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RESEARCH ARTICLE

Effects of State Cervical Cancer Insurance Mandates on Pap Test Rates

Marianne P. Bitler and Christopher S. Carpenter

Objective. To evaluate the effects of state insurance mandates requiring insurance plans to cover Pap tests, the standard screening for cervical cancer that is recommended for nearly all adult women.

Data Sources. Individual-level data on 600,000 women age 19–64 from the CDC's Behavioral Risk Factor Surveillance System.

Study Design. Twenty-four states adopted state mandates requiring private insurers in the state to cover Pap tests from 1988 to 2000. We performed a difference-in-differences analysis comparing within-state changes in Pap test rates before and after adoption of a mandate, controlling for the associated changes in other states that did not adopt a mandate.

Principal Findings. Difference-in-differences estimates indicated that the Pap test mandates significantly increased past 2-year cervical cancer screenings by 1.3 percentage points, with larger effects for Hispanic and non-Hispanic white women. These effects are plausibly concentrated among insured women.

Conclusions. Mandating more generous insurance coverage for even inexpensive, routine services with already high utilization rates such as Pap tests can significantly further increase utilization.

Key Words. Insurance mandates, cervical cancer, Pap tests, difference-in-differences

Recently adopted federal health reform (the Patient Protection and Affordable Care Act, or the ACA) requires that all new or substantially revised insurance plans cover Papanicolau ("Pap") tests, which are the standard screening for cervical cancer, without copays or cost-sharing. This coverage is linked to the fact that the United States Preventive Services Task Force (USPSTF) strongly supports the efficacy of Pap tests, giving them a grade of "A," above that of mammograms (which are the standard screening for breast cancer). This grade reflects scientific consensus that cervical cancer is one of the most preventable, treatable, and survivable cancers, and early

detection through Pap tests is very important to increase cancer survival. In this paper, we provide the first quasi-experimental evidence on the effects of very similar reforms adopted at different times by 24 states from 1988 to 2000 that require private insurance plans to cover (or, far less commonly, to offer) Pap tests.

INSTITUTIONAL DETAILS AND RELEVANT LITERATURE

Institutional Details

The American Cancer Society (ACS) reports that nearly 13,000 women will be diagnosed with invasive cervical cancer in the United States in 2015, and about 4,100 women will die from cervical cancer. Early detection through regular Pap tests is commonly understood in the medical community to be the most important determinant of survival. In a Pap test, a tool is used to gather cells from the outer opening of the cervix. These cells are examined under a microscope for abnormalities, particularly for precancerous changes usually caused by high-risk types of the human papillomavirus which are sexually transmitted. If the test is abnormal, colposcopy (a cervical examination using a microscope) or a biopsy can follow. Pap tests are generally given as part of a comprehensive pelvic examination performed by a woman's obstetrician/gynecologist (OB/GYN) or by another health care provider. They are also commonly performed at women's health clinics when a woman seeks contraception or is treated for a sexually transmitted infection (STI).

Pap test rates are (and for a long time have been) considerably higher than mammography, proctoscopy, and colonoscopy rates. Differential utilization rates may be explained in part by differences in cost and in convenience. For example, historically Pap tests have been much less expensive than screening mammograms or colonoscopies (see, for example, http://health.costhelper.com/pap-test.html, http://health.costhelper.com/mammogram.html, and http://health.costhelper.com/colonoscopy.html), though these differences have been reduced under the preventive services mandate of the ACA, which requires these screenings to be covered without cost-sharing for eligible individuals. Pap tests are also frequently performed in-office as part of a

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standard well-woman exam; in contrast, mammograms and colonoscopies require special equipment and often are performed during another visit to a separate facility upon referral.

Twenty-four states adopted mandates requiring qualified private health insurance plans to cover (or, much less commonly, offer) Pap tests from 1988 to 2000. Cover mandates require privately sold plans to include coverage of Pap tests, while offer mandates only require that insurers offer at least one such plan to an employer. These mandates apply to the insurance companies who sell insurance to private employers (or, in some cases, sell to individuals). Women who have their own employer-related private insurance coverage or who have insurance through employed husbands or others would be affected by these mandates if the firm was not self-insured.

