The Effect of Area HMO Market Share on Cancer Screening

Laurence C. Baker, Kathryn A. Phillips, Jennifer S. Haas, Su-Ying Liang, and Dean Sonneborn

Objective. Managed care may have widespread impacts on health care delivery for all patients in the areas where they operate. We examine the relationship between area managed care activity and screening for breast, cervical, and prostate cancer among patients enrolled in more managed care plans and patients who are enrolled in less managed plans.

Data and Methods. Data on cancer screening from the 1996 Medical Expenditure Panel Survey (MEPS) were linked to data on health maintenance organization (HMO) and preferred provider organization (PPO) market share and HMO competition at the metropolitan statistical area (MSA) level. Logistic regression analysis was used to examine the relationship between area managed care prevalence and the use of mammography, clinical breast examination, Pap smear, and prostate cancer screening in the past two years, controlling for important covariates.

Results. Among all patients, increases in area-level HMO market share are associated with increases in the appropriate use of mammography, clinical breast exam, and Pap smear (OR for high relative to low managed care areas are 1.75, $p < .01$, for mammography, 1.58, $p < .05$, for clinical breast exam, and 1.71, $p < .01$, for Pap smear). In analyses of subgroups, the relationship is significant only for individuals who are enrolled in the nonmanaged plans; there is no relationship for individuals in more managed plans. No relationship is observed between area HMO market share and prostate cancer screening in any analysis. Neither the level of competition between area HMOs nor area PPO market share is associated with screening rates.

Conclusions. Area-level managed care activity can influence preventive care treatment patterns.

Key Words. Cancer screening, managed care, HMO, PPO

In addition to influencing the care provided to the patients they cover, the activities of HMOs and other managed care organizations may also bring about changes in the structure and functioning of the health care system with broader implications for health care delivery. Such “spillover effects” of managed care could ultimately affect all of the health care delivered in the United States, including health care for patients who have not joined managed care organizations.

Existing literature suggests that managed care can influence treatment patterns for non-managed care patients. Prior work suggests that increases in HMO market share are associated with declines in expenditures for the care of patients covered by traditional, fee-for-service, Medicare (Baker 1999; Baker and Sharkarkumar 1998). Other studies indicate that areas with high levels of HMO activity have lower total hospital costs (Gaskin and Hadley 1997; Robinson 1991; Robinson 1996; Noether 1988) and that HMO activity affects premiums for non-HMO health insurance (Baker and Corts 1996; Feldstein and Wickizer 1995; Frank and Welch 1985; Baker et al. 2000). Some work suggests that increases in the number of Medicare beneficiaries enrolled in Medicare HMOs are associated with lower overall Medicare expenditures (Welch 1994; Baker 1997; Clement, Gleason, and Brown 1992; Rodgers and Smith 1995).

All of these studies focused on measures related to spending. While differences in spending suggest differences in treatment patterns, relatively little work directly examines treatment patterns. Nonetheless, understanding the extent to which managed care activity is associated via spillover effects with treatment patterns, and the ways in which treatment patterns are affected, is necessary for the formation of a clear understanding of the overall impact of managed care on health care delivery and for the formation of optimal policy responses to changes in the size and characteristics of managed care plans.

This article examines the relationship between area managed care activity and the use of appropriate cancer screening. We use Medical Expenditure Panel Survey (MEPS) data to identify the timely receipt of screening for breast, cervical, and prostate cancer among patients for whom such screening is appropriate. Screening for cancer is an area in which it is quite plausible that managed care could influence treatment patterns. Studies of managed care and cancer screening (primarily mammography) have generally found that

This research was supported by the National Cancer Institute (R01 CA81130) and the Agency for Healthcare Research and Quality (AHRQ P01 HS10771, P01 HS10856, and R01 HS10925). The authors appreciate the comments of Dr. Harold Luft on previous versions of this manuscript.

Address correspondence to Laurence Baker, Ph.D., Department of Health Research and Policy, HRP Redwood Building, Rm. 110, Stanford University School of Medicine, Stanford, CA. Dr. Baker is also with the National Bureau of Economic Research, Cambridge, MA. Kathryn A. Phillips, Ph.D., and Su-Ying Liang, Ph.D., are with the Institute for Health Policy Studies, University of California, and the School of Pharmacy, University of California, San Francisco. Jennifer S. Haas, M.D., M.S.P.H., is with the Division of General Medicine, Brigham and Women's Hospital, Harvard Medical School, Boston, MA. Dean Sonneborn, M.A., is with the Institute for Health Policy Studies, University of California, San Francisco.

screening is higher among patients enrolled in HMOs or other managed care plans than patients in less-managed types of plans, although more recent studies examining a wider range of plan types have had ambiguous results (Tu, Kemper, and Wong 1999; Gordon, Rundall, and Parker 1998; Solanki and Schaufli 1999; Bernstein, Thompson, and Harlan 1991; Potosky et al. 1998; Phillips et al. 1998; Brown et al. 1990; Zapka et al. 1991; Hsia et al. 2000; Wee et al. 2001; Tye, Phillips, and Liang 2004; Phillips et al. 2004). These studies suggest the potential for area-level managed care to influence screening, but little work examines this issue specifically (Phillips 1998). Work on cancer diagnosis and treatment rates (Baker and McClellan 2001) and work on mammography facilities (Baker and Brown 1999) also suggests the potential for an effect of area-level managed care, but does not directly examine screening.

POTENTIAL MECHANISMS AND EMPIRICAL APPROACH

By “spillover effects,” we mean effects of the area level of managed care activity on non-managed care patients. There are a number of potential mechanisms by which spillover effects could come about. We believe two types of mechanisms are particularly applicable to a discussion of screening. First, spillover effects could come about through changes in physician practice patterns. For example, suppose that the care management, information dissemination, and other practices of HMOs lead to changes in the practice styles of HMO doctors (at least when treating HMO patients) that produce higher screening rates among HMO patients. Such a “better” practice style could spread to other providers. If there are physicians who treat primarily non-HMO patients, then as the number of HMO patients increases (and thus as the number of HMO doctors in their area increases), non-HMO doctors may come in contact with HMO doctors more frequently, and information about practice style may be transferred to the non-HMO doctors who may, in turn, adopt techniques that increase their screening rate. In a similar way, doctors who treat both HMO and non-HMO patients may find that their practice style is shifted more and more toward the “HMO” way of doing things as the share of their patients from HMOs rises. Physicians increasingly conditioned to function in a managed care environment may find themselves treating even fee-for-service patients with more of a managed care mindset.

