Are Gatekeeper Requirements Associated with Cancer Screening Utilization?

Kathryn A. Phillips, Jennifer S. Haas, Su-Ying Liang, Laurence C. Baker, Sherilyn Tye, Karla Kerlikowske, Julie Sakowski, and Joanne Spetz

Objective. There is widespread debate over whether health plans should require enrollees to use “gatekeepers,” which are primary care providers that coordinate care and control access to specialists. However, little is known about whether health plan gatekeeper requirements improve or reduce quality-of-care. Our objective was to examine whether gatekeeper requirements are associated with the utilization of cancer screening for breast, cervical, and prostate cancer.

Data Sources. Three linked sources ($N = 13,534$): (1) 1996 Medical Expenditure Panel Survey (MEPS) Household Survey, a nationally representative, ongoing survey sponsored by the Agency for Healthcare Research and Quality; (2) 1996 MEPS Health Insurance Plan Abstraction, which codes data from health plan booklets obtained from privately insured respondents, and (3) 1995 National Health Interview Survey.

Study Design/Data Collection. Cross-sectional, multivariate logistic regression analysis using secondary data.

Principal Findings. We found in multivariate analyses that women in gatekeeper plans were significantly *more* likely to obtain mammography screening (Odds Ratio [OR] = 1.22, 95 percent Confidence Interval [CI] 1.07–1.40), clinical breast examinations (OR = 1.39, 95 percent CI 1.23–1.57), and Pap smears (OR = 1.33, 95 percent CI 1.16–1.52) than women not in gatekeeper plans. In contrast, gatekeeper requirements were not associated with prostate cancer screening (OR = 1.11, 95 percent CI 0.93–1.33). We found no association between screening utilization and aggregate plan types (HMO, POS, PPO, FFS).

Conclusions. Gatekeeper requirements are associated with higher utilization of widely recommended cancer screening procedures, but not with utilization of a less uniformly recommended cancer screening procedure. Researchers should consider the analysis of specific plan characteristics rather than aggregate plan types in conducting future research, and insurers and policymakers should consider the potential benefits of gatekeepers with respect to preventive care when designing health plans and legislation.

Key Words. Utilization, cancer screening, health insurance, managed care

Although early studies of the impact of managed care on cancer screening found that screening is higher in health maintenance organizations (HMOs) or

managed care plans, more recent studies have had ambiguous results (Bernstein, Thompson, and Harlan 1991; Brown et al. 1990; Gordon, Rundall, and Parker 1998; Hsia et al. 2000; Makuc, Freid, and Parsons 1994; Phillips, Kerlikowske et al. 1998; Potosky et al. 1998; Reschovsky and Hargraves 2000; Solanki and Schauffler 1999; Tu, Kemper, and Wong 1999; Wee et al. 2001; Weinick, Zuvekas, and Drilea 1997; Zapka et al. 1991). There is now widespread agreement that comparisons of aggregate plan types such as "HMO versus not HMO" or "managed care versus fee-for-service" are less relevant because of the wide variation among types of managed care plans (e.g., Brach et al. 2000; Weiner and de Lissovoy 1993). It has been suggested that studies examining specific plan characteristics could offer more insight on the factors influencing utilization than aggregate measures of plan types such as "managed care" (Brach et al. 2000; Conrad et al. 1998; Docteur, Colby, and Gold 1996; Gold and Hurley 1997; Grembowski 1998; Grembowski et al. 2000; Landon, Wilson, and Cleary 1998; Tu, Kemper, and Wong 1999; Weiner and de Lissovoy 1993; Welch, Hillman, and Pauly 1990).

One specific plan characteristic that may be associated with screening utilization is plan gatekeeper requirements. There has been widespread debate over whether managed care health plans should require enrollees to use "gatekeepers," which are primary care providers that coordinate care and control access to specialists. The requirement of many managed care health plans that enrollees use gatekeepers has been considered essential for cost-containment, but there has been concern that gatekeepers unnecessarily restrict access to specialists, ration care, and strain the patient-provider relationship (Ferris et al. 2001; Grumbach et al. 1999; Halm, Causino, and Blumenthal 1997; Mitchell et al. 2000). Thus, recent policy proposals and new health plan products have focused on increasing freedom of choice by removing gatekeeper requirements (Forrest et al. 2001; Joyce et al. 2000; Richard and Wood 1999; Robinson 2001).

This work was supported by funding to Dr. Phillips from the National Cancer Institute (R01 CA81130). Partial support was also provided by the Agency for Healthcare Research and Policy (P01 HS10771 and P01 HS 10856).

Address correspondence to Kathryn A. Phillips, Ph.D., Associate Professor of Health Services Research and Health Economics, School of Pharmacy, Institute of Health Policy Studies, and UCSF Comprehensive Cancer Center, University of California, San Francisco, 3333 California St., Suite 420, Box 0613, San Francisco, CA 94143. Jennifer S. Haas, M.D., M.S.P.H., Su-Ying Liang, Ph.D., Sherilyn Tye Ph.D., Julie Sakowski, Ph.D., Joanne Spetz, Ph.D., are with the University of California, San Francisco. Laurence C. Baker, Ph.D., is with Stanford University. Karla Kerlikowske, M.D., is with the University of California, San Francisco, Department of General Internal Medicine, VAMC.

