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EFFECTS OF DIRECT CARE PROVISION TO THE UNINSURED: EVIDENCE FROM FEDERAL BREAST AND CERVICAL CANCER PROGRAMS

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ABSTRACT

Much research has studied the health effects of expanding insurance coverage to low-income people, but there is less work on the direct provision of care to the uninsured. We study the two largest federal programs aimed at reducing breast and cervical cancer among uninsured women in the US: one that paid for cancer screenings with federal funds and one that paid for cancer treatments under state Medicaid programs. Using variation in rollout of each program across states from 1991-2005, we find that funding for cancer treatment did not significantly increase most types of cancer screenings for uninsured women. In contrast, funding for cancer detection significantly increased breast and cervical cancer screenings among 40-64 year old uninsured women, with much smaller effects for insured women (who were not directly eligible). Moreover, we find that these program-induced screenings significantly increased detection of early stage pre-cancers and cancers of the breast but had no significant effect on early stage or other cancers of the cervix. Our results suggest that direct provision can significantly increase healthcare utilization among vulnerable populations.

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1. Introduction

A large literature in economics demonstrates that exogenous increases in insurance coverage and generosity are associated with increases in health care utilization (Manning et al. 1987, Card et al. 2008, and others). This has been shown to be especially true in low-income populations: for example, multiple studies in the literature have demonstrated significant positive utilization effects of the Affordable Care Act (Courtemanche et al. 2019), positive effects from expanding Medicaid eligibility criteria (Currie and Gruber 1996a, 1996b, 2001; Busch and Duchovny 2005; Dubay et al. 2001; and the review in Buchmueller, Ham and Shore-Sheppard 2016), negative effects of terminating Medicaid (Lurie et al., 1984), and positive effects of expanding SCHIP and broadening the sets of services covered by Medicaid (Buchmueller, Orzol, and Shore-Sheppard 2015). Similarly, the Oregon Medicaid experiment found that lottery-based assignment to public insurance in the state significantly boosted preventive care utilization (Baicker et al. 2014). Thus, there is a great deal of work showing that more generous health insurance for low-income people increases their health care utilization.

There is far less work, however, on the effects of what might be termed 'direct provision' of health care to the poor.[1] In this study we provide new

[1] For a notable exception, see Bailey and Goodman-Bacon (2015) who study the effects of the rollout of federally qualified health centers (FQHCs) on mortality and find that health centers significantly reduce mortality.

evidence on the question of how relatively direct care provision affects health care utilization and health by studying the two largest federal programs for breast and cervical cancer in the United States: the National Breast and Cervical Cancer Early Detection Program (NBCCEDP) and the Breast and Cervical Cancer Treatment Program (BCCTP). These programs provide fertile ground for studying the effects of direct provision for several reasons. First, the health conditions targeted by the program are important: breast cancer is by far the most commonly diagnosed cancer among women in the US and is the second leading cause of all cancer deaths (behind lung cancer). Although cervical cancer is less prevalent, over 12,000 women are diagnosed in the United States each year. Second, there is strong evidence that health care utilization can affect ultimate health outcomes in this setting: early detection of cancers through regular screenings – clinical breast exams and mammograms for breast cancer and Papanicolaou ('Pap') tests for cervical cancer – is commonly understood to be a key if not the most important determinant of survival.[2] Third, there is a large insurance-related gradient in cancer screening utilization: in our data, for example, uninsured women have past year mammography screening rates that are roughly half those of insured women age 50-64.

Historically, state and federal governments have adopted a number of public policies to incentivize screenings, such as requiring that cancer screenings

[2] At the same time, welfare effects of increased detection of pre-cancers is more ambiguous.

be included in health insurance plans and/or prohibiting insurance companies from charging out of pocket costs for mammograms and Pap tests (Nikpay 2016; Wherry 2013; Adams et al. 2013; Bitler and Carpenter 2016, 2017). In addition to insurance-based interventions, governments have also offered more direct provision of breast and cervical cancer screenings. In 1990, the Breast and Cervical Cancer Mortality Prevention Act established federal funding for the National Breast and Cervical Cancer Early Detection Program (NBCCEDP). The original mission of the NBCCEDP was to provide cancer screenings for uninsured low-income women within the states as well as diagnostic testing for those with abnormal screening results. NBCCEDP – which still exists today – is a federal program; states were required to submit plans to the federal government to receive funds, and they were also required to commit to use the majority of funds for direct service provision and to provide matching state funds. NBCCEDP programs were rolled out at different times across all states from 1991 to 1999. A follow-up program authorized in 2000 created the Breast and Cervical Cancer Treatment Program (BCCTP) and allowed states to use Medicaid funds to pay for treatment for uninsured women whose tumors were detected under NBCCEDP.

The timing of these programs is consistent with their possibly having a role in one of the most important public health improvements in modern times: the reversal in age-adjusted cancer mortality rates during the 1990s. Cutler (2008) argues that increases in routine cancer screenings are the most important factor contributing to this phenomenon, while Berry et al. (2005) find that the share of the decrease in the rate of breast cancer deaths from 1975 to 2000 due to screening ranged from 28% to 65% (with treatment accounting for the rest). Thus, major federal investments in screening and treatment programs for breast and cervical cancer have the potential to have played important roles in advancing women's health at the end of the 21st century.

Our paper provides the first comprehensive study of the effects of the NBCCEDP and BCCTP on women's preventive health behaviors and diagnoses of breast and cervical cancers. We draw on data that include mammography use, clinical breast exams, and Pap tests for over half a million women from the 1991-2005 Behavioral Risk Factor Surveillance System (BRFSS), a publicly available dataset that is designed to be representative at the state level in each year. The main empirical approach takes advantage of the staggered timing of adoption of the NBCCEDP and BCCTP rollouts across states in a difference in differences (DD) framework with state and year fixed effects, combined with a proxy for health insurance status, as the programs should have mainly affected outcomes for uninsured women. We supplement these analyses with administrative data on cancer detections from the Surveillance, Epidemiology, and End Results (SEER) Program, the standard source of data on cancer diagnoses in the field.