A related possibility is that there are effects at the patient level. Non-managed care patients in markets with high levels of activity by plans that endeavor to increase screening rates may more frequently encounter managed

care plan materials, other individuals who have been screened, or other forms of encouragement that promote screening. This may then influence their behavior.

A second class of potential mechanisms is area-level changes in service availability. Suppose that HMOs are better at promoting screening than non-HMO carriers. Increases in HMO market share in an area may then attract potential providers of screening services (e.g., physicians or screening center operators) to the area, increasing the availability of services. This may make it easier for all patients to get screened. Managed care activity does appear to be related to the number or types of health care providers in an area (e.g., Escarce et al. 1998, 2000).

We begin our analysis by studying the relationship between screening use and HMO market share for all patients in the market. This provides a useful beginning point, but will not provide the clearest evidence about spillover effects that influence non-managed care patients. We thus also estimate separate models of screening for patients in managed and nonmanaged plans. The extent to which we observe effects in the nonmanaged population is perhaps the most straightforward measure of the presence of spillovers.

Differences between results for the managed and nonmanaged plan patients may provide some useful information about the mechanisms at work. If spillovers result from shifts in practice patterns, a plausible scenario is that a regression of screening rates in the nonmanaged population on area HMO market share would show positive relationships, but a parallel regression on the population in managed plans would not. Screening rates among managed plan patients are, in this scenario, already in some sense the standard and need not be further driven up by higher market share. If changes in infrastructure or other area characteristics are at work, it seems more plausible that increases in HMO market share could increase screening for both nonmanaged and managed patients, as all benefit from easier access.

DATA AND METHODS

Data

We used data from the 1996 Medical Expenditure Panel Survey-Household Component (MEPS-HC), a large panel survey sponsored by the Agency for Healthcare Research and Quality and conducted in conjunction with the National Center for Health Statistics. The MEPS is designed to provide nationally representative information about a range of health-care-related variables for

the U.S. civilian, noninstitutionalized population (Cohen et al. 1996). Full-year (1996) data is available for 22,601 individuals, with a first-round response rate of 77.7 percent (Cohen, DiGaetano, and Goskel 1999).

From the complete set of MEPS-HC respondents, we identified individuals who resided in a metropolitan statistical area (MSA), and merged the MEPS-HC with MSA-level data about community characteristics, including HMO market share. After this merge, information on 17,360 individuals was available. For our analyses, we further restrict the sample to include individuals for whom the four screening tests we examine were appropriate, as described below.

Some models include only individuals in “managed” or “nonmanaged” health plans. “Managed” plans are defined as private or public health insurance plans with a closed panel or a gatekeeper requirement. “Nonmanaged” plans are other health plans. The group of managed plans includes Medicare HMOs and Medicaid managed care plans as well as private plans with closed panels or gatekeeper requirements. The group of nonmanaged plans includes traditional Medicare and traditional Medicaid as well as those in private insurance plans with open panels and no gatekeeper requirements. Few insurance plans are without any form of care management, so the nonmanaged group is best conceptualized as comprising individuals with health insurance arrangements among the less restrictive set of arrangements available, but not individuals without any form of management whatsoever. Individuals without health insurance are included in the analysis of all patients, but not included in specific analyses of patient in managed and nonmanaged plans.

Dependent Variables

We examine four types of cancer screening: mammography screening among women ages 40 to 75, clinical breast examination among women ages 40 to 75, Pap smear among women ages 18 to 65, and prostate cancer screening among men ages 45 to 75. Using four measures allows us to compare and contrast effects between different types of screening. One key difference is that the first three types of screening are generally recommended, while prostate cancer screening is not recommended by the U.S. Preventive Services Task Force (1996), though it is recommended by other groups like the American Cancer Society (Smith et al. 2002).

Appropriate ages for screening, particularly for mammography and prostate cancer screening, have been controversial. We use relatively wide age ranges here. We verified that our results are robust to examining

mammography among 50-to-75-year-old women and prostate cancer screening among 50-to-75-year-old men.

For all four measures of screening, the dependent variables measure screening within the past two years as opposed to screening more than two years ago. Individuals who indicated that they were never screened were dropped from the analysis since they appear likely to have different characteristics than those who have ever been screened. Individuals who reported a history of relevant cancers were excluded. In the case of the prostate cancer measure, the MEPS data only allow construction of a general measure based on self-reports of receiving screening. We are unable to construct a measure that indicates the specific receipt of digital rectal examination or prostate specific antigen testing. However, our estimates of self-reported screening are consistent with other nationally representative estimates (Cowen, Kattan, and Miles 1996).

Managed Care Measures

Managed care effects of the type that we hypothesize could in principle be caused by a variety of different health plan activities or by different kinds of organizations. We focus on HMO market share here. This is a variable for which good quality data for the entire United States for all MSAs can be obtained. We expect variation in HMO market share to be a good proxy for variation in the area presence of health plans with strong financial incentives and utilization review, the kinds of things that seem most likely to influence overall treatment patterns. This variable is also consistent with measures used in other previous work on systemwide effects of managed care activity. Specifically, for each individual, we linked a measure of the percent of the population enrolled in an HMO in 1996 in the MSA of residence, using measures of HMO market share that have been used in previous work (Baker 1997; Baker and Phibbs 2002; Baker 2001). For analysis, we divided markets into three groups using categories based on our previous work: "low" markets with HMO market share under 10 percent, "medium" HMO market share between 10 percent and 25 percent, and "high" HMO market share over 25 percent. We also verified the robustness of our results to the use of a categorization with three groups consisting of the lowest quartile market share areas, the highest quartile market share areas, and the middle two quartiles of market share areas.

Some studies have hypothesized that the level of competition between managed care plans may also be an important factor. We measured the degree of competition between plans using the Hirschman-Herfindahl index (HHI), a common measure of competition in the economic literature. A value of the

HHI was computed for each MSA, based on the number and relative sizes of the HMOs operating in the market. We classified MSAs into three groups: “low” markets in the lowest quartile of the HHI distribution with HHIs of 0.14 or less; “medium” markets in the second or third quartiles of the HHI distribution with HHIs between 0.14 and 0.25; and “high” markets in the highest quartile of the distribution with HHIs of 0.25 or more.