Little is known about whether gatekeeper requirements improve, reduce, or have no impact on quality-of-care (Bindman et al. 1995; Blumenthal, Mort, and Edwards 1995; Ferris et al. 2001; Gill and Mainous 1998; Hargraves, Cunningham, and Hughes 2001; McGlynn 1998; Weinberger and Oddone 1996; Weiss and Blustein 1996). One measure of quality-of-care is the provision of recommended preventive services. Although gatekeeper requirements are often viewed negatively because of their function of controlling access to specialty care, such requirements may actually improve the provision of recommended services because of their function in coordinating care.

Our objective was to examine whether gatekeeper requirements are associated with the utilization of widely recommended cancer screening procedures (for breast and cervical cancer), but not associated with the use of a less uniformly recommended cancer screening procedure (for prostate cancer). Our study adds to the literature by focusing specifically on one specific plan characteristic—gatekeeper requirements—as opposed to the less precise, dichotomous measures of HMOs or managed care plans used in the vast majority of previous studies on the impact of managed care (Miller and Luft 1997; Phillips et al. 2000). Gatekeeper requirements are not synonymous with either “HMOs” or “managed care” plans; gatekeeper requirements are common in group/staff HMOs and HMO/POS plans but less common in PPO plans (Cunningham, Denk, and Sinclair 2001; Grossman, Schaefer, and Kemper 1999).

We used data from the 1996 Medical Expenditure Panel Survey (MEPS), an ongoing survey that provides extensive data on insurance coverage. The MEPS is the only nationally representative survey that collects detailed information on plan characteristics from both household respondents and health plan booklets, which is important because some household respondents are unaware of details of their plan, and plan booklet data can be objectively and reliably coded (Monheit, Wilson, and Arnett 1999). Since MEPS obtains data on four types of cancer screening, we were able to compare results between three uniformly and one less uniformly recommended screening procedures.

METHODS

Conceptual Framework

The conceptual framework for this study (described more fully in Tye, Phillips, and Liang [2003]) is based on the behavioral model as well as other

models of demand and utilization (Aday, Andersen, and Fleming 1980; Andersen 1968; Andersen 1995; Conrad et al. 1998; Docteur, Colby, and Gold 1996; Grembowski and Milgrom 1988; Landon, Wilson, and Cleary 1998; Phillips, Morrison et al. 1998). The model postulates that patient, provider, and plan characteristics influence utilization. We expanded the traditional conceptualization of aggregate plan characteristics (HMO, PPO, etc.) to instead examine specific plan characteristics including gatekeeper requirements, choice of providers/existence of provider network, out-of-network coverage, cost-sharing, and benefit coverage (other plan characteristics were examined in studies on mammography screening [Tye, Phillips, and Liang 2003] and prostate cancer screening [Liang et al. 2003]).

We specifically examined gatekeeper requirements because they were hypothesized to have more of an association with cancer screening utilization than aggregate plan types or other specific plan characteristics. Gatekeeper requirements may have more of an effect than other plan characteristics because characteristics such as price and out-of-network coverage are less relevant to cancer screening. These services are routinely covered by managed care plans and in many states all private insurers are mandated to provide coverage (National Cancer Institute 2001), and screening can be performed by primary care providers or by within-network specialists. Thus, in this study, we expected that the role of gatekeepers as coordinators of care, rather than as controllers of referrals, would be more relevant.

We tested the null hypothesis that gatekeeper requirements have no association with utilization. On the one hand, gatekeeper requirements could increase utilization of *recommended* services because gatekeepers' role as coordinators of care may increase access to recommended services. Gatekeepers also operate within systems that provide financial and organizational incentives to provide recommended services. This is particularly true in this study because breast and cervical cancer screening are used as measures of health plan quality-of-care in the Health Plan Employer Data and Information Set (HEDIS) system.

On the other hand, gatekeeper requirements may *not* be associated with utilization of cancer screening services that are less uniformly recommended because of incentives to restrict access to services that may be considered less essential. This hypothesis was tested using prostate cancer screening, which is not routinely recommended by the U.S. Preventive Services Task Force (United States Preventive Services Task Force 2003) nor used as a quality measure in HEDIS, but is recommended by other groups (American Cancer Society 2001).

Data Sources

Our data are derived from linked observations from three datasets sponsored by the Agency for Healthcare Research and Quality and National Center for Health Statistics:

- a. The 1995 National Health Interview Survey (NHIS), from which the 1996 MEPS sample was drawn (<http://www.cdc.gov/nchs/nhis>, last accessed 10 January 2002).
- b. The 1996 Household Component of the Medical Expenditure Panel Survey (MEPS) (<http://www.meps.ahrq.gov>, last accessed 10 January 2002) (Total $N = 22,601$; joint response rate based on NHIS and MEPS = 78 percent).
- c. The MEPS Health Insurance Plan Abstraction (HIPA), which collects data on the private insurance plans held by MEPS households by coding data from the plan booklets obtained from respondents. The 1996 HIPA contains data on 54 percent of privately insured household respondents (Total $N = 13,534$).

Our study sample included privately insured individuals from the MEPS household component who were linked to HIPA (unweighted $n = 13,534$, Table 1).¹ We provide additional details about our analyses elsewhere (available on request) (Baker et al. 2003; Haas, Lee et al. 2002; Haas et al. 2003; Haas, Phillips, et al. 2002; Liang et al. 2003; Phillips 2003a, b; Phillips et al. 2003; Sakowski et al. 2003; Tye, Phillips, and Liang 2003).

Dependent Variables

We examined four types of cancer screening in order to test the robustness of our results in different populations and across uniformly and less uniformly recommended types of screening:

1. Mammography screening (ages 40+)
2. Clinical breast examination (ages 40+)
3. Pap smear (ages 18+)
4. Prostate cancer screening (ages 45+, which is the age recommended by some organizations for screening initiation for high-risk groups).