To preview, we find that NBCCEDP increased recent utilization of mammograms, clinical breast exams, and Pap tests among women age 50-64 without a health plan (the group explicitly targeted by the program) by 5.8, 3.8, and 3.5 percentage points, respectively. Estimates for 50-64 year old women with a health plan (who were not directly eligible in most states) are much smaller in magnitude and generally insignificant. We also find some evidence that NBCCEDP also increased all types of past-year screenings among slightly younger 40-49 year old women without a health plan who were targeted by the program to a lesser extent. Event-study models show that the effects are not observed prior to program implementation and are obtained fairly quickly after program implementation. Moreover, we find that our effects are unique to the directly-provided services: we find no association between NBCCEDP and other health behaviors such as cholesterol checks, flu shots, seatbelt use, or smoking.

Regarding Medicaid coverage of cancer treatments for NBCCEDP-eligible women, we find no effects of BCCPT on take-up of preventive cancer screenings except for increases in clinical breast exams for 50-64 year old uninsured women. Finally, we use cancer registry data to show that NBCCEDP rollout across states was associated with statistically significant increases in detection of in-situ pre-cancers of the breast and localized (stage 1) breast cancers but was not meaningfully related to detection of cervical cancers.[3] Overall our findings provide important new evidence that relatively direct provision of

[3] Below, we acknowledge and discuss some uncertainty and debate within the medical community regarding possible over diagnosis and overtreatment of the earliest stage in situ cancers which

cancer-related preventive health services to low-income women was effective at improving population health behaviors among uninsured women and resulted in meaningful changes in breast cancer detection.

The paper proceeds as follows: Section 2 outlines institutional details regarding breast and cervical cancer screenings and describes the NBCCEDP and BCCTP. Section 3 provides a brief literature review. Section 4 describes the data and empirical approach. Section 5 presents the main results, and Section 6 offers a discussion and concludes.

2. Institutional Background

a. Breast and Cervical Cancer Screenings

Our paper focuses specifically on federal programs to improve breast and cervical cancer screenings for uninsured low-income women. The standard screenings for breast cancer are mammograms and clinical breast exams, while the standard screening for cervical cancer is the Pap test. In mammography, a woman's breasts are placed on a machine that takes low-dose X-ray pictures to check for abnormalities. Screening mammograms are typically given to asymptomatic women to look for suspicious markers. Diagnostic mammograms usually occur among women who have had a previous abnormal screening mammogram (approximately 10% of those screened in the early 1990s), have a family history

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complicates somewhat our ability to draw strong welfare conclusions about the effects on of breast cancer, or have certain symptoms (e.g., presence of lumps in a breast or changes in a nipple or breast). Abnormal screening results can also lead to more invasive procedures such as biopsy. The average cost of a mammogram over our sample period was approximately $150. Clinical breast exams (CBE) are physical exams of a woman's breasts performed by a doctor, nurse, or other health professional to manually feel for abnormalities. In general, no special equipment is required, and clinical breast exams are much cheaper than mammograms and are often carried out during a check-up with an OB/GYN, or at times, during a visit with a primary care physician or other health care professional. Clinical breast exams are viewed as less effective than mammograms at detecting breast cancer.

The Pap test (sometimes also called "Pap smear," "cervical smear," or "cervical test") is the standard method for detecting early cancer of the cervix. In a Pap test, a swab is used to gather cells from the outer opening of the cervix. These cells are examined under a microscope for abnormalities, particularly for pre-cancerous changes usually caused by the human papillomaviruses which are sexually transmitted. If the test is abnormal, colposcopy (a cervical examination using a microscope) or a biopsy can follow. The average cost of a Pap test over our sample period was around $25-$40. Like CBEs, Pap tests may be carried out

increased cancer detection.

during a typical well-woman visit, while mammograms typically require an additional visit to a specialized facility with the appropriate imaging equipment.

b. The National Breast and Cervical Cancer Early Detection Program (NBCCEDP)

The NBCCEDP program was introduced after being signed into existence in the Breast and Cervical Cancer Mortality Prevention Act of 1990. Federal funding was provided initially to fund efforts by 8 states to establish early detection programs. An additional 18 states were funded in 1992, and by 1999 NBCCEDP was provided to all 50 states and the District of Columbia (Ryerson, Benard, and Major, 2002). Grantees were required to provide matching funding either in kind or monetarily, and those obtaining funding were required to submit data on demographics and outcomes for screened women to CDC. Initially, CDC followed the guidelines of major medical organizations and funded screening of women 40 and older for mammography/CBEs and women over 18 for Pap tests. However, in 1996 NBCCEDP shifted the rules to require ¾ of the mammogram funding be for care provided to women 50 and older to reflect changes in screening guidelines. A further change removed those 65 and older who are eligible for Medicare Part B from eligibility for NBCCEDP funded mammography screenings after 1998, when Medicare started covering screening mammography fully. With an eye towards reaching underserved populations, NBCCEDP also targets low-income women (women under 250% of poverty).[4]

c. The Breast and Cervical Cancer Treatment Program (BCCTP)

The BCCTP program gives states the option to use their Medicaid programs to cover breast cancer treatments for women who were screened through the NBCCEDP. The timing of when state Medicaid programs implemented such coverage varied across states but was concentrated exclusively in 2001 and 2002. An explicit rationale for the BCCTP was the idea that a low-income woman might not take advantage of free NBCCEDP screening if she thought that she would not be able to pay for the treatments were her mammogram or Pap test to indicate the presence of cancer or cancer-related problems. If so, it is reasonable to expect that extending coverage for treatment might further boost screenings among low-income women.

3. Literature Review

Numerous studies in economics have examined the effects of insurance-related interventions on breast and cervical cancer screenings, including several that have used randomized experiments to generate exogenous variation in health insurance. 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

[4] Notably, citizenship status plays no role in determining NBCCEDP eligibility.

Health Insurance Experiment (HIE) from 1971 to 1982. Lurie et al. (1987), however, show that mammography rates among women aged 45-64 in the RAND HIE were only around 2 percent, precluding direct tests of cost-sharing on mammography in particular; moreover, for Pap tests they found no difference between screening rates for people in the ‘free’ plan versus people randomized to cost-sharing. Finkelstein et al. (2012) study low-income Medicaid-eligible women and find that participants who took-up Medicaid (which did not have cost sharing) 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 mammogram in the first year after the program, an effect on the order of 60 percent relative to the control group mean.