Relevant Literature

Our paper is related to a large literature in economics that has used experimental and quasi-experimental methods to identify causal effects of insurance coverage and insurance generosity on use of health services and health outcomes, including Pap tests. Manning et al. (1987) found that cost-sharing deterred participants from obtaining preventive care relative to the "free" plan in the controlled setting of the RAND Health Insurance Experiment from 1971 to 1982. Lurie et al. (1987), however, found no difference between screening rates for people in the "free" plan versus people randomized to cost-sharing. Finkelstein et al. (2012) studied low-income Medicaid-eligible women and found that participants who took up Medicaid in the state due to winning a lottery in 2008 (i.e., generally moved from no insurance to public insurance) were significantly more likely to get a Pap test in the first year after the program. Kolstad and Kowalski (2012) found no significant change in Pap test use for women in Massachusetts relative to women in other states after the implementation of the state's mandated health insurance reform in 2006, though Sabik and Bradley (2016) did find a long-term increase in Pap tests associated with the same reform. Barbaresco, Courtemanche, and Qi (2015) studied the effects of the ACA-dependent coverage expansion in a difference-in-differences (DD) framework using slightly older young adults as controls, and they found no significant effects of this particular reform on Pap test use. Thus, the existing quasi-experimental evidence on the role of insurance coverage in Pap test use is mixed. We complement these studies by exam-

ining a different type of insurance-related intervention that specifically targets Pap tests.

We are aware of no studies that examine the effects of state insurance benefit mandates requiring coverage of Pap tests. The absence of a substantial literature on the utilization effects of Pap test mandates is striking given that Pap tests are one of the most commonly mandated benefits (Bunce and Wieske 2008). Moreover, other types of state-level insurance benefit mandates have been studied extensively, including mammography screenings (Bitler and Carpenter 2016), pregnancy benefits (Gruber 1994a), infertility treatment (e.g., Schmidt 2007; Bundorf, Henne, and Baker 2007; Buckles 2007; Bitler 2010; Bitler and Schmidt 2012), and others.

Researchers have identified a number of considerations for understanding the extent to which any mandated benefits laws should affect outcomes. First, mandated benefits laws may cause employers—particularly small firms—to reduce offers of health insurance in response to the rising costs when mandated benefits laws are adopted, though empirical evidence on this is mixed (Gabel and Jensen 1989; Gruber 1994b; Sloan and Conover 1998; Jensen and Morrisey 1999). Second, as noted above, certain insurance plans are exempted from compliance requirements with any state health insurance mandates. The largest of these is the exemption because of ERISA for self-funded insurance plans, which generally affects large employers (Buchmueller et al. 2007). Third, it is possible that benefits mandates do not have much "bite" to the extent that preexisting private health insurance plans were already covering or offering Pap tests. Sullivan and Rice (1991) reported that the Health Insurance Association of America (HIAA) employer benefits survey fielded in 1990 showed that only about 67 percent of private plans were covering Pap tests in 1990. By 1999 the Kaiser/HRET Survey of Employer-Sponsored Health Benefits found that 94 percent of conventional plans and 98 percent of HMO plans were covering mammography screening (the most closely related benefit to Pap tests in this survey, which soon after was not asked about), suggesting a large increase in coverage over a period of significant mandate adoption (The Henry J. Kaiser Family Foundation and Health Research Educational Trust 1999). It is also worth noting, however, that the Pap test mandates could have indirect effects on cervical cancer screenings through mechanisms other than insurance, for example by changing the behaviors and/or recommendations of health care providers.

Data Description and Empirical Approach

Data Description

Our main outcome data come from the Center for Disease Control's Behavioral Risk Factor Surveillance System (BRFSS). Fielded annually since 1984, the BRFSS included questions about Pap tests in every year of our sample period and is designed to be representative at the state level. Surveys are fielded by the individual states and then sent to CDC to be compiled into a public-use dataset. Our analysis focuses on 1988 to 2000, which spans the period when 24 states adopted these laws. We study women aged 19–64.

The BRFSS Pap test questions allow us to create consistent measures of utilization along several dimensions for women age 19 and older. Specifically, in 1988, women were asked: "Have you ever had a Pap smear?" Women who report ever having had a Pap test then asked about the timing of their most recent Pap test. We create three key outcome variables (exact details for variable construction can be found in the Appendix). First, we identify Ever had Pap test as equal to one if the woman reports ever having had a Pap test and zero otherwise. Second, we create Pap test in the past year as equal to one if the woman reports that she had a Pap test within the past year and zero otherwise. Third, we create Pap test in the past 2 years as equal to one if the woman reports that she had a Pap test within the past 2 years. Note that these latter two variables are not mutually exclusive: All observations where Pap test in the past year is 1 also have Pap test in the past 2 years equal to 1.