We chose age ranges and time intervals that took into account the range of recommendations at the time of the survey (sensitivity analyses based on different ranges were similar). Our primary dependent variables were

self-reported screening within the past two years versus screening more than two years ago or never screened.²

Independent Variables

We examined a range of screening predictors in MEPS based on previous studies, including patient characteristics (sociodemographic characteristics and “preventive orientation”), provider characteristics (type of provider), and plan characteristics (gatekeeper requirements, continuity of insurance coverage, and aggregate plan types) (e.g., Bernstein, Thompson, and Harlan 1991; Brown et al. 1990; Gordon, Rundall, and Parker 1998; Hsia et al. 2000; Makuc, Freid, and Parsons 1994; Phillips, Kerlikowske et al. 1998; Potosky et al. 1998; Reschovsky and Hargraves 2000; Solanki and Schauffler 1999; Tu, Kemper, and Wong 1999; Weinick and Beauregard 1997; Zapka, et al. 1991). All final variables were based on data from the MEPS Household or HIPA surveys except for continuity of coverage, which also incorporated NHIS data.

We created both a primary measure for gatekeeper requirements and tested several alternative definitions. It is important to note that we examined plan gatekeeper requirements, not the direct impact of a specific physician who was a gatekeeper. We used both self- and plan-reported data on plan characteristics because self-perceptions may be more important determinants of behavior than actual plan characteristics (Reschovsky and Hargraves 2000). Our primary measure defined respondents as being in gatekeeper plans if respondents were in gatekeeper plans based on either self- *or* plan-report. Results when defining respondents as being in a gatekeeper plan only if they were in such plans based on *both* self- and plan-report were similar.

Specifically, respondents were categorized as being in gatekeeper plans in our primary analyses if *any* of the following were true:³

1. *Household respondents* reported being “required to sign up with primary care doctor(s) for all routine care.”
2. *Household respondents* reported being in an HMO, defined as “you must generally receive care from HMO physicians. For other doctors, the expense is not covered unless you were referred by the HMO or there was a medical emergency.” (Respondents who were in an HMO were not asked the gatekeeper question above because of the MEPS assumption that these individuals have gatekeepers. This assumption was confirmed by the finding that 94 percent of respondents in an HMO were also coded as having gatekeepers [based on plan booklet data].)

3. Respondents' *health plan booklets* indicated that a gatekeeper is required, that is, "a referral is required in order to see a specialist."

Statistical Analyses

We used chi-square tests to examine bivariate relationships and logistic regression to examine the predictors of screening use. All analyses used sampling weights to reflect the U.S. civilian, noninstitutionalized population and standard error adjustment to account for the complex survey design (*Stata*, version 7). We used Hosmer-Lemeshow tests to ensure that logistic regression models adequately fit the data (Hosmer and Lemeshow 1989). Variables for regression models were chosen based on theory, study hypotheses, statistical significance, clinical relevance, comparability across types of screening, and parsimony. In final regression models, we used the most parsimonious models possible to avoid collinearity and model instability by excluding variables that were relatively less important or potentially endogenous. We conducted numerous sensitivity analyses to examine the robustness of our findings and the potential for selection bias (see "Results"; details on request).

RESULTS

Sample Description

Seventy-four percent of women reported mammography screening, 84 percent a clinical breast examination, and 79 percent a Pap smear (Table 1). Seventy-one percent of men reported prostate cancer screening.

Gatekeepers were found across several plan types. Of those in HMO plans 94 percent had gatekeepers, of those in HMO/POS plans 84 percent had gatekeepers, of those in PPO/EPO plans 16 percent had gatekeepers, and of those in FFS plans 7 percent had gatekeepers (based on plan booklet data) (not shown). Consistent with other studies (Cunningham, Denk and Sinclair 2001, Grossman, Schaefer and Kemper 1999), slightly more than half of the relevant population (54 percent) was in gatekeeper plans.⁴

Predictors of Screening Use

In bivariate analyses, women in gatekeeper plans were *more* likely than women not in gatekeeper plans to receive mammography screening (77 percent versus 71 percent), clinical breast examinations (87 percent versus 80 percent),

• 50–69	26%	82%	87%	80%	73%
• 70 +	10%	61%	71%	51%	85%
Race/ethnicity		<i>N</i> = 2,824	<i>N</i> = 2,830	<i>N</i> = 4,754	<i>N</i> = 1,840
• White	73%	74%	83%***	79%***	72%***
• African American	10%	75%	90%	89%	60%
• Hispanic	13%	73%	80%	80%	60%
• Other	4%	75%	83%	76%	40%
Education		<i>N</i> = 2,824	<i>N</i> = 2,830	<i>N</i> = 4,754	<i>N</i> = 1,840
• Less than HS	36%	60%***	71%***	62%***	68%*
• HS grad	26%	75%	82%	77%	67%
• College	30%	76%	88%	83%	74%
• College plus	8%	84%	94%	90%	74%
Household income		<i>N</i> = 2,822	<i>N</i> = 2,828	<i>N</i> = 4,752	<i>N</i> = 1,840
• Low (\$0–\$28,000)	24%	68%***	77%***	73%***	74%
• Medium (> \$28,000–< \$56,000)	37%	73%	84%	79%	69%
• High (> \$56,000)	39%	80%	89%	84%	71%
Recency of dental check-up		<i>N</i> = 2,824	<i>N</i> = 2,830	<i>N</i> = 4,754	<i>N</i> = 1,840
• Twice a year or more	42%	83%***	91%***	86%***	77%***
• Once a year	27%	76%	87%	82%	76%
• Less than once a year	19%	63%	73%	71%	57%
• Never	12%	54%	66%	58%	64%
Whether has usual source of care and type of usual provider		<i>N</i> = 1,932	<i>N</i> = 1,937	<i>N</i> = 3,097	<i>N</i> = 1,238
• Ob-gyn or internal medicine	16%	81%***	87%***	80%	84%***
• General or family medicine or other	62%	72%	82%	78%	73%
• No usual source of care	22%	62%	72%	77%	42%
Self- or non-self-report		<i>N</i> = 2,824	<i>N</i> = 2,830	<i>N</i> = 4,754	<i>N</i> = 1,840
• Self-report	NA	74%	84%	80%	73%
• Not self-report	NA	76%	83%	78%	69%