Other studies have used alternative quasi-experimental designs to understand how health insurance affects cancer screenings. Decker (2005), for example, finds a discontinuous increase in mammography screenings at age 65, the universal Medicare eligibility age. In contrast, Kolstad and Kowalski (2010) find no significant change in mammography rates 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 do find that the state’s reform increased mammography and Pap test rates three years following the reform (2016). Tello-Trillo (2016) finds that a large public health insurance disenrollment in Tennessee in 2005 that affected childless adults did not significantly affect breast or cervical cancer screenings, while Barbaresco et al. (2015) study the young-adult coverage mandate of the ACA and find that it did not significantly increase Pap test rates among young adult women (mammograms were not recommended for asymptomatic women under age 27 affected by the ACA young adult mandate). Thus, there is a large literature that has used exogenous variation in insurance coverage to study effects on breast and cervical cancer screenings.

Our work is also related to a growing body of research examining policy-relevant determinants of cancer screenings among insured women more broadly. Bitler and Carpenter (2016) show that state mandates requiring private insurers to cover screening mammograms significantly increased mammography, while similar mandates for Pap tests also increased Pap test rates among Hispanic women (Bitler and Carpenter 2017). Kadiyala and Strumpf (2011) find that age-specific recommendations and medical guidelines for cancer screening rates significantly increase screening and detection, though they do not separately examine effects by insurance status. Buchmueller and Goldzahl (2018) study the effects of a national program of organized breast cancer screening in France, finding that its staggered adoption across areas was associated with significant increases in recent mammography screenings on the order of ten percentage points or more.

Regarding the specific programs we study here, there has been substantial attention paid to the NBCCEDP in public health and health services research.[5] Two public health studies examine the mortality effects of NBCCEDP. Howard et al. (2010) examine a panel of breast cancer mortality rates from 1991-2005 and control for the timing of NBCCEDP rollout across states (similar to what we use below) and, alternately, a measure of the intensity of NBCCEDP screening in a state. Difference-in-differences models using the former measure provided no evidence that the program significantly reduced breast cancer mortality rates, while models using the latter measure provided some evidence of contemporaneous (but not lagged) effects of NBCCEDP screening intensity on breast cancer mortality. They interpret these findings as mixed evidence for a role of the program at reducing deaths from breast cancer. Hoerger et al. (2011) also study the effects of NBCCEDP on mortality but use a simulation model using data from 2008-2009 and find that between 1991 and 2006 the NBCCEDP saved 100,800 life-years compared with no program.

Two public health studies have also examined the effects of NBCCEDP on cancer screenings and are therefore more closely related to our study. Adams et al. (2003) use variation in the state rollout of NBCCEDP and federal funding of the program to examine whether the maturity (age) of a state program was associated with increased mammography and Pap test use among women in the

[5] We are not aware of any studies that evaluate the effects of BCCTP on screening or cancer

state, controlling for insurance type, demographic characteristics, and state and year fixed effects from 1996-2000. They find that program maturity was significantly associated with increased use of both types of screenings. Adams, Joski, and Breen (2003) examine whether NBCCEDP reduced race/ethnicity disparities in screening outcomes using the same data and basic empirical setup as the earlier study. They do not find that the program significantly reduced these disparities.

Relative to the limited existing work on these programs, then, our study advances the literature in several important ways. First, we consider a longer period (1991-2005 for screenings and 1985-2005 for diagnoses) compared to previous work which has studied 1996-2000.[6] Our added data from 1991-1995 includes the heart of the timing of rollout of NBCCEDP: by 1996 the majority of states had already rolled out NBCCEDP.[7] Examining the earlier period also allows us to more credibly control for pre-existing trends in outcomes under study. Adding the later period covers the entire period of BCCTP rollout and also allows us to measure the medium term effects of NBCCEDP. Second, we

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mortality outcomes.

[6] Prior studies examine 1996-2000 because these are the years the BRFSS separately identifies source of insurance. However, a summary measure of whether the woman has any type of health plan is available over the entire 1991-2000 period, and as the NBCCEDP program was explicitly targeted at uninsured women, information on type of insurance is not critical.

[7] The timing of the state rollout of the NBCCEDP program is: 1991: 2 (CO, WV); 1992: 7 (CA, MD, MI, MN, NM, SC, TX); 1993: 4 (MA, MO, NC, NE); 1994: 5 (GA, NY, OH, WA, WI); 1995: 9 (AK, AL, KS, NJ, OK, OR, PA, SD, UT); 1996: 10 (AR, AZ, CT, FL, IA, IL, LA, ME, RI, VT); 1997: 9 (DC, ID, IN, KY, MT, ND, NH, TN, WY); 1998: 4 (DE, HI, NV, VA); 1999: 1

explicitly study variation in the estimated effects of the programs by insurance status, which is relevant because NBCCEDP in particular was initially explicitly designed to target uninsured women. Prior work has controlled for insurance status in estimating the effects of NBCCEDP but, importantly given how the program is targeted, has not examined whether the program effects vary with insurance status. Third, we separately consider outcomes of women age 40-49 versus 50-64 to study the effectiveness of the programs in promoting breast cancer screenings.[8] (We also look at women aged 21-39, who were directly eligible for Pap tests.) States varied in when, whether, and to what extent they targeted 40-49 year old women for mammograms (in part due to changing understandings over this period about the appropriateness of mammography screening for women in this age group).[9] Finally, we consider a wider range of outcomes than in previous work. In addition to mammograms and Pap tests, we also study clinical breast exams and use as placebo tests other preventive health

(MS). This is depicted graphically in Figure 4. Figure 5 depicts the timing of state rollout of the BCCTP.

[8] We also considered models for 65-74 year olds, but because of nearly universal eligibility for Medicare at age 65 and its effects on health outcomes (Card et al., 2008, 2009), the group of uninsured women in this age range is likely to be extremely small and different from the uninsured population of slightly younger women. Although women age 65-74 were technically eligible for NBCCEDP services over the early part of our sample period, they were not the primary target of the program. Importantly, over our sample period Medicare covered all of the services we consider as outcomes at some frequency, though the generosity of coverage changed over time. In fact, Medicare did not start fully covering mammograms for age-eligible women until 1998, at which time women at or above age 65 became explicitly ineligible for NBCCEDP mammograms. We revisit the 65-74 year old women when we examine cancer diagnoses, below.

[9] We lack detailed information on timing of when the 40-49 year old women were targeted or not targeted in each state.

investments and behaviors that should not have been directly affected by NBCCEDP or BCCTP (e.g., flu shots and cholesterol checks).

4. Data Description and Empirical Approach

Our main outcome data come from the Center for Disease Control's Behavioral Risk Factor Surveillance System (BRFSS). Fielded annually since 1984, the BRFSS includes questions about mammograms, clinical breast exams, and Pap tests and was 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 the period 1991 to 2005 which spans the entire period of NBCCEDP and BCCTP rollout across states.[10] State participation in the BRFSS increased over the late 1980s, and the last state joined the BRFSS in the mid-1990s.