We also observe standard demographic characteristics in the BRFSS, including age, race, education, marital status, family income (in ranges), and employment status. The BRFSS also includes a very basic measure of health insurance coverage (beginning in 1991): we are able to identify whether the woman is covered by "any health plan". As the state mandates we study should work primarily through the mechanism of increasing generosity of insurance coverage for Pap tests, the insurance variable—though imperfect—constitutes an important plausibility check on our results (i.e., any effects of mandates should be observed mainly in the sample of women with a health plan).

Empirical Approach

Our main empirical approach is DD, in which we compare the within-state over time change in Pap test outcomes for women in a treated state that

adopted a Pap test insurance mandate in a given year to the associated change in outcomes for women in control states that did not adopt a Pap test mandate in that same year. We expand the simple two period treatment/control DD setup to incorporate a series of time-varying state Pap test mandate adoptions in a two-way fixed effects model that controls for state and year fixed effects. In this model every adopting state serves as both a treatment state (in the year they adopt) and a control state (in the other nonadopting years), while states without Pap test mandates serve as additional control groups throughout, with the key estimate coming from a difference across adopting states and nonadopting states in the differences within time. A key advantage of the two-way fixed effects framework is that as many unobserved factors contributing both to outcomes and to policy adoption are likely to be time invariant within a state (e.g., voters in some states have stronger unobserved preferences for women's health than other states), unrestricted state fixed effects remove these sources of bias. Relatedly, any national, secular influences on outcomes can also be purged by including unrestricted year fixed effects. We also observe state/year measures of some of the key variables which could be alternative explanations for increased cervical screenings such as managed care and HMO penetration, and we include these directly in the regression models (described below). We also account for other co-occurring aspects of the policy environment toward cervical cancer. In these augmented DD models with controls for demographics, other policies, and fixed characteristics of states, the key identifying assumption is that there were no other unobserved shocks to outcomes coincident with policy adoption that affected cervical cancer screening outcomes.

We implement the DD analysis using a standard OLS model with fixed effects for each state and each year and leveraging variation across states in the timing of policy adoption; logistic regression models returned very similar results. This model takes the form:

$$Y_{ist} = \beta_0 + \beta_1 X_{ist} + \beta_2(\text{PAP TEST MANDATE})_{st} + \beta_3 Z_{st} + \beta_4 S_s + \beta_5 T_t + \varepsilon_{ist} \quad (1)$$

where Y_{ist} are the various dichotomous screening outcomes for woman i in state s at time t. X_{ist} is a vector of individual-level demographic characteristics that includes age group dummies (19–24, 30–34, 35–39, 40–44, 45–49, 50–54, 55–59, 60–64, 25–29 omitted), race/ethnicity (non-Hispanic black, non-Hispanic other race, Hispanic ethnicity, white non-Hispanic omitted), education (less than high school, high school degree, some college, Don't

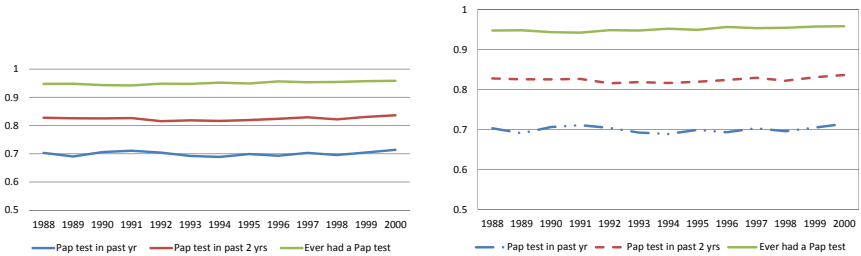
know [DK]/Refused [RF], college degree or more omitted), and marital status (never married, widowed/divorced/separated, cohabiting, DK/RF, married omitted). The key policy variable reflects the presence of any state mandate for cervical cancer screening (regardless of whether it was a cover mandate or, far less commonly, an offer mandate), and β_2 is the coefficient of interest. Note that our key policy variable for the 1- and 2-year Pap outcomes is the share of that 1- or 2-year window before the interview month that the policy was in effect; the ever Pap specifications use contemporaneous laws.