Continued

Table 1. *Continued**Notes:*

N's are unweighted; percentages are weighted and adjusted for the complex survey design.

*** $p < .001$, ** $p < .01$, * $p < .05$.

P values for Type of plan *dependent variables:

Mammography: $p = 0.88$

Clinical breast exam: $p = 0.48$

Pap smear: $p = 0.07$

Prostate cancer screening: $p = 0.18$

P values for Gatekeeper and plan type *dependent variables:

Mammography: $p = 0.90$

Clinical breast exam: $p = 0.90$

Pap smear: $p = 0.99$

Prostate cancer screening: $p = 0.09$

Variable definitions:

- Continuity of insurance coverage was measured using both 1996 MEPS and 1995 NHIS data. Since only individuals with insurance at some time during 1996 were linked to HIPA, the percentage of individuals with less than one year of coverage is low.
- Type of plan based on plan booklet. Respondents for whom data were "not ascertained" were not included. FFS = fee-for-service (indemnity), PPO = preferred provider organization, EPO = exclusive provider organization, HMO = health maintenance organization (i.e., closed panel plan), POS = point of service
- Age categories were chosen based on screening recommendations.
- The category of "other" race/ethnicity is primarily Asian.
- Categories for income were based on percentiles. Both household and personal income had similar results; thus, only household income is shown.
- Recency of dental check-up is a measure of "preventive orientation." Results for other preventive services (e.g., whether had flu shot) were similar; however, we included this variable because it was the most applicable to the age groups included.
- Type of usual provider. Respondents were asked whether they had a usual source of care; if so, they were asked the type. Thus, this variable combines data from two variables to avoid collinearity. Respondents reporting ob-gyns or internal medicine physicians as their primary providers were grouped together because screening rates were similar (versus general or family medicine physicians) and due to sample sizes. Respondents with missing data are not included and thus the Ns shown are lower than the total Ns. Missing data for this variable is primarily because the speciality of some respondents' usual source of care was not asked about.
- Self-report. The household interview takes place with a family respondent, who reports for him/herself and for other family members. Thus, responses may be self-reported, reported by a respondent within the reporting unit (usually a family), or reported by a "proxy" (outside the reporting unit). The latter two categories were coded as "non-self-report." The percentage of self-reported screening is 77% for mammography and CBE screening, 75% for Pap smears, and 47% for prostate cancer screening.

and Pap smears (84 percent versus 74 percent) (all comparisons, $p < .001$). In contrast, men who were in gatekeeper plans were *less* likely to receive prostate cancer screening than men not in gatekeeper plans (69 percent versus 73 percent, $p = .03$). Other predictors of screening use were as expected. In contrast, several of the predictors of prostate cancer screening were different than for female cancer screening (Table 1).

In analyses adjusting for all covariates (Table 2), women in gatekeeper plans were significantly *more* likely to obtain mammography screening (Odds Ratio [OR] = 1.22, 95 percent Confidence Interval [CI] 1.07–1.40, $p = .005$), clinical breast examinations (OR = 1.39, 95 percent CI 1.23–1.57, $p < .001$), and Pap smears (OR = 1.33, 95 percent CI 1.16–1.52, $p < .001$). In contrast, men in gatekeeper plans were *not* significantly more likely to obtain prostate cancer screening (OR = 1.11, 95 percent CI 0.93–1.33, $p = .22$).

We calculated the adjusted predicted probability of screening for respondents in or not in gatekeeper plans by adjusting for all covariates based on the characteristics of a “typical” respondent.⁵ The probability of screening for a “typical” respondent (adjusted for all covariates) in a gatekeeper plan versus not in a gatekeeper plan was 83 percent versus 80 percent (mammography), 89 percent versus 85 percent (clinical breast examination), 80 percent versus 75 percent (Pap smears), and 83 percent versus 82 percent (prostate cancer screening) (all $p < .01$ except NS for prostate cancer screening).

Sensitivity Analyses

We conducted several analyses to explore the extent to which our results were due to other factors. First, Table 1 shows that we found *no* significant differences in screening rates across aggregate plan types (FFS/PPO/HMO/POS/other). Additional bivariate analyses (not shown) found differences in screening utilization for HMOs versus not HMOs only for Pap smear screening and no differences in utilization by the amount of copayments or deductibles. In regression analyses, plan type was insignificant both when all plan types were included and when HMO only was included. We also explored whether the gatekeeper results remained consistent for individuals with gatekeepers regardless of whether they were in HMO plans or in other plans (e.g., PPO plans). The results were consistent, as we found no significant differences in screening rates for these individuals (Table 1). For example, mammography screening rates were 77 percent in both groups ($p = .99$).