It is also possible that forms of managed care other than HMOs influence screening. We hypothesize that the impact of HMO market share is likely to be stronger than the impact of other managed care forms because HMOs have tended to be the most aggressive in attempting to influence practice patterns. Nonetheless, we investigate the impact of PPO market share as well. We developed measures of PPO market share based on consumer surveys conducted by the National Research Corporation. These are based on household surveys in which respondents were asked to self-report the type of health plan in which they were enrolled. We used these responses to estimate the share of the population enrolled in a PPO in each MSA. We classified markets into three groups based on PPO market share: “low” markets in the lowest quartile of the PPO market share distribution, with PPO market shares of 19 percent or less; “medium” markets in the second or third quartiles of the distribution, with PPO market shares between 19 percent and 31 percent; and “high” markets in the highest quartile of the distribution, with PPO market shares of 32 percent or more.

Other Control Variables

We are concerned about the potential for confounding that could result if the geographic distribution of HMOs is related to variations in population demographics, health status, or other variables. In particular, it is sometimes hypothesized that HMOs have been more likely to locate in areas with healthier, more prevention-oriented populations (Dranove, Simon, and White 1998). To mitigate the potential for bias from this source, we use a wide range of control variables for individual and area characteristics. At the individual level, we include controls for age (categories 18–39, 40–49, 50–59, 60–64, 65–69, 70 and over), race/ethnicity (Hispanic, Asian, black, white), education (≤ 12 years, 13–15 years, 16 years, and 17 or more years), marital status (currently married versus unmarried), household income (< 100 percent of poverty, 100–124 percent of poverty, 125–199 percent of poverty, 200–399 percent of poverty, and 400 percent of poverty or more), and employment status and job type (unemployed, clerical, sales/tech/blue collar/agricultural, managerial/professional).

In our models for all individuals, we include controls for whether or not the individual was uninsured, in a managed plan (defined as described above), or in a nonmanaged plan. At the area level, we include controls for regions of the country (Northeast, Midwest, South, and West), the percent of the population that graduated from high school, the percent of the population that is white non-Hispanic, the number of office-based generalist physicians per 1,000 population, and the area population per square mile as a measure of urbanization.

In addition to the individual controls above that capture important aspects of health status and demand for health care, we include controls specifically intended to address concerns about bias from variation in the health status and preferences of individuals. First, in all of our models, we control for each individual's self-reported health status (poor/fair, good, very good/excellent). To go further, we also estimated models that add controls for whether or not the individual reported having a usual source of care, and for the frequency of dental checkups for each individual. We expect both of these variables to proxy for individual preferences for and attitudes about preventive care (as well as perhaps capturing relevant demographic and other characteristics), so that their inclusion should reduce bias from omitted variables. Their inclusion should also provide information about the extent of possible bias. If the inclusion of these observable measures of preferences does not substantially change our results, it would tend to suggest that bias from other aspects of unobserved preferences is also unlikely.

In some settings, instrumental variables estimation or related techniques can be applied to overcome the potential for bias from unobserved area characteristics (Bowden and Turkington 1990). This approach, however, relies on the availability of suitable instrumental variables to support analysis. Although we considered the use of instrumental variables estimation here, we were not satisfied that the available candidates for instruments were suitable. Indeed, previous literature has consistently encountered difficulties in identifying convincing variables that can be used as instruments for managed care activity. Instead, we rely on the inclusion of strong individual-level controls for health status and related demographics. We expect these controls to largely account for important variation in health status or other preferences that would lead to bias in our estimates.

Statistical Analyses

We used weighted logistic regression to examine the relationship between area HMO market share and screening use, controlling for the covariates

listed above. We used Hosmer-Lemeshow tests to ensure that logistic regression models adequately fit the data (Hosmer and Lemeshow 1989). These models were estimated using *SAS*, version 8.2 (SAS Institute 2001) and *SUDAAN*, version 8.0.0 (Research Triangle Institute 2001) using sampling weights to reflect the U.S. civilian, noninstitutionalized population and standard error adjustment to account for the complex survey design (Cohen, DiGaetano, and Goskel 1999). This analysis incorporates measures of HMO market share (and other variables) measured at the area level, raising the potential that the standard errors are biased downward due to clustering by area. *SUDAAN* is unable to incorporate both adjustments for clustering and for complex survey design. To investigate the effects of clustering, we used *SAS*'s PROC GENMOD to estimate models that accounted for clustering by MSA, but not the complex survey design. Results from this analysis are consistent with the results we report. To attempt to get a general sense for the impacts of doing both adjustments simultaneously, we computed the ratio of the *SUDAAN* standard errors to ordinary least squares standard errors for some test cases, and then applied this ratio to the PROC GENMOD standard errors, and noted that, in at least these cases, the standard errors would still not be large enough to make the coefficients insignificant.

RESULTS

Sample Characteristics

Among MEPS respondents with linked MSA-level data and complete data for our regression control variables, we identified 2,482 women between the ages of 40 and 75 who had ever been screened using mammography, 2,759 women ages 40–75 ever screened with clinical breast exam, 4,600 women ages 18–65 ever screened with Pap smear, and 1,456 men ages 45 to 75 ever screened for prostate cancer. These form the base samples for our analyses of mammography, clinical breast exam, Pap smear, and prostate cancer screening. Table 1 reports the mean characteristics of the sample.

Relationship between Area Managed Care Activity and Cancer Screening

In bivariate comparisons, there is a noticeable statistically significant relationship between area HMO market share and the timely use of mammography, clinical breast exam, and Pap smear (Table 2). In all three cases, screening rates increase with area HMO market share. For prostate cancer screening, the relationship between screening rates and increases in market share is not consistent, and is statistically insignificant ($p = 0.09$).

