care is associated with lower use of both appropriate and inappropriate medical services, including recommended screening tests. This has been found as a direct effect, when members share costs for the service itself, and as an indirect effect, when cost-sharing for outpatient visits leads to fewer primary care encounters (21, 24, 26, 47, 48). For instance, Blustein (24) found that rates of breast cancer screening were substantially lower among women covered by Medicare who did not have supplemental insurance than among women who did. Solanki and Schaffler (21) found that cost-sharing was associated with lower rates of mammography and Pap tests. A study of the association between cost-sharing and colorectal cancer screening found lower rates of screening, most likely because of reductions in nonacute physician office visits (48). Trivedi and colleagues (26) found that small copayments for mammography were associated with lower breast screening rates among a population enrolled in Medicare managed-care plans. A recent study analyzed breast and cervical cancer screening among high-deductible health plan members when these services were fully covered (46); similar to our study, high-deductible health plan members did not underuse these services compared with members of traditional health plans. Although these studies provide valuable insights, interpretation is limited by such factors as cross-sectional design, selection bias, and uncertain estimates of cost-sharing levels—possible biases that our study design avoided.

Our study has several limitations. Because we could not assess cancer screening before the baseline year, we probably underestimated the use of population screening. This is particularly relevant for colorectal cancer screening, in which members with previous normal results on colonoscopy do not need further screening for up to 10 years. However, our high-deductible health plan and control groups were similar in terms of key control variables, so that the frequency of previous screening should in theory be similar. In addition, a sensitivity analysis that included only members who were unlikely to have received

previous colorectal cancer screening revealed similar trends in screening as the overall cohort. Because we could not perform detailed chart review, we may have considered members eligible for screening who were in fact ineligible because of previous colectomy, mastectomy, or hysterectomy. However, we expect the percentage of such ineligible members to be low and therefore unlikely to substantially influence observed findings. Our results apply largely to health plan members who are at least somewhat familiar with the general structure of a traditional health plan. However, given the substantial percentage of employers who are considering introducing high-deductible health plans (17), our results should be highly relevant to a large segment of the private health insurance market. Finally, we studied a population with a relatively high socioeconomic status, which is typical of employed, commercially insured populations.

Our findings suggest that high-deductible health plans that fully cover mammography, Pap tests, and FOBT and have minimal cost-sharing for primary care visits are associated with similar population frequencies of breast, cervical, and colorectal cancer screening as HMO plans that fully cover all cancer screening services, including colonoscopy. However, observed statistically significant decreases in colonoscopy suggest that screening tests should be subject to a deductible only if a fully covered and adequate substitute exists. Given the higher sensitivity of colonoscopy versus FOBT in detecting colorectal cancer, further study is needed regarding cancer detection and mortality among high-deductible health plan members.

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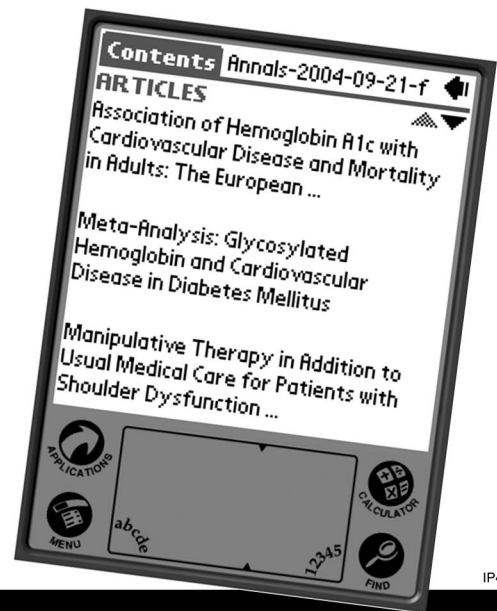
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