Table 2: Predictors of Screening within Past Two Years versus Greater Than Two Years Ago or Never Screened (Source: Logistic Regressions)

<i>VARIABLES</i>	<i>Mammography Screening (N = 2,814) Odds Ratios (95% Confidence Intervals)</i>	<i>Clinical Breast Exam (N = 2,820) Odds Ratios (95% Confidence Intervals)</i>	<i>Pap Smear (N = 4,742) Odds Ratios (95% Confidence Intervals)</i>	<i>Prostate Cancer Screening (N = 1,834) Odds Ratios (95% Confidence Intervals)</i>
Age				
• Continuous	NA	NA	0.98 (0.98–0.99)***	1.07 (1.05–1.08)***
• 50–69 (vs. other)	2.26 (1.92–2.67)***	1.48 (1.19–1.85)***	NA	NA
Race/ethnicity				
• Nonwhite (vs. white)	1.21 (0.94–1.56)	1.70 (1.39–2.07)***	1.47 (1.15–1.88)*	NA
• African American (vs. other)	NA	NA	NA	1.46 (1.02–2.07)*
Education (continuous)	1.06 (1.03–1.09)***	1.11 (1.06–1.16)***	1.10 (1.07–1.13)***	1.07 (1.03–1.11)***
Recency of dental check-up (ordinal)	0.66 (0.60–0.73)***	0.63 (0.59–0.68)***	0.69 (0.63–0.77)***	0.72 (0.68–0.77)***
Has usual source of care who is ob-gyn or internal medicine (vs. general, family medicine, other, or no usual source of care)	1.56 (1.21–2.00)***	1.26 (1.00–1.58)	1.09 (0.88–1.34)	2.02 (1.46–2.81)***
Continuity of insurance coverage over past 2 years (ordinal)	1.15 (0.86–1.54)	1.00 (0.74–1.36)	0.92 (0.75–1.12)	1.07 (0.81–1.41)
Gatekeeper requirement (vs. no gatekeeper requirement)	1.22 (1.07–1.40)**	1.39 (1.23–1.57)***	1.33 (1.16–1.52)***	1.11 (0.93–1.33)

*** $p < .001$,** $p < .01$,* $p < .05$.

Hosmer–Lemeshow goodness of fit tests were as follows: mammography ($p = 0.39$), breast exam ($p = 0.27$), Pap smear ($p = 0.43$), prostate cancer screening ($p = 0.14$).

Sensitivity analyses controlling for other characteristics are discussed in the text.

We also conducted several analyses to explore possible explanations for our results (not shown). The gatekeeper effect remains similar when the sample is limited to individuals that report having a usual source of care ($p < .01$ for mammography and clinical breast examination, $p = .14$ for Pap smears, $p = .31$ for prostate cancer screening, logistic regressions). In addition, we found that there was a strong relationship between being in a gatekeeper plan and respondents' willingness to go to their usual source of care for preventive care ($p < .01$, chi-square test). The strongest relationship between being in a gatekeeper plan and screening use was for respondents who reported "average" access to care (compared to "very good" or "poor" access) ($p < .01$, chi-square test).

Analyses using different definitions of our gatekeeper variable were consistent with our primary results, for example, categorizing respondents as being in gatekeeper plans only if they reported being in a gatekeeper plan *and* were coded as such in plan booklets—mammography ($p < .01$), breast exam ($p < .01$), Pap smear ($p < .01$), prostate cancer screening ($p = .12$), logistic regressions. Analyses using population subsets also were consistent with our primary results based on logistic regressions. Results were similar when excluding respondents reporting having never been screened, using different age groups (e.g., clinical breast examination for women ages 18+), and for respondents who named a person as their usual source of care as opposed to a facility.

Selection Bias

Many studies have examined whether healthier people choose managed care plans, therefore potentially biasing the observed results for insurance. Earlier studies found this tendency (e.g., Hellinger 1995), while more recent studies have found less evidence of selection bias (e.g., Hellinger and Wong 2000; Reschovsky and Hargraves 2000). Most prior studies have examined selection specifically into HMO or managed care plans, based on health status and therefore there is no available evidence specific to selection into plans with and without gatekeepers. It is also important to note that selection bias is primarily relevant only to the 50 percent of privately insured respondents in our sample who had a choice of plans. Therefore, this literature leaves us unsure about the extent to which selection bias is a potential complication for our study, but since we cannot rule it out, we used several approaches to assess whether our results are affected by selection bias.

In sum, we found that like most analyses not based on randomized experiments, we cannot definitively rule out the possibility that biased selection into plans that have gatekeeper requirements influenced our results. However, a number of attempts to investigate the potential for selection bias revealed little evidence that such selection changed our results and efforts to correct for selection bias did not produce better models. Specific methods and results are described in the Appendix. To summarize, we first added health status to the regression models as a control variable (in addition to a measure of preventive orientation) and the results did not change. Since we hypothesize that a key dimension for selection bias is health status, the fact that controlling for an observable aspect of it did not change the results increases our confidence that unobserved aspects of it are not having a strong impact on the results. Second, we estimated the regression models separately for those who had a choice of health plan and those who did not, since we hypothesized that the potential for selection bias is much greater among the group with a choice of health plan. We found that the effects of gatekeeper requirements on cancer screening utilization are similar between those with and without a choice. Finally, we employed an instrumental variables (IV) approach. We considered several candidates of instrumental variables from both conceptual and empirical perspectives and identified two instrumental variables, occupational establishment size, and insurance premium in 1995, which we expected to be strong predictors of being in a plan with gatekeeper requirements but not predictors (conditional on the other control variables) of screening preferences. Based on a series of tests, we concluded that our instruments may not pass all validity tests in alternative estimation models but are likely to be minimally adequate. The exogeneity test shows that gatekeepers and defined provider networks can be treated as exogenous right-hand-side variables in all models except for the Pap smear model. In addition, the IV estimates were generally consistent with the results reported above. The odds ratios are increased in magnitude in the instrumented models, suggesting that the uninstrumented models may actually underestimate the true effect. However, confidence intervals for the IV estimates were very large, suggesting that these models were more unstable than the uninstrumented regression models.