Table 1: Sample Characteristics

	<i>Mammogram</i>	<i>Clinical Breast Exam</i>	<i>Pap Smear</i>	<i>Prostate Cancer</i>
<i>N</i>	2,482	2,759	4,600	1,456
HMO market share < 10%	9.4%	9.8%	9.0%	7.9%
HMO market share 10–25%	48.9%	48.8%	49.5%	49.4%
HMO market share ≥ 25%	41.7%	41.5%	41.5%	42.8%
High competition	29.1%	28.6%	27.9%	29.3%
Medium competition	46.5%	46.7%	47.3%	46.1%
Low competition	24.4%	24.7%	24.7%	24.6%
PPO market share low	27.0%	26.7%	27.2%	27.4%
PPO market share medium	48.1%	48.4%	47.3%	49.4%
PPO market share high	24.9%	25.0%	25.5%	23.2%
Age 18–39	—	—	50.4%	—
Age 40–49*	39.3%	41.2%	25.5%	19.1%
Age 50–59	27.9%	27.2%	16.5%	35.3%
Age 60–64	10.7%	10.4%	6.3%	15.6%
Age 65–69	10.5%	10.1%	1.4%	14.8%
Age 70+	11.6%	11.1%	—	15.2%
Hispanic	7.0%	7.1%	9.7%	5.4%
Asian	2.8%	2.9%	2.7%	1.6%
Black	10.5%	10.8%	13.1%	9.1%
White	79.7%	79.1%	74.5%	83.9%
≤ 12 years education	55.7%	22.2%	50.1%	48.7%
13–15 years education	22.1%	11.4%	25.5%	19.1%
16 years education	12.1%	9.7%	15.1%	16.5%
> 16 years education	10.1%	43.4%	9.3%	15.8%
Not married	34.5%	35.3%	41.1%	22.3%
Married	65.5%	64.7%	58.9%	77.7%
Household income < 100% of poverty	9.1%	10.1%	13.6%	7.1%
Household income 100–124% of poverty	3.7%	3.9%	3.9%	3.0%
Household income 125–199% of poverty	12.6%	12.5%	13.2%	9.5%
Household income 200–399% of poverty	31.3%	31.7%	31.9%	29.2%
Household income ≥ 400% of poverty	43.3%	41.9%	37.4%	51.2%
Uninsured	6.7%	8.1%	11.9%	6.0%
Managed care plan member	41.5%	40.3%	45.1%	39.0%
Nonmanaged care plan member	51.8%	51.6%	43.0%	54.9%
Unemployed	38.0%	37.5%	23.6%	33.3%
Job class: clerical	16.2%	15.9%	19.2%	4.4%
Job class: sales, tech., blue collar, agri.	23.6%	25.0%	32.6%	36.0%
Job class: managerial or professional	22.2%	21.6%	24.6%	26.3%
Health status fair or poor	16.6%	16.8%	12.1%	17.2%
Health status good	25.2%	25.5%	25.1%	27.1%
Health status excellent or very good	58.2%	57.7%	62.9%	55.7%
Northeast Region	20.5%	19.9%	19.3%	21.1%
Midwest Region	24.0%	23.8%	23.1%	22.8%
South Region	35.2%	35.8%	36.0%	35.1%
West Region	20.3%	20.6%	21.6%	21.0%

continued

Table 1: Continued

	Mammogram	Clinical Breast Exam	Pap Smear	Prostate Cancer
Mean % pop, high school grad	77.4%	77.4%	77.5%	77.7%
Mean % pop, white non-Hispanic	71.8%	71.7%	71.3%	72.0%
Mean office-based physicians/1k pop	0.631	0.630	0.633	0.634
Mean population per square mile/100	10.804	10.841	11.096	10.845

Note: Sample for mammography includes 40–75-year-old women who had ever had a mammo-gram, for Pap smear 18–65-year-old women who had ever had a Pap smear, for clinical breast exam (CBE) 40–75 year-old-women who had ever had a CBE, for prostate cancer screening 45–75-year-old men who had ever had prostate cancer screening.

*Age category for prostate cancer is 45–49 years.

Table 2: Rates of Cancer Screening Use by Area HMO Market Share

	HMO Market Share			P-value
	Low	Medium	High	
Mammography	77.3%	82.3%	84.4%	0.043
Clinical breast exam	78.4%	85.4%	86.5%	0.024
Pap smear	77.9%	86.3%	86.4%	0.002
Prostate cancer screening	81.8%	78.7%	83.6%	0.091

Note: P-values shown are from chi-squared tests of the hypothesis that screening rates are the same across market share categories.

Table 3 reports results from logistic regression models that examine the relationship between HMO market share and screening rates, controlling for individual-level and area-level characteristics. All respondents are included in the models shown in Table 3. For HMO market share, the values shown are coefficients (and odds ratios in brackets) for cancer screening among individuals in medium and high HMO market share areas, relative to those in low HMO market share areas. For mammography, women in the highest HMO market share areas had odds of being recently screened 1.75 times higher than the odds for a woman in a low market share area ($p < 0.01$). Women in medium market share areas had an odds ratio of 1.33, though with only marginal significance ($p = 0.08$). Evaluating at the sample mean (82.7 percent), these would translate to increases in timely screening rates of 3.7 and 6.6 percentage points for women in medium and high market share areas, respectively, compared to women in low market share areas.

Table 3: Results from Logistic Regression Analysis of Area HMO Market Share and Screening Use

	<i>Mammogram</i>	<i>Clinical Breast Exam</i>	<i>Pap Smear</i>	<i>Prostate Cancer Screening</i>
HMO market share medium	0.285 (0.164) [1.330]	0.393 (0.213) [1.481]	0.495** (0.151) [1.640]	− 0.285 (0.289) [0.752]
HMO market share high	0.558** (0.182) [1.747]	0.460* (0.218) [1.584]	0.537** (0.186) [1.711]	0.261 (0.315) [1.298]
Age 18–39	—	—	0.980** (0.314)	—
Age 40–49 [#]	0.035 (0.202)	0.149 (0.211)	0.217 (0.328)	− 0.857 (0.327)
Age 50–59	0.501* (0.231)	0.327 (0.222)	0.214 (0.311)	− 0.484 (0.283)**
Age 60–64	0.102 (0.218)	− 0.125 (0.217)	− 0.067 (0.349)	− 0.559 (0.306)
Age 65–69	0.738* (0.294)	0.476 (0.275)	0.000 (0.000)	− 0.392 (0.315)
Hispanic	0.390* (0.193)	0.253 (0.191)	0.129 (0.161)	0.045 (0.292)
Asian	0.108 (0.344)	0.072 (0.379)	0.091 (0.322)	− 0.762 (0.635)
Black	0.229 (0.179)	0.631** (0.228)	0.515** (0.162)	0.535 (0.290)
≤ 12 years education	− 0.633* (0.251)	− 1.263** (0.347)	− 0.889** (0.228)	− 0.188 (0.258)
Some college	− 0.696** (0.262)	− 1.009** (0.382)	− 0.692** (0.249)	0.177 (0.265)
College graduate	− 0.302 (0.302)	− 0.569 (0.390)	− 0.558* (0.234)	0.172 (0.247)
Not married	0.214 (0.155)	0.075 (0.130)	0.182 (0.130)	− 0.294 (0.204)
HH Income < 100% poverty line	− 0.203 (0.257)	− 0.459* (0.206)	− 0.470** (0.170)	− 0.224 (0.318)
HH Income 100–124% poverty line	− 1.072** (0.324)	− 0.635* (0.271)	− 0.778** (0.202)	− 0.006 (0.588)
HH Income 125–199% poverty line	− 0.698** (0.196)	− 0.698** (0.183)	− 0.509** (0.166)	0.293 (0.306)
HH Income 200–399% poverty line	− 0.284 (0.148)	− 0.268 (0.139)	− 0.292* (0.116)	0.190 (0.201)
Uninsured	− 0.753** (0.238)	− 1.065** (0.216)	− 0.851** (0.139)	− 1.607** (0.297)
Managed care plan member	0.104 (0.149)	0.206 (0.128)	0.141 (0.108)	0.075 (0.169)