The BRFSS breast health questions allow us to create consistent measures of mammography use along several dimensions for women age 21 and older.[11] Specifically, in 1995, women were asked: "A mammogram is an X-ray of each breast to look for breast cancer. Have you ever had a mammogram?" Women who report ever having had a mammogram are then asked about the timing of

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[10] We focus on 1991 forward in the BRFSS due to the fact that insurance coverage or coverage by "any health plan" is first available in 1991.

[11] Questions about the primary outcomes we study were placed into an optional 'Women's Health' module in 2001, 2003, and 2005, and only 11-15 states asked respondents about these outcomes in those years.

their most recent mammogram. We create two key outcome variables related to mammography use: first, we identify Ever Had Mammogram as equal to one if the woman reports ever having had a mammogram and zero otherwise. Second, we create Had Mammogram in the Past Year as equal to one if the woman reports that she had a mammogram within the past year and zero otherwise.[12] The analysis sample for these outcomes includes all women—including those who have not ever had a mammogram—since we are interested in effects on population mammography use.

We also create nearly identical variables for outcomes related to clinical breast exams. Women are asked if they have ever had a breast physical exam (also known as a clinical breast exam or CBE).[13] Women who indicate "yes" are then asked the same follow-up questions about timing as for the mammography screener regarding the recency of the most recent CBE. Following the previous logic, we define: Ever Had CBE and Had CBE in Past Year.

[12] Item non-response is fairly low for these questions. We omit observations with a 'don't know' or 'refused (DK/RF) response to the mammogram questions. Note that we lack exact timing of the most recent mammogram (beyond first year, second year, or later). Moreover, any of the mammography outcomes that measure recency of screening raise questions about recall bias, as well as whether the woman is reporting behavior within the previous calendar year or within the previous 365 days.

[13] Question wording for CBE changed over time. In 1991 the screener read: "The next questions are about breast physical examination, which is when the breast is felt for lumps by a doctor or medical assistant. Have you ever had a breast physical exam by a doctor or medical assistant?" In 1992 the BRFSS replaced 'breast physical exam' with 'clinical breast exam' and replaced 'doctor or medical assistant' with 'doctor, nurse, or other professional'. Starting in 1993, the question specifically indicated that the purpose of the exam is to 'feel the breast for lumps'.

Next, we create nearly identical variables for outcomes related to cervical cancer screenings. Women are asked if they have ever had a Pap test (referred to as "Pap smear" in the BRFSS).[14] Women who indicate "yes" are then asked the same follow-up questions as for the mammography screener regarding the timing of the most recent Pap test. Following the previous logic, we define: Ever Had Pap Test and Had Pap Test in Past Year.

Finally, we consider a variety of health outcomes that we use as placebo or falsification tests in the analyses below. Specifically, we study outcomes reflecting that the woman: Had a Flu Shot in the Past Year, Had Blood Cholesterol Checked in the Past Year, Always Wears a Seatbelt, and Currently Smokes Regularly. While it is plausible that there are real spillovers of the NBCCEDP and/or BCCTP health care visits on these outcomes, any effects should plausibly be much smaller than the directly targeted outcomes we study above. More likely these outcomes should not be directly affected by the program rollout, such that if we observed meaningful associations between the program and these outcomes that would suggest model misspecification or otherwise cast doubt on our main interpretation that direct provision (uniquely) increased screenings.

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[14] Actual question wording changed very slightly from 1991 to 1992 and from 1992 to 1993. In 1991 women were first told that a Pap smear tests for cancer of the cervix or uterus before they were asked about whether they had heard of a Pap smear. We code individuals who report never having heard of a Pap smear as never having had a Pap test. Starting in 1992, women were no

We also observe standard demographic characteristics in the BRFSS, including age, race, and education.[15] The BRFSS also includes a summary measure of health insurance coverage: we are able to identify whether the woman is covered by "any health plan," although we cannot determine the type of plan (e.g., employer sponsored vs. public insurance (Medicare/Medicaid)). For our evaluation of NBCCEDP this limitation is not particularly problematic since the program explicitly targeted uninsured women.

To estimate the effect of NBCCEDP and BCCTP on outcomes we use straightforward difference-in-difference models that identify program effects using variation across states in the timing of rollout of the programs. Specifically, we formulate the model as:

$$(1)\quad Y_{ist} = \beta_0 + \beta_1 X_{ist} + \beta_2(\text{STATE HAS ROLLED OUT THE NBCCEDP PROGRAM})_{st} + \beta_3(\text{STATE HAS ROLLED OUT THE BCCTP PROGRAM})_{st} + \beta_4 Z_{st} + \beta_5 S_s + \beta_6 T_t + \varepsilon_{ist}$$

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 (21-24, or 5 year age groups after that, leaving out one dummy), race (non-Hispanic black, non-Hispanic other race, leaving out non-

longer asked whether they had heard of a Pap smear; instead, women were asked about lifetime cervical cancer screening after the interviewer first defined the procedure.

[15] We also observe employment and household income (in ranges), but we choose not to control for them in the regression models below due to their likely endogeneity with our outcomes and key variables of interest.

Hispanic White), Hispanic ethnicity, education (less than high school, high school degree, some college, DK/RF, leaving out college degree or more), and marital status (never-married, widowed/divorced/separated, cohabiting, DK/RF, leaving out married). The relevant policy variables are dummies indicating that the state has rolled out its NBCCEDP and BCCTP programs, respectively.[16]

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 4, and the state fractions black, Hispanic, and urban. The Z_{st} vector also includes controls for other relevant public policies that may be expected to affect private or public access to insurance such as Medicaid expansions for pregnant women, welfare reform, laws requiring women to be able to directly access an OB/GYN without referral, and state participation in the

[16] Note that the BRFSS questions introduce a "reference window" problem due to the fact that the questions typically ask about screening behavior over some recent period. Given this, it is important to account for the systematic BRFSS interview structure when defining someone as treated by the policy in question. Specifically, we can make use of the fact that BRFSS interviews are distributed almost uniformly across the calendar year. This information means that we can create a more precise treatment variable that captures the share of the recent period that the individual was treated by the NBCCEDP or BCCTP program.