In conclusion, our results are consistent with the view that our results are not strongly biased by selection or other forms of unobserved heterogeneity, and that efforts to correct for selection bias did not produce better results. We therefore present the results based on regular logistic regression instead of instrumental variable estimates.

DISCUSSION

We found that women who were in health plans that require gatekeepers were more likely to obtain mammography screening, clinical breast examinations, and Pap smears than women not in gatekeeper plans. In contrast, gatekeeper requirements were not associated with a less widely recommended service (prostate cancer screening). We found no association between screening rates and aggregate plan types (HMO, POS, PPO, FFS), a finding consistent with another recent analysis (Reschovsky and Hargraves 2000). The higher rates of screening associated with gatekeeper plans were modest, but these results suggest that gatekeeper requirements are not associated with reduced utilization of recommended preventive services and, in fact, are associated with modestly higher utilization of these services.

Our study adds to the literature by being the first to our knowledge that has examined the association of health plan gatekeeper requirements with the use of preventive services. It is also one of the few studies using nationally representative data to examine the impact of specific health plan characteristics, rather than relying on simple comparisons of “managed care” versus “non-managed care” plans.

Gatekeeper requirements have been viewed negatively by the public because of their role in controlling the provision of care and referrals. However, the public and policymakers may be less cognizant of the possible advantages of gatekeepers as coordinators of care. Gatekeeper requirements may facilitate the receipt of recommended preventive services if fulfilling the role of care coordinator improves access to care, continuity of care, or the ability of gatekeepers to effectively encourage screening among their patients. Our results suggest that having a gatekeeper may be associated with better ongoing access to care, especially for individuals who have “average” access to care. Conversely, individuals who already have very good access to care may benefit less from having a gatekeeper because they have little room for improvement, while individuals who have poor access to any care may benefit less because a gatekeeper is less relevant. It may also be that the use of gatekeepers enables other plan strategies to be more effective. For example, many plans engage in information dissemination or monitoring of screening rates designed to improve screening use, but these strategies may be more effective when coupled with a provider structure that uses gatekeepers.

It is important, however, to recognize that our findings should not be interpreted as demonstrating a causal relationship between gatekeeper requirements and screening use. Gatekeeper requirements are only one of

several highly correlated factors in determining screening use and our results could therefore be due to other factors. However, several of our results suggest that gatekeeper requirements may have an independent effect on screening use; specifically, we did not find evidence that either plan type or cost-sharing was associated with screening and that having a gatekeeper was not highly correlated with having a usual source of care. Given the paucity of research in this area, our results are suggestive enough of a gatekeeper effect to warrant attention.

We also note that screening rates were high in both gatekeeper and nongatekeeper plans and thus the effects seen of gatekeeper requirements were modest. However, even though the increase in Pap smear screening rates for individuals in gatekeeper plans was only 5 percent, this translates to 3.3 million more women getting screened. Future studies should examine whether gatekeeper requirements are associated with the use of other types of services where utilization is much lower than recommended (e.g., colorectal cancer screening) (Phillips 2003a).

Our analysis had several limitations. Although self-reported measures can be inaccurate (Gordon, Hiatt, and Lampert 1993; King et al. 1990; Zapka et al. 1996), our key measures appear reasonably accurate for this study, for example, of those with a gatekeeper plan according to plan booklet data, 85 percent were in a gatekeeper plan based on self-report. We attempted to minimize measurement error by using multiple measures, as well as extensive sensitivity analyses. Our results were robust, and thus it is unlikely that measurement error would have changed our primary results. Our study is also potentially limited by several analytical issues that are germane to all similar analyses (for details, see Phillips 2003a, b). First, the timeframe for insurance coverage may not be congruent with the timeframe during which services were obtained, an issue typically ignored by prior studies (Phillips, Morrison et al. 1998). We obtained similar results in sensitivity analyses examining screening within the past one (versus two) years, restricting our samples to only individuals that had no change in their health plan, and using another self-reported MEPS measure of mammography screening that is less prone to temporal bias (whether a mammogram was obtained during a specific visit). However, we could not completely control for possible temporal bias.

In conclusion, we found that gatekeeper requirements are not associated with lower utilization of recommended cancer screening procedures. Gatekeeper requirements may have beneficial outcomes, and insurers and policymakers should consider the potential benefits of gatekeeper

requirements with respect to preventive care when designing health plans and legislation.

ACKNOWLEDGMENTS

We are grateful for contributions from Harold S. Luft and Eyal Oren, University of California at San Francisco.

APPENDIX ANALYSES OF SELECTION BIAS

This appendix describes the approaches and methods we used to examine selection bias for the two manuscripts in this issue (Phillips et al. 2004; Tye et al. 2004). In sum, we found that, like most papers not based on randomized experiments, we cannot definitively rule out the possibility of biased selection into plans that have network or gatekeeper requirements. However, a number of attempts to investigate the potential for selection bias revealed little evidence that such selection changed our results and efforts to correct for selection bias did not produce better models.