continued

Table 3: Continued

	<i>Mammogram</i>	<i>Clinical Breast Exam</i>	<i>Pap Smear</i>	<i>Prostate Cancer Screening</i>
Unemployed	0.210 (0.197)	0.022 (0.211)	−0.102 (0.178)	0.091 (0.252)
Job type: clerical	0.205 (0.236)	0.376 (0.228)	0.186 (0.177)	−0.114 (0.360)
Job type: sales, tech., blue collar, agricultural	0.028 (0.186)	−0.311 (0.180)	−0.141 (0.158)	−0.043 (0.209)
Health status fair or poor	−0.208 (0.164)	0.169 (0.167)	0.054 (0.151)	0.260 (0.235)
Health status good	0.055 (0.150)	0.194 (0.133)	−0.009 (0.115)	0.339 (0.175)
Northeast Region	0.218 (0.233)	−0.063 (0.269)	0.317 (0.180)	1.112 (0.346)
Midwest Region	0.177 (0.188)	0.026 (0.226)	0.181 (0.167)	0.321 (0.271)**
South Region	0.397* (0.186)	−0.023 (0.217)	0.214 (0.174)	0.611 (0.254)
% MSA pop. high school graduate	0.480 (1.442)	−1.502 (1.536)	0.742 (1.072)	2.484 (2.091)*
% MSA pop. white non-Hispanic	0.424 (0.503)	0.426 (0.647)	−0.441 (0.388)	−0.709 (0.851)
Office-based generalist MDs/1k population in MSA	−0.166 (0.508)	0.390 (0.578)	−0.367 (0.381)	0.077 (0.679)
Population per square mile in MSA (/100)	0.004 (0.005)	0.001 (0.006)	−0.003 (0.004)	−0.005 (0.006)
Intercept	0.736 (1.073)	2.974** (1.128)	1.538 (0.902)	0.063 (1.300)
<i>N</i>	2,482	2,759	4,600	1,456

Note: Regression coefficients shown. Standard errors in parentheses. Odds ratios in brackets. MSA = metropolitan statistical area.

ages 45–49 for prostate cancer screening models.

*denotes $p < 0.05$;

**denotes $p < 0.01$.

Increasing HMO market share is also associated with increasing rates of clinical breast exam and Pap smear use. For clinical breast exam, the odds ratio for women in high market share areas is 1.58 relative to women in low market share areas ($p < 0.05$). Evaluated around the sample mean (85.2 percent), this would imply an increase in the rate of screening within the past two years of 4.9 percentage points for women in high market share areas. For Pap smear use, the odds ratios are 1.64 and 1.71 for women in medium and high

market share areas (both $p < 0.01$). Evaluated around the sample mean (85.6 percent), these imply increases of 5.0 and 5.4 percentage points, respectively.

For prostate cancer screening, the one form of screening that is not universally recommended, the results are inconsistent and statistically insignificant, suggesting no relationship between HMO market share and screening rates.

An interesting feature of these results is that the coefficient on the variable indicating individuals who are members of managed plans, compared to individuals who are not, is positive but not statistically significant. This is intriguing since one might expect to see this coefficient positive and significant if there are to be spillover effects at the broader area level. As we discuss below, however, it is plausible that there are spillover effects even though these coefficients are not significant.

A concern in estimating these types of models is the potential for bias from unobserved characteristics of area populations, such as preferences about health. Our base specification contains a number of controls to attempt to account for this. As an additional check, we added controls for whether or not an individual has a usual source of care, and the frequency with which the respondent reports dental visits. Both of these should proxy for preferences about health and related individual characteristics, and thus reduce any omitted variables bias that arises because we cannot control for preferences. When we add these controls, we observe that individuals with a usual source of care and those with frequent dental visits have significantly higher rates of screening. However, our results for HMO market share are quite similar to the previous estimates. For mammography, women in high market share areas have an odds ratio of 1.74 ($p < 0.01$) relative to women in low market share areas. For clinical breast exam and Pap smear, the odds ratios are 1.61 ($p < 0.05$) and 1.74 ($p < 0.01$), respectively. There is no statistically significant relationship for prostate cancer screening. We interpret the fact that the coefficients are not substantially affected by adding these two variables as evidence against the existence of significant bias from a systematic relationship between area HMO market share and health preferences or related characteristics.

Table 4 reports results from models estimated separately for members of managed and nonmanaged plans. For members of managed plans, the relationships observed between HMO market share and screening rates are broadly consistent with those observed in Table 3 for all respondents, but generally smaller in magnitude and statistically insignificant. For members of nonmanaged plans, results are also consistent. In fact, in the nonmanaged population, the measured effect of increasing market share on screening rates tends to be larger, statistically significant for clinical breast exam and Pap

Table 4: Area HMO Market Share and Screening Rates for Managed and Nonmanaged Plan Members

	<i>Mammogram</i>	<i>Clinical Breast Exam</i>	<i>Pap Smear</i>	<i>Prostrate Cancer Screening</i>
Managed Plan Members				
HMO market share medium	0.073 (0.380) [1.076]	0.229 (0.351) [1.257]	0.402 (0.337) [1.495]	− 0.242 (0.744) [0.785]
HMO market share high	0.237 (0.401) [1.267]	0.070 (0.338) [1.073]	0.499 (0.391) [1.647]	0.595 (0.762) [1.813]
<i>N</i>	1,121	1,218	2,239	630
Nonmanaged Plan Members				
HMO market share medium	0.396 (0.324) [1.486]	0.602 (0.327) [1.826]	0.568** (0.198) [1.765]	− 0.397 (0.263) [0.672]
HMO market share high	0.649 (0.346) [1.914]	0.753* (0.314) [2.123]	0.690** (0.229) [1.994]	0.021 (0.336) [1.021]
<i>N</i>	1,179	1,304	1,788	743

Note: Regression coefficients shown. Standard errors in parentheses. Odds ratios in brackets. MSA = metropolitan statistical area. Models also control for additional variables shown in Table 3: age, race/ethnicity, education, marital status, household income, employment category, self-reported health status, region, MSA education rate, MSA race/ethnicity, MSA physicians per capita, and population density.