federally funded WISEWOMAN program.[17] For the models of Pap test outcomes we control for the presence of a state mandate requiring insurance coverage of Pap tests. For the models of mammography and CBE outcomes we control for the presence of a state mandate requiring insurance coverage of mammograms.[18] Dummy variables for each state are captured by S_s and control for time-invariant state-specific factors. Dummy variables for each survey year are captured by T_t and control for period-specific shocks common to all states in any given year.[19] 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 is all women aged 21-64 interviewed by the BRFSS in survey years 1991-2005. Because eligibility for mammography was explicitly targeted toward 40-64 year olds (and later to 50-64 year olds in many states), we separately examine 21-39 year olds from 40-49 or 50-64 year olds for all outcomes.[20]

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[17] Bitler et al. (2005) found that welfare reforms adopted over this time period reduced health insurance coverage, mammography, and Pap test use, particularly for single Hispanic women. The Well-Integrated Screening and Evaluation for Women Across the Nation (WISEWOMAN) program was funded by the CDC and provides screening for high blood pressure, hypercholesterolemia, and interventions to help women eat better, exercise more, and quit smoking (Will and Loo 2008). Three states were funded from 1995-1998 and 14 states were funded from 1999-2007.

[18] Specifically, we separately control for the presence of a mandate requiring coverage of an annual mammogram, a mandate requiring coverage of a biennial mammogram, and a mandate requiring coverage of a baseline mammogram (Bitler and Carpenter 2016). Models for placebo outcomes control for both mammogram and Pap test mandates in addition to the other controls.

[19] We also include month of interview dummies throughout (though not shown in the estimating equation) to account for idiosyncratic month effects.

[20] Note that 21-39 year olds were not technically eligible for NBCCEDP-sponsored mammograms. We analyze them as an additional placebo-type test for understanding the effects of the program.

Finally, because eligibility for NBCCEDP services (and thus eligibility for any BCCTP services) was explicitly tied to availability of other sources of insurance, we estimate equation (1) for each age group in the full sample and separately by whether the woman reports having a health plan. If the programs were effective, we would expect utilization increases associated with program rollout primarily for the women *without* a health plan. Any associated 'effects' for the sample of women with a health plan are more likely to reflect the effects of program-sponsored outreach, and in that case we would expect larger estimated effects for the sample of women without a health plan if we want to isolate the unique effect of NBCCEDP-financed and BCCTP-induced screenings.

5. Results

a. Descriptive Statistics

In Figures 1-3 we show the trend from 1991 to 2005 for past-year mammograms, clinical breast exams, and Pap tests, respectively, for women age 50-64 who were targeted by and eligible for all NBCCEDP services. We show these trends separately for insured and uninsured women. A few patterns are notable. First, past-year screenings for all outcomes are substantially higher for insured women compared to uninsured women, with the largest discrepancy observed for

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To do so, we code the NBCCEDP variable as equivalent to the way it is defined for older old women. That is, the NBCCEDP variable in these models is not defined to be age-specific, despite that in truth it did have some age-specific eligibility criteria.

mammography: past-year mammography rates for uninsured women are roughly double the rates of insured women. Second, past-year mammography rates saw remarkable improvements for all 50-64 year old women during the 1990s, while Pap test rates increased modestly and clinical breast exams exhibited no change. Third, there were declines in all types of screenings in the early 2000s.

Table 1 presents descriptive statistics for the key demographic variables used in this analysis for adult women in the BRFSS. Column 1 presents means for 21-39 year old women, column 2 presents means for 40-49 year old women, and column 3 presents means for 50-64 year old women. We present statistics for basic demographic characteristics (e.g., age, race, education, marital status), cancer screening outcomes, and NBCCEDP rollout variation. The pattern of demographic characteristics across groups indicates that most of the sample for each age group is white non-Hispanic, while about ten percent of the sample is black non-Hispanic, and a similar proportion is Hispanic. The majority of the sample is married, and well over 80 percent of the sample has a health plan. Regarding the cancer-screening outcomes, we find a strong age gradient in lifetime and past year mammography: the 21-39 year old women are substantially less likely than either the 40-49 or 50-64 year old women to have had breast cancer screenings, which was consistent with the recommendations of major medical organizations such as the US Preventative Services Task Force or the American Cancer Society over the vast majority of our sample period for screening of asymptomatic women. For clinical breast exams, we find that over 90 percent of women in all age groups reports having ever had a CBE, while 68-70 percent reports having had one in the past year. Notably, there is not a strong age gradient in clinical breast exam utilization. Finally, we find very high rates of lifetime Pap test use, and we find that recent Pap tests are declining in age.

b. Results on Insurance Status and Cancer Screenings

We present the first set of evaluative results on the effects of the NBCCEDP program in Table 2 for the outcome reflecting the likelihood of having any health plan. Since our primary empirical strategy is to compare outcomes for uninsured women (who were directly eligible) versus insured women (who were not directly eligible) coincident with NBCCEDP and BCCTP rollout, it is important first to evaluate whether these programs are associated with the presence of a health plan at all. We present the coefficient estimate on the variable indicating the state has rolled out each program from a fully saturated difference-in-differences model from equation (1). Each entry is from a separate model. The results in Table 2 provide little evidence that program rollout was meaningfully associated with the presence of a health plan. Although we find a marginally significant positive coefficient in column 1 for 21-39 year old women for NBCCEDP, the actual point estimate is small both absolutely (indicating a 0.8 percentage point increase) and relative to the average rate of having a health plan in the population for that age group (nearly 82 percent as reported in Table 1).

Moreover, the estimates for slightly older women ages 40-49 and 50-64 are even smaller in magnitude and are not statistically significant, and all of the BCCTP estimates are small and statistically insignificant. Overall, we conclude that the programs were not strongly associated with insurance coverage, particularly for 40-49 and 50-64 year old women. This suggests that our models stratified by the presence of a health plan provide meaningful tests of whether direct service provision was effective.

In Table 3 we report estimates of the effect of NBCCEDP on the mammogram outcomes. As in Table 2, each entry is from a separate fully saturated model that includes all the controls in equation (1). Columns 1 and 2 show the results for Ever Had a Mammogram and Had a Mammogram in the Past Year, respectively, for the 21-39 year old sample. Columns 3 and 4 (5 and 6) do the same for 40-49 (50-64) year olds. The top panel reports estimates from the full sample for all years in which BRFSS identifies both mammography outcomes and health insurance outcomes, as the latter is critical to an evaluation of the programs given their eligibility requirements. The middle panel reports estimates for women who currently have a health plan and therefore should not have been directly eligible for NBCCEDP services. The bottom panel reports estimates for the women who lack any health plan, i.e., the directly targeted treatment group.