We addressed two questions in our analyses of selection bias:

- (1) Is there potential for selection bias?
- (2) Is there evidence that selection bias changes our results?

Since the methods and results for the two manuscripts are similar, we describe them together. However, the sample used in the manuscript by Tye et al. (2004) uses a slightly different population, and thus the relevant tables for these results are presented separately.

(1) Is There Potential for Selection Bias?

To address the first question of whether there is potential of selection bias, we conducted three sets of analyses: (1) whether there are differences in individual characteristics between individuals enrolled in gatekeeper and network plans and those not enrolled in such plans, (2) whether there are differences in utilization between individuals with a choice of health plans and those without, (3) whether the gatekeeper and network variables pass the exogeneity test based on an instrumental variables approach.

Are there differences in individual characteristics between people in gatekeeper and network plans and those not in such plans?

First, we used descriptive analyses to check whether there are differences in individual characteristics between people enrolled in gatekeeper and network plans and those not in such plans. We found that there are significant differences in perceived health status and preventive orientation (measured using the frequency of dental check up) between individuals in plans with a gatekeeper ($p < .01$) and without a gatekeeper, and between women in plans with and without defined networks ($p < .01$). For example, individuals who had more frequent dental checks and better health status were more likely to be in a plan with gatekeepers or a defined provider network than those who had less frequent dental checks and poor health status. However, our results did not change when we controlled for these characteristics in regression models (see below).

Are there differences in utilization between individuals with a choice of plans and those without?

Second, we compared whether there are differences in cancer screening utilization between individuals with and without a choice of health plans. We estimated the logistic regression models separately for those who had a choice of health plan and those who did not. We hypothesize that the potential for selection bias is much greater among the group with a choice of health plan. Approximately 50% of our MEPS sample did not have a choice of plans. We found that the effects of a defined provider network and gatekeeper requirements on cancer screening utilization are similar between those with and without a choice (although the effects are generally not significant due to smaller sample sizes) (Tables A1 and A1a).

Instrumental Variable-Based Endogeneity Test

A strong test of the presence of endogeneity can be conducted using instrumental variables methods if suitable instruments are available. While obtaining airtight instruments in this setting can be difficult, we were able to identify two instruments that provide a plausible basis for instrumental variables estimation. We considered several candidate instruments that could be associated with the choice of plans with specific characteristics (gatekeepers or a defined provider network) but *not* associated with cancer screening procedures, including occupation type, whether the plan was chosen based on quality or cost, insurance premium, and occupation establishment size. In the

Table A1: Effect of Gatekeeper Status on Four Outcome Measures (Logistic Regressions)

	<i>Full Sample</i>	<i>Had Choice</i>	<i>No Choice</i>
Mammography	1.22 (1.07–1.40) $p < .01$ $N = 2,814$	1.20 (0.83–1.76) $p = .32$ $N = 736$	1.03 (0.73–1.47) $p = .85$ $N = 540$
CBE	1.39 (1.23–1.56) $p < .01$ $N = 2,820$	0.76 (0.35–1.63) $p = .47$ $N = 738$	1.05 (0.79–1.39) $p = .72$ $N = 542$
Pap smear	1.33 (0.16–1.52) $p < .01$ $N = 4,742$	0.76 (0.56–1.03) $p = .08$ $N = 1,394$	1.02 (0.81–1.29) $p = .85$ $N = 1,040$
Prostate cancer screening	1.11 (0.93–1.33) $p = .22$ $N = 1,834$	1.40 (0.90–2.17) $p = .13$ $N = 520$	0.94 (0.70–1.26) $p = .66$ $N = 419$

Table A1a: Effect of a Defined Provider Network and Gatekeepers on Mammography Utilization (Logistic Regression)

	<i>Full Sample</i>	<i>Had Choice</i>	<i>No Choice</i>
Provider network	1.21 (1.07–1.35) $p < 0.01$ $N = 2,692$	0.99 (0.72–1.38) $p = 0.97$ $N = 724$	1.10 (0.77–1.72) $p = 0.66$ $N = 541$
Gatekeeper	1.19 (1.03–1.37) $p = 0.02$ $N = 2,613$	1.09 (0.70–1.70) $p = 0.71$ $N = 724$	1.09 (0.68–1.74) $p = 0.73$ $N = 534$

end, we used occupational establishment size and employers' contributions to insurance premium in 1995 as the instruments. We implemented a standard two-stage instrumental variable (IV) model using these instruments.

As part of the analysis, we conducted a series of tests to assess the quality of instruments. A Wald test was used to assess the explanatory power of the instruments due to the nonlinear nature in the first stage. Both instruments appeared to be significant predictors of the potentially endogenous variable ($p < .01$ in predicting the gatekeeper variable in all models; $p = 0.01$ in predicting the provider network variable for the mammography paper). A linear probability model was also estimated. This model allowed us to run the first-stage F-statistics to assess the predictive power of the instruments and to perform an overidentifying restriction test to assess whether the instruments

are uncorrelated with the outcome variables and therefore can be excluded from the main equations. We found the F-statistics in these linear probability models were low, which is generally an indication of weak instruments (F-statistics = 4.85, 4.98, 6.56, 4.19 for mammography, clinical breast exam, Pap smear, and prostate cancer screening, respectively; $F = 4.64$ and $F = 5.86$ for predicting the provider network and gatekeeper variables in the mammography paper.) Results from the overidentifying restriction test do not suggest that the instruments are strongly correlated with the error term. Specifically, we cannot reject the joint null hypothesis that the model is correctly specified and the instruments are uncorrelated with the error term at the significance level of .05 (e.g., $p = 0.10$, $p = 0.9$, $p = 0.12$, $p = 0.89$ for mammography, clinical breast exam, Pap smear, and prostate cancer screening, respectively; $P = 0.13$ and $p = 0.07$ for the provider network and gatekeeper variables for the mammography paper). Based on these tests, we concluded that our instruments may not pass all validity tests in alternative estimation models but are likely to be minimally adequate.