*denotes $p < 0.05$;

**denotes $p < 0.01$.

smear, and marginally significant ($p = 0.06$) for mammography screening in the high market share areas. When we add the controls for usual source of care and dental visits, results are consistent: we continue to observe no significant relationship between HMO market share and screening in the managed population, but we observe even stronger and more significant results in the nonmanaged population. The presence of the results most strongly in the nonmanaged population is consistent with the existence of a spillover effect, and the fact that it is not observed as strongly in the managed population seems to lend strength to the view that practice-pattern-based mechanisms are at work, though these results do not definitively prove this.

When we include the HHI measures in the models, we observe no meaningful changes to the HMO market share coefficients, and no strong evidence of an effect of HMO competition on screening rates. We also investigated the presence of interaction effects between HMO market share and HMO competition and did not find strong evidence for interaction effects.

Table 5: HMO Market Share, PPO Market Share, and Screening Rates

	<i>Mammogram</i>	<i>Clinical Breast Exam</i>	<i>Pap Smear</i>	<i>Prostate Cancer Screening</i>
HMO market share medium	0.249 (0.160) [1.283]	0.374 (0.218) [1.454]	0.502** (0.137) [1.652]	− 0.335 (0.284) [0.715]
HMO market share high	0.421* (0.196) [1.523]	0.437 ⁺ (0.229) [1.548]	0.435** (0.168) [1.545]	0.105 (0.318) [1.111]
PPO market share medium	0.194 (0.174) [1.214]	0.142 (0.178) [1.153]	− 0.061 (0.126) [0.941]	0.314 (0.215) [1.369]
PPO market share high	− 0.109 (0.208) [0.897]	0.084 (0.216) [1.088]	− 0.289* (0.144) [0.749]	− 0.022 (0.253) [0.978]
<i>N</i>	2,482	2,759	4,600	1,456

Note: Regression coefficients shown. Standard errors in parentheses. Odds ratios in brackets. MSA = metropolitan statistical area. Models also control for additional variables shown in Table 3: age, race ethnicity, education, marital status, household income, health insurance type, employment category, self-reported health status, region, MSA education rate, MSA race ethnicity, MSA physicians per capita, and population density.

*denotes $p < 0.05$;

**denotes $p < 0.01$;

⁺denotes $p = 0.057$.

Adding in controls for PPO market share has little impact on the patterns observed in the HMO market share variables (Table 5), although the effect sizes are somewhat smaller and statistical significance somewhat diminished with the PPO market share controls in the model. Estimated coefficients for the PPO variables do not suggest strong or consistent effects, except perhaps for Pap smear, where women in the highest PPO market share areas had significantly lower Pap smear rates. These relationships are not substantially changed (the HMO relationships are in fact, slightly strengthened) if we add controls for usual source of care and dental visit frequency.

DISCUSSION

Increases in area-level HMO market share are significantly associated with changes in rates of receiving timely screening for breast and cervical cancer, particularly with increases in screening among patients in nonmanaged health care plans. This finding is consistent with the view that area-level effects of managed care can have important impacts on health care delivery, and that

managed care activity can influence the delivery of health care for all patients regardless of the type of health plan in which they are enrolled. This finding extends earlier research on expenditures that did not provide direct evidence on treatment patterns.

Opposite the increase in screening for breast and cervical cancer, we find no evidence of an effect on prostate cancer screening. This is intriguing since prostate cancer screening is controversial whereas breast and cervical cancer screening are widely accepted as beneficial. It may be that HMOs have been effective at reducing the use of prostate cancer screening and this effect has spread to general practice patterns as well. It is also important to note that drawing definitive conclusions based on the prostate cancer results is difficult. The measure of prostate cancer screening available to us is based on self-report and does not distinguish between different types of screening, and so may contain nontrivial measurement error. It is also possible that differential effects for prostate cancer reflect differing patterns of health service utilization among men and among women.

In addition to examining HMO market share, we also included measures of PPO market share in some of our models. We found that inclusion of these controls did not change the pattern of findings for HMO market share. We also observed little relationship between PPO market share and screening rates. This is consistent with the observation that HMOs have been much more aggressive in their efforts to influence practice patterns than PPOs.

There are a number of mechanisms by which systemwide effects of managed care could come about. It is plausible that as managed care plans have worked to change physician practice patterns, using reminders and other forms of encouragement to promote breast and cervical cancer screening, their efforts have induced generalized changes in the practices of physicians that are then applied to both managed care and nonmanaged care patients. That managed care plans would be interested in changing practice patterns with respect to breast and cervical cancer screening is not surprising. Both breast and cervical cancer screening were used as measures of health plan quality-of-care in the Health Plan Employer Data and Information Set (HEDIS) system (Thompson et al. 1998). It is also possible that there are effects at the patient level. We expect that these kinds of effects could produce the results we observe. In particular, they could produce changes in treatment patterns in the nonmanaged patients without producing changes in managed patients.

There are also other mechanisms that could play a role. There may be differences in the availability of infrastructure in higher managed care markets

that make a difference. For example, some evidence suggests that higher market share areas have higher-volume mammography facilities (Baker and Brown 1999). If these facilities have more effective mechanisms for handling appointments, quicker visits, or other ways of improving the convenience of screening, screening rates may be influenced. Since it seems most plausible that these kinds of mechanisms would produce changes in screening rates for both managed and nonmanaged patients, we believe them less likely an explanation for our finding here, though it is still possible that they play a role.