As noted above, we also include covariates that vary at the state and year level and that are standard in two-way fixed effects models such as ours. These variables are captured in Z_{st}, a vector of state economic and demographic characteristics, including the unemployment rate, the HMO penetration rate, the number of obstetric beds in the state per 1000 women age 15–44, the share of women age 15–44 with private health insurance, the share of women age 15–44 who work (or whose spouses work) at private firms of various sizes (<24, 25–99, 100+), real median income for a family of four, fraction black, fraction Hispanic, and fraction urban. The Z_{st} vector also includes controls for other relevant public policies that may be expected to affect insurance such as Medicaid expansions for pregnant women and welfare reform. This vector also controls for the presence of a state direct access law (Baker and Chan 2007), state by year variation in the rollout of the federal cervical screening program for low-income uninsured women (the National Breast and Cervical Cancer Early Detection Program), and section 1115 Family Planning waivers to Medicaid which commonly covered Pap tests (Kearney and Levine 2009). Dummy variables for each state are captured by S_s, and in the DD models, control for time-invariant state-specific factors. Dummy variables for each survey year are captured by T_t, and in the DD specifications, control for period-specific shocks common to all states in any given year. We also control for month of interview to account for idiosyncratic month differences. Throughout, we cluster the standard errors at the state level (Bertrand, Duflo, and Mullainathan 2004). Regressions are weighted to be population representative, and the main sample includes women interviewed by the BRFSS in survey years 1988–2000 with responses to the relevant Pap test questions.

RESULTS

In Figure 1, we show the trend from 1988 to 2000 for our main outcomes: Ever had Pap test, Pap test in the past 2 years, and Pap test in the past year.

Figure 1: Pap Test Rates among 19- to 64-Year-Old Women, BRFSS 1988–2000



Several features are notable. First, Pap test rates are very high: about 95 percent of women age 19–64 report ever having had a Pap test, while over 80 percent report having had one in the past 2 years and about 70 percent have had one in the past year. Second, Pap test rates were very stable over the sample period. Thus, our finding below that adoption of state Pap test mandates was associated with significant increases in cervical cancer screenings suggests that the overall trend in Pap tests would have been negative in the absence of the policies we study.

Table 1 presents descriptive statistics of the key demographic and outcome variables used in this analysis for adult women in the BRFSS. Nearly 85 percent of women report that they have a health plan (our proxy for health insurance), and 70 percent of women report that they had a Pap test in the past year, with higher rates for past 2-year and lifetime Pap test rates. About 37.4 percent of the sample was treated by a mandate for an annual Pap test.

We present the baseline DD results in Table 2 for the main Pap test screening outcomes. Each entry in the table is from a separate model. We present coefficient estimates on the key mandate variable of interest, though the models control for all the covariates described above, including state and year fixed effects. Thus, the printed estimate is the DD estimate of β_2 in Equation (1) above. The format of Table 2 is as follows: In the top row we present estimates from the full 1988–2000 sample. The middle panel restricts attention to individuals with a health plan (our proxy for health insurance, reported for 1991–2000), while the bottom panel shows results for women without a health plan. We present results for Pap test in past 2 years in column 1, Pap test in the past year in column 2, Ever had a Pap test in column 3, and Mammogram in the past 2 years (among 40- to 64-year-old women who were recommended to get regular mammograms over this period by the ACS) in column 4. The

Table 1: Descriptive Statistics, 19- to 64-Year-Old BRFSS Females

Variable	*Mean*
White non-Hispanic	.748
Black non-Hispanic	.108
Other race non-Hispanic	.037
Hispanic	.103
Less than high school degree	.112
HS degree	.333
Some college	.295
Bachelors degree or more	.259
Don't know/refuse to answer about education	.001
Married	.621
Widowed/divorced/separated	.175
Never married	.175
Living with a partner	.027
Don't know/refuse to answer about marital status	.002
Employed	.600
Self-employed	.064
Unemployed	.055
Not in labor force	.279
Has a health plan (1991–2000)	.842
Ever had a Pap test	.951
Had a Pap test within the past 2 years	.824
Had a Pap test within the past year	.700
Treated by mandate for annual Pap test	.374
N	602,407

Notes. Author calculations from 1988 to 2000 BRFSS for adult females 19–64. Some of the variables are not defined in some of the years (e.g., presence of health insurance was not asked until 1991).

last outcome is a key placebo test: if Pap test mandates were correlated with other women's health initiatives or programs more generally, we might expect to observe spurious increases in mammography screenings (which were not covered by the mandates we study) coincident with cervical cancer mandate adoption.