The results in Table 3 provide strong support for the idea that NBCCEDP (but not BCCTP) played an important role in increasing past-year mammography, particularly among 40-49 and 50-64 year old women. Specifically, among women age 50-64 (who were directly targeted by and explicitly eligible for NBCCEDP mammograms over our entire sample period), we find in the bottom panel that NBCCEDP was associated with a 5.8 percentage point increase in past-year mammography screenings for women without a health plan, with a statistically insignificant 1.2 percentage point increase among women with a health plan. Past-year mammography rates among uninsured women age 50-64 increased by about 12 percentage points over our period; we estimate that NBCCEDP can account for nearly half of this increase. The point estimate for lifetime mammography use in column 5 of Table 3 is also sizable and positive (1.9 percentage points), but it is not statistically significant. In the full sample, we do not estimate that the NBCCEDP-induced increase among uninsured women was large enough to induce statistically significant overall increases in past year mammography for 50-64 year old women, though notably less than 12 percent of the 50-64 year old sample reports that they do not have a health plan. There are similarly large increases in use of a mammogram last year for 40-49 year olds with NBCCEDP while BCCTP has no effect for the 40-49 year olds getting screenings.

A few other patterns in Table 3 merit mention. First, we do find significant increases in both lifetime mammography and past-year mammography for 21-39 year old women in the full sample, which is contrary to expectations, as these women were not targeted by the program. These effects are smaller than those observed for older women age 40-49 or 50-64. When we cut these results by health plan status we find a 1.7 percentage point increase in past year mammography for uninsured 21-39 year old women associated with NBCCEDP that is statistically significant at the ten percent level. There are several reasons these increases in screenings for younger women could be attributable to NBCCEDP even though uninsured 21-39 year old women were not directly targeted. First, in the early rollout of NBCCEDP, the age-based eligibility rules may not have been followed to the letter. Second, the 40-49 and 50-64 year old women who were screened under NBCCEDP may have provided informational spillovers to their slightly younger friends and family members; in that case, it could be that the younger and older women are obtaining recent mammograms not directly provided by NBCCEDP but indirectly induced by a NBCCEDP-provided mammogram of a friend or family member. Finally, it is possible that having outside funding from the CDC for women aged 40-49 and 50-64 frees up other money at clinics serving low-income women to provide services to younger women. We cannot directly address these hypotheses, but they are important areas for future work.

We present the associated results for clinical breast exams in Table 4, the format of which is identical to Table 3. The results for clinical breast exams in Table 4 also provide strong evidence that NBCCEDP significantly increased past-year use of CBEs. As with the mammography results in Table 3, we estimate that among 50-64 year old women without a health plan, NBCCEDP is associated with a 3.8 percentage point increase in the likelihood a women reports she had a past-year CBE. The associated estimate for women with a health plan is also positive and statistically significant (unlike the results for mammograms), but it is much smaller in magnitude (2.1 percentage points) than the estimate for women without a health plan. We also find that the large increases in past-year CBE for women without a health plan translate into sizable full sample increases in this outcome. This same basic pattern is replicated to an even larger extent in column 4 for 40-49 year old women, and as with the mammography outcomes we also find a marginally significant effect of NBCCEDP at increasing CBE among uninsured 21-39 year old women. Overall the findings in Table 4 – like those in Table 3 for past year mammography – are most supportive of a causal effect of NBCCEDP rollout at increasing past year CBE utilization among uninsured 40-49 and 50-64 year old women. Notably, unlike the results in Table 3 for mammograms, we do find a significant role for BCCTP at significantly increasing CBE among 50-64 year old uninsured women (with no effects for insured women of the same age group). This suggests that allowing states to use Medicaid funds to cover treatments for breast cancer induced some women to get CBEs.

We present the results for Pap tests in Table 5, and again the format follows the previous tables. Results for Pap tests are less clear than those in

Tables 3 and 4 for mammograms and CBEs, respectively, in part because lifetime and past-year Pap test rates are so much higher than the rates for the outcomes measured in the earlier tables. Despite this, we find some support for a role of NBCCEDP at increasing Pap test rates among 21-39 and 40-49 year old women. Specifically, we estimate that NBCCEDP significantly increased past-year Pap test use among uninsured 21-39 (40-49) year old women by 2.4 (5.6) percentage points, with much smaller estimated effects on insured women of the same age. Notably, the younger women age 21-39 *were* eligible for NBCCEDP-provided Pap tests. We find a similar pattern for 50-64 year old women: a substantively meaningful positive estimate for the uninsured sample (3.5 percentage points) and smaller estimates for the insured sample, though neither estimate is statistically significant.[21] We do not find any consistent effects of BCCTP on Pap test rates for any age group.[22]

[21] The ACS and USPSTF recommendations for the older groups of women actually do not recommend annual Pap test screenings, but we are unable in the BRFSS to identify the 'recommended' screening interval (past 3 years or past 5 years if the recent Pap tests were negative).

[22] In Appendix Table 1 we provide evidence on an alternative outcome that may shed light on the underlying mechanisms through which NBCCEDP boosted screenings: whether the woman reports she had a checkup in the past year. We present results for the sample of women with a health plan in the top panel and for the sample of women without a health plan in the bottom panel. It is plausible that uninsured women may pay out of pocket (perhaps on a sliding scale) at clinics for checkups at which time health care providers inform them of NBCCEDP or BCCTP services. Alternatively, it could be that women who are being primarily served by these programs could view their program-related health care interaction as having been a 'checkup' when asked by the BRFSS interviewer. In either of these cases, we might expect to observe a significant association between NBCCEDP and BCCTP rollout and reports of a past year checkup among uninsured women. Indeed, we find evidence in Appendix Table 1 that NBCCEDP is significantly associated with increased likelihood of reporting a past year checkup for 21-39 and 50-64 year old women without a health plan. The NBCCEDP estimate for 40-49 year old women and the

We next turn to examining the robustness of the main findings that NBCCEDP increased breast and cervical cancer screenings for uninsured women. In columns 1 and 2 of Appendix Table 2 we present event-study estimates of the effects of NBCCEDP for uninsured 50-64 year old women on past-year mammogram and past-year CBE likelihood, respectively, where we replace the NBCCEDP dummy with a series of indicator variables representing time since program rollout in the state, controlling for all the other factors as in the baseline specification. Results indicate that the increases in screenings attributable to NBCCEDP are generally not driven by significant differences in states prior to NBCCEDP rollout, consistent with a key assumption of the research design. The results also indicate that the effects of NBCCEDP appear very quickly after implementation and remain sizable several years after program rollout. We find similar event-study patterns for past-year Pap test rates for uninsured 50-64 year old women in column 1 of Appendix Table 3.[23]

In Table 6 we present the results of alternative robustness tests where we replace the key outcomes with other 'placebo' preventive behaviors and risky behaviors that should not have been plausibly affected by NBCCEDP or BCCTP.