The fact that we did not find significant coefficients on the variables indicating individual membership in a managed plan as opposed to a nonmanaged plan (the “managed care plan member” coefficient in Table 3) raises an interesting question about how it is that spillover effects could be observed without first observing a direct effect associated with an individual joining a managed plan. One possibility is that market dynamics play an important role here. In particular, it may be that, within markets, care for managed care and nonmanaged plan members converges over time, but that there remain noticeable differences across areas. If, for example, there is some pull toward commonality in practice patterns within a market, then care patterns in the same area could converge over time so that differences between care for managed and nonmanaged plan members dissipate, but differences could still persist across markets in the ultimate characteristics of care patterns. In the limit, one would observe higher screening rates for all patients in some markets and lower screening rates for all patients in other markets. Our results are consistent with such a scenario. If this kind of convergence is happening over time, it may be that we would have detected bigger “managed care plan member” coefficients in earlier years, but not at the time period of the study. Another possibility is measurement error in our “managed care plan member variable,” since it may not measure all of the characteristics of each respondent’s plan with complete accuracy. While the managed versus nonmanaged plan distinction seems functionally useful in structuring or project, it is not designed to study effects of plan type per se on utilization. If this variable contains some measurement error, in the sense of it perhaps not capturing all of the relevant plan characteristics needed to clearly identify plan-type effects on utilization, coefficients would naturally be attenuated. In either case, further exploration might be able to provide further information about these relationships, and could be valuable. It could be argued that, instead of reflecting an effect of managed care on screening rates, the results we obtained simply reflect other underlying characteristics of markets that we did not measure but that are associated with area HMO market share and with screening rates.

In particular, managed care areas may be most likely to locate in areas with healthier populations who may be favorably disposed to screening. Like virtually all studies of effects of area-level managed care activity, we cannot rule this possibility out entirely. However, we do not expect it to play a significant role in our findings. Because of the richness of the MEPS data, we were able to include controls for a wide variety of individual-level characteristics that we expect to capture variation in preferences for screening. The fact that including or excluding controls, like self-reported health status and dental visit frequency, did not have an important effect on the results is consistent with the view that confounding from unobserved characteristics is not a significant problem.

It is also sometimes argued that there is biased selection of healthier people into HMOs, though the most recent evidence is somewhat mixed (Glied 2000). If there were biased selection in which more health-conscious people disproportionately enroll in HMOs, then increases in HMO markets share would tend to leave the non-HMO population systematically less health-conscious. This might induce a downward bias in estimates of the relationship between HMO market share and screening rates. Since we find the opposite, we view our results as conservative.

While one can sometimes encounter the belief that managed care has had a uniformly negative impact on health care delivery, these results suggest that there might be some positive results from the growth of managed care. If managed care activity can promote the use of screening, the associated benefits should be considered when evaluating the overall effects of managed care. As we move away from traditional managed care plans, there may be important lessons from the managed care experience that we can apply to the design of optimal health insurance plans in the future.

One aspect of the effects of managed care activity that has until recently not been widely recognized is the potential for systemwide changes in the structure and functioning of the health care delivery system. Most of the public, and public policy, attention on managed care has concentrated on the implications for individuals of joining a managed care plan. This is an important aspect, but the evidence in this and other papers suggests the ability of shifting health insurance structures to broadly change health care delivery patterns. That this is possible should not be a surprise. The health care delivery system is, after all, constantly evolving to adapt to the environment in which it functions. Decades of unmonitored fee-for-service insurance contributed to the formation of the institutions and components of the delivery system we have today. Changes in the insurance market would naturally prompt changes

in the structure and functioning of these institutions and delivery system components. Debates about the future of managed care, and about policies that would either encourage or further restrict its growth, should take into account both direct effects of managed care on enrollees and systemwide effects of changes.

It is important to note that we have focused on cancer screening alone. It is possible that the systemwide effects of managed care could vary from condition to condition. Indeed, results herein suggest differences in effects on different kinds of cancer screening. Developing a full understanding of the situations in which area-level managed care activity can have important implications will require examination of a wider range of populations and conditions.

REFERENCES

- Baker, L. C. 1997. "The Effect of HMOs on Fee-for-Service Health Care Expenditures: Evidence from Medicare." *Journal of Health Economics* 16 (4): 453–82.
- . 1999. "Association of Managed Care Market Share and Health Expenditures for Fee-for-Service Medicare Patients." *Journal of the American Medical Association* 281 (5): 432–7.
- . 2001. "Managed Care and Technology Adoption in Health Care: Evidence from Magnetic Resonance Imaging." *Journal of Health Economics* 20 (3): 395–421.
- Baker, L. C., J. C. Cantor, S. H. Long, and M. S. Marquis. 2000. "HMO Market Penetration and Costs of Employer-Sponsored Health Plans." *Health Affairs* 19 (5): 121–8.
- Baker, L. C., and M. L. Brown. 1999. "Managed Care, Consolidation among Health Care Providers, and Health Care: Evidence from Mammography." *Rand Journal of Economics* 30 (2): 351–74.
- Baker, L. C., and K. S. Corts. 1996. "HMO Penetration and the Cost of Health Care: Market Discipline or Market Segmentation?" *American Economic Review* 86 (2): 389–94.
- Baker, L. C., and M. B. McClellan. 2001. "Managed Care, Health Care Quality, and Regulation." *Journal of Legal Studies* 30 (2, part 2): 715–42.
- Baker, L. C., and C. S. Phibbs. 2002. "Managed Care, Technology Adoption, and Health Care: The Adoption of Neonatal Intensive Care." *Rand Journal of Economics* 33 (3): 524–48.
- Baker, L. C., and S. Sharkarkumar. 1998. "Managed Care and Health Care Expenditures: Evidence from Medicare, 1990–1994." In *Frontiers in Health Policy Research*, edited by A. M. Garber, pp. 117–52. Cambridge, MA: MIT Press.
- Bernstein, A. B., G. B. Thompson, and L. C. Harlan. 1991. "Differences in Rates of Cancer Screening by Usual Source of Medical Care: Data from the 1987 National Health Interview Survey." *Medical Care* 29 (3): 196–209.