The first column in the top panel of Table 2 shows that Pap test mandates are estimated to have significantly increased the likelihood a woman reports having had a Pap test in the past 2 years by 1.3 percentage points. Relative to the average of this outcome, this represents a 1.6 percent effect. In the second column of Table 2 we also see that the presence of a Pap test mandate is associated with a statistically significant increase of 1.1 percentage points in the likelihood a woman reports she received a Pap test within the past year, and in the third column we estimate that a Pap test mandate increased the likelihood a woman reports she ever had a Pap test by 0.8 percentage points.

Table 2: Pap Test Mandates Significantly Increased Recent Pap Test Use among Insured; DD Models with State and Year Fixed Effects; BRFSS Women 19–64, 1988–2000

	(1)	*(2)*	*(3)*	*(4)*
Outcome is →	Pap test in past 2 years	Pap test in past year	Ever had a Pap test	Mammogram in past 2 years, among 40- to 64-year olds (placebo test)
All (1988–2000)				
Treated by mandate for annual Pap test	.013** (.006)	.011* (.006)	.008*** (.002)	.008 (.008)
Adjusted R^2	.05	.04	.09	.08
N	599,163	599,163	602,407	324,127
Women with a Health Plan (1991–2000)				
Treated by mandate for annual Pap test	.018*** (.007)	.017** (.007)	.007*** (.002)	.012 (.010)
Adjusted R^2	.04	.04	.07	.04
N	475,705	475,705	478,192	247,369
Women without a Health Plan (1991–2000)				
Treated by mandate for annual Pap test	.010 (.012)	.013 (.012)	.021*** (.007)	.017 (.030)
Adjusted R^2	.06	.06	.10	.04
N	80,332	80,332	80,888	33,257

Notes. Each column shows the results from a separate DD model. All models include state, month, and year fixed effects, as well as controls for the following: age groups (19–24, 30–34, 35–39, 40–44, 45–49, 50–54, 55–59, and 60–64; 25–29 is the excluded category), race/ethnicity (non-Hispanic black, non-Hispanic other race; Hispanic; non-Hispanic white is the excluded category), education (less than high school, high school degree, some college, and DK/RF; college degree or more is the excluded category), and marital status (never married, widowed/divorced/separated, cohabiting, DK/RF; married is the excluded category). All models also control for the following variables for each state and year: presence of a direct access law for OB/GYNs; presence of a National Breast and Cervical Cancer Early Detection Program (NBCCEDP); Section 1115 Family Planning waivers to Medicaid; share of women 15–44 with private health insurance; share of women who work or who have a husband who works at a firm with 24 or fewer employees, 25–99 employees, or 100 or more employees; the unemployment rate; welfare reform; the level of HMO penetration (as a share of the population); the number of obstetric beds per 100 women 15–44, the eligibility threshold for Medicaid eligibility for a pregnant woman in the state as a share of the FPL; and the share urban, share black, and share Hispanic in the state. Standard errors throughout are clustered at the state level and estimates are weighted.
*Significant at 10%; **Significant at 5%; ***Significant at 1%.

Finally, we find no statistically significant relationship between the presence of a cervical cancer screening mandate and the likelihood a 40- to 64-year-old woman reports she received a mammogram in the past 2 years.

How large are these effects? Several comparisons are relevant. First, the implied effect for the directly affected women is a scaling-up of the reduced

form estimate (1.3 pp for the past 2-year Pap test outcome), with the scaling factor being the proportion of women whose insurance-related Pap test coverage was changed by the mandate. Unfortunately, we do not directly observe the "first stage" effect on benefits. Estimates from Butler (2000) indicate that the first stage should bind for at most one-third of women in the BRFSS (i.e., privately insured women whose insurance is not subject to ERISA exemptions), indicating that insurance coverage for Pap tests increased the likelihood of having a Pap test in the past 2 years by about 3.9 percentage points (1.3*3). This estimate is based on the assumption that no ERISA-exempted plans were treated by the mandates, even indirectly. This may not be true if firms with self-funded insurance plans change their benefits in response to Pap test mandates for other reasons such as labor market competitiveness. Second, our estimates of the effects of Pap test mandates are substantially smaller than estimates of the effects of similar insurance mandates for mammography screenings on utilization of those screenings. Bitler and Carpenter (2016) estimate in similarly specified DD models that mammography insurance mandates significantly increased past year mammography use by about 5.5 percentage points for women 25–64.