We then performed a Davidson and Mackinnon test of exogeneity for the gatekeeper variable in models predicting the four types of cancer screening utilization and found that we cannot reject the null hypothesis of exogeneity in all models except for the Pap smear model ($p = 0.45$, $p = 0.17$, $p = 0.04$, $p = 0.44$ for mammography, clinical breast exam, Pap smear, and prostate cancer screening, respectively). The same set of instruments was applied to test the exogeneity of the gatekeeper and provider network variables in predicting screening mammography. Again, we cannot reject the null hypothesis that the defined provider network and gatekeeper variables are exogenous ($p = 0.40$ for defined provider network, $p = 0.60$ for use of gatekeepers). Though these results are consistent with the view that we do not need to do additional work to correct for endogeneity, we do present the IV results below.

(2) Is there evidence that selection bias changes our results?

As a result of our findings that selection bias may exist, our next step was to assess whether our results are affected by selection bias. We checked whether our results are consistent with and without controlling for potential sources of selection bias (Table A2). We added health status to the model as a control variable (in addition to a measure of preventive orientation) and the results did not change. Since we hypothesize that a key dimension for selection bias is health status, the fact that controlling for an observable aspect of it did not

Table A2: Effect of Gatekeeper Status on Four Outcome Measures

	<i>Our Primary Model Including Dental Check</i>	<i>Alternative Models with and without Controlling for Sources of Selection Bias</i>	
		<i>Including Dental Check and Health Status</i>	<i>Excluding Dental Check and Health Status</i>
Mammography	$P < .01 +$ (OR = 1.22)	$P < .01 +$ (OR = 1.22)	$P < .01 +$ (OR = 1.30)
CBE	$P < .01 +$ (OR = 1.40)	$P < .01 +$ (OR = 1.40)	$P < .01 +$ (OR = 1.49)
Pap smear	$P < .01 +$ (OR = 1.33)	$P < .01 +$ (OR = 1.33)	$P < .01 +$ (OR = 1.34)
Prostate cancer screening	NS + (OR = 1.11)	NS + (OR = 1.11)	NS + (OR = 1.23)

Table A2a: Effect of a Provider Network and Gatekeepers on Mammography Utilization

	<i>Our Primary Model Including Dental Check</i>	<i>Alternative Models with and without Controlling for Sources of Selection Bias</i>	
		<i>Including Dental Check and Health Status</i>	<i>Excluding Dental Check and Health Status</i>
Provider network	$P < .01 +$ (OR = 1.21)	$P < .01 +$ (OR = 1.21)	$P < .01 +$ (OR = 1.26)
Gatekeeper	$P = .02 +$ (OR = 1.19)	$P = .02 +$ (OR = 1.19)	$P < .01 +$ (OR = 1.23)

change the results increases our confidence that unobserved aspects of it are not having a strong impact on the results.

We also compared estimates obtained from a standard logistic regression with the instrumental variable estimates (i.e., corrected for endogeneity of the gatekeeper variable). The signs are consistent but the instrumental variable estimates become insignificant except for the Pap smear model (Tables A3 and A3a). The odds ratios are increased in magnitude in the instrumented models, suggesting that the uninstrumented models may actually underestimate the true effect. However, confidence intervals for the IV estimates were very large, suggesting that these models were more unstable than the uninstrumented regression models.

Table A3: Effect of Gatekeepers on the Use of Cancer Screening Procedures

	<i>Standard Logistic Regression</i>	<i>Two-Stage Model (Instrumental Variables Approach)</i>
Mammography	OR = 1.22 (1.92–2.67) <i>P</i> < 0.01	OR = 2.41 (0.32–18.26) <i>P</i> = 0.40
CBE	OR = 1.39 (1.23–1.57) <i>P</i> < 0.01	OR = 5.42 (0.46–64.34) <i>P</i> = 0.18
Pap smear	OR = 1.33 (1.16–1.52) <i>P</i> < 0.01	OR = 23.85 (1.16–489.56) <i>P</i> = 0.04
Prostate cancer screening	OR = 1.11 (0.93–1.33) <i>P</i> = 0.22	OR = 3.25 (0.34–30.89) <i>P</i> = 0.31

Table A3a: Effect of Provider Network and Gatekeepers on Mammography Utilization

	<i>Standard Logistic Regression</i>	<i>Two-Stage Model (Instrumental Variables Approach)</i>
Defined network	OR = 1.21 (1.07–1.36) <i>P</i> < 0.01	OR = 3.55 (0.10–124.81) <i>P</i> = 0.49
Gatekeeper	OR = 1.18 (1.03–1.36) <i>P</i> = .021	OR = 1.84 (0.12–18.55) <i>P</i> = 0.61

In sum, our results are consistent with the view that our results are not strongly biased by selection or other forms of unobserved heterogeneity, and that efforts to correct for selection bias did not produce better results. We therefore present the results based on regular logistic regression instead of instrumental variable estimates.

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