- Bowden, R. J., and D. A. Turkington. 1990. *Instrumental Variables*. Econometric Society Monographs in Quantitative Economics. New York: Cambridge University Press.
- Brown, M. L., A. L. Potosky, G. B. Thompson, and L. G. Kessler. 1990. "The Knowledge and Use of Screening Tests for Colorectal and Prostate Cancer: Data from the 1987 National Health Interview Survey." *Preventive Medicine* 19 (5): 562-74.
- Clement, D. G., P. M. Gleason, and R. S. Brown. 1992. *The Effects of Risk Contract HMO Market Penetration on Medicare Fee-for-Service Costs: Final Report*. Princeton, NJ: Mathematica Policy Research.
- Cohen, J. W., A. C. Monheit, K. M. Beauregard, S. B. Cohen, D. C. Lefkowitz, D. E. Potter, J. P. Sommers, A. K. Taylor, and R. H. Arnett III. 1996. "The Medical Expenditure Panel Survey: A National Health Information Resource." *Inquiry* 33 (4): 373-89.
- Cohen, S. B., R. DiGaetano, and H. Goskel. 1999. "Estimation Procedures in the 1996 Medical Expenditure Panel Survey Household Component." Rockville, MD: Agency for Health Care Policy and Research.
- Cowen, M. E., M. W. Kattan, and B. J. Miles. 1996. "A National Survey of Attitudes Regarding Participation in Prostate Carcinoma Testing." *Cancer* 78 (9): 1952-7.
- Dranove, D., C. J. Simon, and W. D. White. 1998. "Determinants of Managed Care Penetration." *Journal of Health Economics* 17 (6): 729-45.
- Escarce, J. J., D. Polsky, G. D. Wozniak, and P. R. Kletke. 2000. "HMO Growth and the Geographical Redistribution of Generalist and Specialist Physicians, 1987-97." *Health Services Research* 35 (4): 825-48.
- Escarce, J. J., D. Polsky, G. D. Wozniak, M. V. Pauly, and P. R. Kletke. 1998. "HMO Penetration and the Practice Location Choices of New Physicians: A Study of Large Metropolitan Areas in the U.S." *Medical Care* 36 (11): 1555-66.
- Feldstein, P. J., and T. M. Wickizer. 1995. "Analysis of Private Health Insurance Premium Growth Rates: 1985-1992." *Medical Care* 33 (10): 1035-50.
- Frank, R. G., and W. P. Welch. 1985. "The Competitive Effects of HMOs: A Review of the Evidence." *Inquiry* 22: 148-61.
- Gaskin, D. J., and J. Hadley. 1997. "The Impact of HMO Penetration on the Rate of Hospital Cost Inflation, 1985-1993." *Inquiry* 34 (3): 205-16.
- Glied, S. 2000. "Managed Care." In *Handbook of Health Economics*, vol. 1A, edited by A. J. Culyer and J. P. Newhouse, pp. 707-53. Amsterdam: North Holland.
- Gordon, N. P., T. G. Rundall, and L. Parker. 1998. "Type of Health Care Coverage and the Likelihood of Being Screened for Cancer." *Medical Care* 36 (5): 636-45.
- Hosmer, D. W., and S. K. Lemeshow. 1989. *Applied Logistic Regression*. New York: Wiley.
- Hsia, J., E. Kemper, C. Kiefe, J. Zapka, S. Sofaer, M. Pettinger, D. Bowen, M. Limacher, L. Lillington, and E. Mason. 2000. "The Importance of Health Insurance as a Determinant of Cancer Screening: Evidence from the Women's Health Initiative." *Preventive Medicine* 31 (3): 261-70.
- Noether, M. 1988. "Competition among Hospitals." *Journal of Health Economics* 7 (3): 259-84.

- Phillips, K. A., K. Kerlikowske, L. C. Baker, S. W. Chang, and M. L. Brown. 1998. "Individual, Practitioner, and Environmental Factors Associated with Adherence to Screening Mammography Guidelines." *Health Services Research* 33 (1): 29–53.
- Phillips, K. A., J. S. Haas, S. Y. Liang, L. C. Baker, S. Tye, K. Kerlikowski, J. Sakowski, and J. Spetz. 2004. "Are Gatekeeper Requirements Associated with Cancer Screening Utilization?" *Health Services Research* 39 (1): 153–74.
- Potosky, A. L., N. Breen, B. I. Graubard, and P. E. Parsons. 1998. "The Association between Health Care Coverage and the Use of Cancer Screening Tests: Results from the 1992 National Health Interview Survey." *Medical Care* 36 (3): 257–70.
- Research Triangle Institute. *SUDAAN* statistical software, version 8.0.0. Research Triangle Park, NC: Research Triangle Institute.
- Robinson, J. C. 1991. "HMO Market Penetration and Hospital Cost Inflation in California." *Journal of the American Medical Association* 266 (19): 2719–23.
- . 1996. "Decline in Hospital Utilization and Cost Inflation under Managed Care in California." *Journal of the American Medical Association* 276 (13): 1060–4.
- Rodgers, J., and K. E. Smith. 1995. *Do Medicare HMOs Reduce Fee-for-Service Costs?* Washington, D.C.: Price-Waterhouse LLP, Health Policy Economics Group.
- SAS Institute, Inc. 2001. *SAS* statistical software (version 8.2). Cary, NC: SAS Institute.
- Smith, R. A., V. Cokkinides, A. C. von Eschenbach, B. Levin, C. Cohen, C. D. Runowicz, S. Wener, D. Saslow, and H. J. Eyre. 2002. "American Cancer Society Guidelines for the Early Detection of Cancer" *CA: A Cancer Journal for Clinicians* 52 (1): 8–22.
- Solanki, G., and H. H. Schauffler. 1999. "Cost-Sharing and the Utilization of Clinical Preventive Services." *American Journal of Preventive Medicine* 17 (2): 127–33.
- Thompson, J. W., J. Bost, F. Ahmed, C. E. Ingalls, and C. Sennett. 1998. "The NCQA's Quality Compass: Evaluating Managed Care in the United States." *Health Affairs* 17 (1): 152–8.
- Tu, H. T., P. Kemper, and H. J. Wong. 1999. "Do HMOs Make a Difference? Use of Health Services." *Inquiry* 36 (4): 400–10.
- Tye, S., K. A. Phillips, S. Y. Liang, and J. S. Haas. 2004. "Moving beyond the typologies of managed care: the example of health plan predictors of screening mammography." *Health Services Research* 39 (1): 179–206.
- U.S. Preventive Services Task Force. 1996. *Guide to Clinical Preventive Services*, 2d ed. Baltimore: Williams and Wilkins.
- Wee, C. C., R. S. Phillips, H. R. Burstin, E. F. Cook, A. L. Puopolo, T. A. Brennan, and J. S. Haas. 2001. "Influence of Financial Productivity Incentives on the Use of Preventive Care." *American Journal of Medicine* 110 (3): 181–7.
- Welch, W. P. 1994. "HMO Market Share and Its Effect on Local Medicare Costs." In *HMOs and the Elderly*, edited by H. S. Luft, pp. 231–49. Ann Arbor, MI: Health Administration Press.
- Zapka, J. G., A. Stoddard, L. Maul, and M. E. Costanza. 1991. "Interval Adherence to Mammography Screening Guidelines." *Medical Care* 29 (8): 697–707.