In the middle and bottom panels of Table 2, we directly assess the importance of the insurance channel. The intuition here is straightforward: If the mechanism through which cervical cancer screening mandates increase Pap test use is through more generous insurance coverage (as we hypothesize), then the effects should be observed primarily in the sample of women with a health plan (our proxy for health insurance). If, in contrast, we observed that the effect was mainly driven by women without a health plan, this would cast some doubt on the insurance mechanism described above. The results from this exercise in the middle and bottom panels of Table 2 are broadly consistent with the idea that the cervical cancer screening mandates significantly increased recent utilization through the mechanism of insurance, though the estimates are somewhat noisy. For past year and past 2-year Pap test use, the coefficient on the Pap test mandate variable in the insured sample is positive, larger than the full sample estimate, and statistically significant. Moreover, the associated estimates for the uninsured sample in columns 1 and 2 are smaller than the estimates for the insured sample and are not statistically different from zero. This pattern is consistent with an insurance mechanism in driving the significant increases in recent Pap test rates associated with mandate adoption. In contrast, the results in column 3 for lifetime Pap test use stratified by insurance status do not support a role for the Pap test mandates at increasing utilization: Although we estimate that Pap test mandates are associated with a

statistically significant increase in the likelihood of ever having had a Pap test among women with a health plan, the estimated effect for women without a health plan is substantially larger in magnitude.

Because the timing of the link between the policy and the outcome is stronger for the past 2 years and past year Pap test outcomes (compared to the ever had a Pap test outcome, which could have occurred at a time when the woman had insurance), and because the results by insurance status support a mandate-based interpretation for these two recent Pap test outcomes, we focus on results for past 2 year and past year screening in the remaining tables. Table 3 shows results for these two outcomes separately by race/ethnicity and health plan status. As with Table 2, each entry in Table 3 is from a separate DD model. The top panel reports results for Hispanic women, the middle panel reports results for non-Hispanic white women, and the bottom panel reports results for non-Hispanic black women. Columns 1–2 (for Pap test in the past 2 years and Pap test in the past year, respectively) report results for the sample of women with a health plan, while columns 3–4 restrict attention to women without a health plan. The results in Table 3 strongly support a causal role of Pap test mandates at increasing Pap test rates for Hispanic women and non-Hispanic white women. For these two groups of women, the mandate coefficients are large, positive, and statistically significant in the sample of women with a health plan and are much smaller in magnitude and statistically insignificant in the sample of women without a health plan, and indeed we can reject equality of mandate coefficients by insurance status for non-Hispanic white women. Effects for Hispanic women are particularly large: 4–5 percentage point increases (vs. the 1.5–1.6 percentage point increases estimated for non-Hispanic white women), though we cannot reject equality of the mandate estimates by insurance status for this group of women due, in part, to small samples of Hispanic women. Results for black women in the bottom panel of Table 3 are not consistent with a mandate-based explanation. While we find evidence of significant increases in past 2-year Pap test rates among women with a health plan, mandate estimates for both Pap test outcomes are larger and significant for women without a health plan.

In Table 4, we show estimated mandate effects by age and education for Hispanic and non-Hispanic white women with a health plan. The top panel of Table 4 reports results for the sample of 19- to 34-year olds, while the second panel reports results for 35- to 64-year olds. The third panel reports results for women with a high school degree or less, while the bottom panel reports results for women with at least some college education. Columns 1–2 report results for Hispanic women with a health plan, while columns 3–4

Table 3: Mandate Effects Driven by Hispanic and White, Non-Hispanic Women; DD Models with State and Year Fixed Effects; BRFSS Women 19–64, 1991–2000