BCCTP estimates for women of all age groups without a health plan are also positive and sizable but are not statistically significant. Moreover, among the sample of women with a health plan we find no relationship between the NBCCEDP rollout and reports of past year checkups. These patterns further support the idea that there has been an important role for NBCCEDP at improving access to care and utilization among uninsured women with respect to breast and cervical cancer health.

[23] In results not reported but available upon request, we found similar event-study patterns for uninsured 40-49 year old women.

Specifically we report the program coefficients in similarly specified two-way fixed effects models of the likelihood of always wearing a seatbelt (column 1), getting a flu shot in the past year (column 2), having cholesterol checked in the past year (column 3), and being a current smoker (column 4). We focus here on 50-64 year old women without a health plan. We find no economically or statistically significant association between the NBCCEDP or BCCTP rollouts and any of the falsification outcomes in Table 6. This supports our general interpretation that the state rollout of these programs was uniquely responsible for substantial improvements in preventive cancer screenings among uninsured women.[24][25]

[24] In Appendix Tables 4 (for 40-49 year old women) and 5 (for 50-64 year old women) we report estimates of the effect of NBCCEDP on the covered outcomes separately by race/ethnicity and education for women without a health plan. For 40-49 year old uninsured women we find that NBCCEDP was effective at increasing preventive screenings for white women and for relatively highly educated (some college at least) women. For 50-64 year old uninsured women we find that NBCCEDP was particularly (and only) effective at increasing past-year mammography among non-Hispanic black and Hispanic women, and the program was also associated with significant increases in the likelihood of past-year CBE for non-Hispanic black women. For the 50-64 year old women we also find that NBCCEDP effects are larger among relatively highly educated women (some college at least). It is possible that the less-educated women are being served through other public programs, though notably all women in Appendix Tables 4 and 5 report that they do not currently have a health plan (which plausibly includes public insurance such as Medicaid). Another possibility is that conditional on not having a health plan – which was the key eligibility criteria of the original program – the more highly educated women have more access to information, networks, and logistical resources to access the NBCCEDP services. Finally, it is possible that the less-educated women without a health plan – many more of whom should be eligible for income-based public insurance than in the more highly educated group – have already revealed their low demand for health care. Under this explanation it is not surprising that the less-educated women have smaller responses to the program than do more highly educated women.

[25] In Appendix Table 6 we investigate whether NBCCEDP was particularly effective in states with a larger number of federally qualified health centers (FQHCs). Prior work on FQHCs demonstrates their positive effects at improving health for the same types of populations likely to be eligible for NBCCEDP services; thus, it is natural to ask whether NBCCEDP's effects were amplified by the presence of many FQHCs. To investigate this question we obtained data on the

c. Results on Cancer Diagnoses

Next, we provide evidence on the effects of NBCCEDP and BCCTP on breast and cervical cancer diagnoses. If these programs of relatively direct provision were effective, we might expect that state program rollout would be positively associated with more breast cancers being detected than would occur in the absence of the programs. Since the women who were most affected by the program were low-income underserved women whose tumors might have gone unnoticed for longer than other women with stronger attachment to the health care system, we might also expect that the effects of the program funding on tumor detection would be observed throughout the distribution of cancer stages as opposed to being limited to the earliest stage cancers (as would be the case for most screening programs targeted at asymptomatic women).

To test this, we examine total cancer incidence as well as diagnoses at each stage using data from the Surveillance Epidemiology and End Results (SEER) system, which are registry data on the universe of cancer diagnoses (and also on in-situ pre-cancers) within nine areas/states that have been collected since

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number of uncompensated care cases reported in a state from LoSasso and Meyer (2006). We then estimate a variant of the baseline model where we control for NBCCEDP rollout, the number of FQHC uncompensated care cases, and the interaction of the two. A positive and significant interaction effect would indicate that NBCCEDP was particularly effective in places with a larger number of FQHCs. The results in Appendix Table 6 do not indicate that FQHCs played an amplifying role in the effectiveness of NBCCEDP. While we continue to find a significant main effect of NBCCEDP at increasing preventive cancer-related screenings among 40-49 and 50-64 year old uninsured women, we do not find either a significant main association of FQHC uncompensated care cases nor a significant interaction effect of FQHC cases with NBCCEDP

1973 (SEER Research Data 1973-2012).[26] These are the standard cancer diagnosis data used in the field. Note that we do not observe a woman's health insurance status in the SEER data.

We examine the effects of NBCCEDP on breast and cervical cancer detections by estimating models where the outcome is the log of the count of the number of cancers at each stage detected for women age 21-39, 40-49, and 50-64 in each state and year, and we include the same right hand side variables as in equation (1).[27] We assume a 1-month delay between initial screening and diagnosis (Selove et al. 2016), and we control for population as an additional independent variable. Unlike the earlier results, we present *p*-values in

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rollout with respect to any of the outcomes under study. All interaction coefficients are substantively small and statistically insignificant.

[26] We study 1985-2005. The 9 sites/states in SEER are: Georgia, Connecticut, Detroit (Michigan), Hawaii, Iowa, New Mexico, San Francisco Bay (California), Seattle (Washington), and Utah. Note that when the National Cancer Institute (NCI) refers to total cancer incidence, it generally excludes the earliest stage in-situ cancers but includes a very small number of unstaged cancers (National Cancer Institute, 2013). These earliest stage 'in situ' diagnoses are independently interesting and potentially important in our context, and so we analyze them separately. In the context of breast cancer, 'in-situ' refers both to ductal carcinoma in situ (DCIS) and to the less common lobular carcinoma in situ (LCIS). Erbas et al. (2006) discuss uncertainty about what share of DCIS tumors will progress to invasive breast cancer. Regarding uncertainty about LCIS, the American Cancer Society's "Breast Cancer Facts and Figures 2011-2012" report indicates that "many oncologists believe … that LCIS is not a true cancer, but an indicator of increased risk for developing invasive cancer in either breast" (p1). The 2015 version of the "Breast Cancer Facts and Figures" report indicates that of the 60,290 carcinoma in situ detected in that year (constituting 20 percent of all breast tumors), 83 percent of those are DCIS while just 12 percent are LCIS (p1).