	(1)	(2)	(3)	(4)
Outcome is →	Pap test in past 2 years	Pap test in past year	Pap test in past 2 years	Pap test in past year
Sample is →	Has a health plan	Has a health plan	Does not have a health plan	Does not have a health plan
Hispanic				
Treated by mandate for annual Pap test	.040** (.016)	.052*** (.018)	−.007 (.029)	.018 (.027)
Adjusted R^2	.04	.03	.06	.05
N	26,368	26,368	9,784	9,784
White, non-Hispanic				
Treated by mandate for annual Pap test	.016** (.007)	.015** (.007)	−.014 (.018)	−.011 (.018)
Adjusted R^2	.04	.04	.08	.07
N	384,299	384,299	55,521	55,521
Black, non-Hispanic				
Treated by mandate for annual Pap test	.024** (.011)	.024 (.018)	.091*** (.029)	.094*** (.034)
Adjusted R^2	.04	.04	.07	.07
N	44,938	44,938	10,926	10,926

Notes. Each entry is from a separate model. All models include state, month, and year fixed effects, as well as controls for the following: age groups (19–24, 30–34, 35–39, 40–44, 45–49, 50–54, 55–59, and 60–64; 25–29 is the excluded category), education (less than high school, high school degree, some college, and DK/RF; college degree or more is the excluded category), and marital status (never married, widowed/divorced/separated, cohabiting, DK/RF; married is the excluded category). All models also control for the following variables for each state and year: presence of a direct access law for OB/GYNs; presence of a National Breast and Cervical Cancer Early Detection Program (NBCCEDP); Section 1115 Family Planning waivers to Medicaid; share of women 15–44 with private health insurance; share of women who work or who have a husband who works at a firm with 24 or fewer employees, 25–99 employees, or 100 or more employees; the unemployment rate; welfare reform; the level of HMO penetration (as a share of the population); the number of obstetric beds per 100 women 15–44, the eligibility threshold for Medicaid eligibility for a pregnant woman in the state as a share of the FPL; and the share urban, share black, and share Hispanic in the state. Standard errors throughout are clustered at the state level and estimates are weighted. *Significant at 1%; **Significant at 5%; ***Significant at 1%.

report results for non-Hispanic white women with a health plan. The results by demographic group in Table 4 for Hispanic women show that the mandate effects are much larger in magnitude for younger Hispanic women, and there is not much difference in this group by education. For non-Hispanic white women, in contrast, we find that the mandate effects are concentrated in the 35- to 64-year-old sample, and we find no clear patterns of differential effects of mandates by education for non-Hispanic white women.

Table 4: Mandate Effects by Age and Education, Hispanic and White, Non-Hispanic Women; DD Models with State and Year Fixed Effects; BRFSS Women 19–64 with a Health Plan, 1991–2000

	(1)	*(2)*	*(3)*	*(4)*
Outcome is →	Pap test in past 2 years	Pap test in past year	Pap test in past 2 years	Pap test in past year
Sample is →	Hispanic women	Hispanic women	White, non-Hispanic women	White, non-Hispanic women
19- to 34-year olds				
Treated by mandate for annual Pap test	.057** (.027)	.094*** (.025)	.010 (.009)	.004 (.008)
Adjusted R^2	.05	.03	.05	.03
N	11,858	11,858	120,846	120,846
35- to 64-year olds				
Treated by mandate for annual Pap test	.019 (.030)	.014 (.029)	.019* (.010)	.020** (.009)
Adjusted R^2	.03	.02	.03	.03
N	14,510	14,510	263,453	263,453
HS degree or less				
Treated by mandate for annual Pap test	.042* (.021)	.065** (.025)	.022** (.009)	.013 (.009)
Adjusted R^2	.03	.03	.04	.04
N	13,678	13,678	144,655	144,655
Some college or more				
Treated by mandate for annual Pap test	.041* (.023)	.043 (.026)	.011 (.007)	.015* (.008)
Adjusted R^2	.06	.03	.04	.03
N	12,691	12,691	239,358	239,358

Notes. Each entry is from a separate model. All models include state, month, and year fixed effects, as well as controls for marital status (never married, widowed/divorced/separated, cohabiting, DK/RF; married is the excluded category). Models in the top two panels also control for education (less than high school, high school degree, some college, and DK/RF; college degree or more is the excluded category). Models in the bottom two panels also control for 5-year age groups (19–24, 30–34, 35–39, 40–44, 45–49, 50–54, 55–59, and 60–64; 25–29 is the excluded category). All models also control for the following variables for each state and year: presence of a direct access law for OB/GYNs; presence of a National Breast and Cervical Cancer Early Detection Program (NBCCEDP); Section 1115 Family Planning waivers to Medicaid; share of women 15–44 with private health insurance; share of women who work or who have a husband who works at a firm with 24 or fewer employees, 25–99 employees, or 100 or more employees; the unemployment rate; welfare reform; the level of HMO penetration (as a share of the population); the number of obstetric beds per 100 women 15–44, the eligibility threshold for Medicaid eligibility for a pregnant woman in the state as a share of the FPL; and the share urban, share black, and share Hispanic in the state. Standard errors throughout are clustered at the state level and estimates are weighted.
*Significant at 1%; **Significant at 5%; ***Significant at 1%.

Limitations

Our paper is subject to several notable limitations, some of which pertain to the data. For example, our use of observational data means that we cannot make definitive causal claims about the relationship between insurance benefits mandates and Pap tests. Also, all of our outcomes are self-reported. In addition to the usual challenges associated with memory decay and desirability bias, in our setting there is an additional concern that women may report that they had a Pap test when in fact they only had a pelvic exam (see Howard, Agarwal, and Lytwyn 2009, for a review). Because many women use "Pap test" synonymously with "pelvic exam," this could bias our estimates of the levels of Pap test rates, though this error is unlikely to be systematically correlated with the timing of state insurance benefit mandate adoption. Another limitation is that Pap test recommendations have changed since our sample period, with current USPSTF guidelines recommending that 21- to 65-year-old women obtain Pap tests once every 3 years (or once every 5 years after age 30 if combined with HPV testing). Finally, we are also limited by our inability to explain the puzzling pattern of results for non-Hispanic black women: namely, that Pap test mandates are estimated to increase Pap test use rates only for the sample of non-Hispanic black women without a health plan, even after controlling for an extensive set of state level policy and demographic control variables related to fertility and marriage that may differ across races. This is an important caveat and area for future work.

CONCLUSION

The results above suggest that insurance mandates requiring coverage of Pap tests significantly increased Pap test use rates, even though these screenings are inexpensive and utilization was already quite high by the late 1980s. We estimate that adoption of a cervical cancer screening mandate significantly increased past 2-year cervical cancer screenings by 1.3 percentage points. These effects are plausibly observed for women with a health plan and are not observed for other women's health outcomes (e.g., mammograms).

Given recently adopted federal health reform requires coverage of Pap tests, what are the policy implications of our findings? There are several. First, to the extent that our results reflect the effects of real changes in insurance generosity, they are suggestive that federal health reform should significantly increase cervical cancer screenings. Early estimates suggest that there was a

net gain of about 17 million individuals who obtained health insurance under the ACA through 2015 (Carman, Eibner, and Paddock 2015), with nonelderly childless adults seeing the largest insurance coverage increases. Women in this age group are precisely those who are recommended to get cervical cancer screenings, so the total number of new Pap tests due to health reform is likely to be substantial.

Moreover, our results suggest that women with preexisting insurance might also see increases in screenings due to the requirement that new or substantially revised insurance plans cover routine Pap tests without cost-sharing. While we do not observe cost-sharing requirements in our data, we know from other research that they were prevalent prior to the ACA: the Kaiser Family Foundation Survey for 2011, for example, indicates that 23 percent of workers faced changes in cost-sharing due to the ACA. Moreover, other research suggests that insurance mandates for screening mammograms that explicitly limited out-of-pocket costs induced larger increases in screenings for women with low education than insurance mandates without such provisions (Bitler and Carpenter 2016). While we do not have sufficient policy variation in these requirements to test whether the same is true in the context of Pap test mandates, it is plausible that similar requirements could be disproportionately beneficial to women with low socioeconomic status. It is also possible that people may not have known about the provision in federal health reform requiring no deductibles for preventive care, and widespread news coverage about the provision and changes in how plans present information about coverage of preventive care may have increased awareness.

Finally, our results are especially interesting and important given the very low costs of the services we study here. Unlike relatively expensive benefits such as mammograms and infertility treatment, Pap tests could have plausibly been paid for without insurance by many women, and so our results speak to the potential for insurance-based interventions to increase uptake of even low-cost services. As such, our findings could have implications for other relatively inexpensive benefits such as flu shots.

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SUPPORTING INFORMATION

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

Appendix SA1: Author Matrix.
Data S1. Methodological Details.