[27] For the small number of cells with zero cancer detections we add one because the log of zero is not defined. Note that we combine diagnoses within 5-year age bands and have estimated similar models combining black, white, and other race women together for this analysis because there are some SEER sites with very small populations of black and other race women and thus the 'zero cancer detections' problem is substantially worse if we consider race groups separately. We present the log count models for ease of interpretation and because these models allow us to adjust p-values for the small number of clusters (Cameron et al. 2008). We do so with Mammen (1993)

parentheses for the usual inference calculations for the key coefficients and present alternative *p*-values in brackets for the Wild-bootstrap procedure which adjusts for the small number of clusters (Cameron et al. 2008), 9 in our data. We present results for breast cancer diagnoses in Table 7 and for cervical cancer diagnoses in Table 8. The format of these tables is identical: each panel reports the coefficient on the NBCCEDP rollout variable from a fully saturated model separately for 25-39 year old women (top panel), 40-49 year old women (middle panel), and 50-64 year old women (bottom panel).

The results for breast cancer diagnoses in Table 7 indicate that NBCEEDP significantly increased detection of early stage pre-cancers and localized (stage 1) breast cancers for 50-64 year old women, even after adjusting for the small number of clusters.[28] The NBCCEDP estimate for 50-64 year old women indicates that the program significantly increased detection of in-situ pre-cancers in column 1 by 16 percent and significantly increased detection of localized stage

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weights and imposing the null hypothesis. We control for age and race dummies, but no other demographics are available.

[28] We also considered estimating models of breast cancer mortality, but we chose not to examine deaths for several reasons. First, there is usually a long and variable lag between mammography and breast cancer mortality that has changed considerably over time as treatment technologies have changed. This means there is not a clear econometric strategy that consistently yields a particular lag structure for linking particular types of diagnoses to later expected declines in mortality across our time period. Second, when a person has breast cancer, there are usually multiple mammograms involved (e.g., an initial screening one and subsequent diagnostic ones) which additionally complicates decisions about how to appropriately attribute program-induced screenings to breast cancer mortality. We leave this important question to future work. Other studies have directly examined the relationship between NBCCEDP and breast cancer mortality and find mixed results (Howard et al. 2010, Hoerger et al. 2011).

1 breast cancers in column 2 by 6 percent.[29] Estimates for detection of later stage breast cancers for 50-64 year old women are small and statistically insignificant, though we estimate in column 6 that when we include in-situ cancers, we find that NBCCEDP increased detection of total breast cancers by 8 percent.[30] We do not find other consistent evidence for 40-49 year old women or 25-39 year old women that NBCCEDP meaningfully changed cancer diagnoses.

The associated results for cervical cancer diagnoses in Table 8 return no evidence that NBCCEDP – which significantly increased cervical cancer screenings among uninsured women – significantly increased detection of pre-cancers or cancers of the cervix for women in any age group. The models do return evidence that NBCCEDP rollout is significantly associated with *fewer* distant stage cervical cancer diagnoses for both 40-49 and 50-64 year old women. While this pattern is consistent with the idea that NBCCEDP may have moved cervical cancer detections from later to earlier stages, there are at least three key patterns that call this interpretation into question.[31] First, we find no statistically

[29] We control for BCCTP rollout in all models but do not report the coefficient estimates as there was no BCCTP-related increase in mammography. Consistent with this, none of the BCCTP estimates suggest it lead to statistically significant increases in cancer detection.

[30] We present event-study estimates for 50-64 year old women for the breast cancer diagnoses in columns 3-8 of Appendix Table 2.

[31] In results not reported but available upon request, we found that these diagnosis patterns were not sensitive to inclusion of linear time trends for each SEER site, nor to the inclusion of controls for the share of the cohort's life that would have been exposed to legal abortion access (since Pap tests are often obtained in combination with family planning service visits). The patterns were also not meaningfully sensitive to controls for Medicaid family planning waivers or abortion clinics within the state. Nikpay (2016) looks at federal funding of family planning clinics during

significant offsetting *increase* in early stage cervical cancers associated with NBCCEDP rollout, as might be expected if the effect were real. Second, the reduction in distant stage cervical cancers associated with NBCCEDP is also observed for 50-64 year old women for whom we did *not* observe a significant increase in Pap tests associated with NBCCEDP (Table 5).

Finally, in results not reported but available upon request, we also implemented an alternative research design that leverages the fact that NBCCEDP services were primarily targeted at women under the age of 65 (since women 65 and older are nearly universally eligible for Medicare). Specifically, we considered triple difference models on a sample of women age 50-74 where we included fixed effects for: each five-year age group interacted with each state; each five-year age group interacted with each year; and each state interacted with each year (as well as the demographic controls described earlier). In these fully interacted models any state/time varying confounding factors are eliminated, and we focus on a variable that is the NBCCEDP rollout interacted with the age groups who are directly targeted and eligible by the program: 50-64 year olds. In these models we found no evidence of statistically significant associations between NBCCEDP rollout and distant stage cancer diagnoses for the targeted women (i.e., women age 50-64). Moreover, the relevant coefficient estimate was approximately half the magnitude of the associated estimate in the bottom panel

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the War on Poverty led to an increase in use of Pap tests. Wherry (2013) and Adams et al. (2013)

of Table 8. The null finding in this fully interacted specification also was true for each of the other cancer stages in Table 8.[32]

Overall, then, we conclude from Tables 7 and 8 that NBCCEDP – which significantly increased breast and cervical cancer screenings among uninsured women – was associated with significant increases in detections of early stage pre-cancers and cancers of the breast but was not meaningfully related to detections of cancers of the cervix. We acknowledge that the welfare consequences of the significant increases in in-situ pre-cancers of the breast are not obvious given active debates in the medical literature about whether those in-situ pre-cancers would progress to breast cancer if untreated and related concerns about overdiagnosis and overtreatment (Cavallo 2018).[33] Despite this, we do also find evidence in Table 7 that NBCCEDP rollout was also associated with statistically significant increases in detections of localized stage 1 breast cancers for which the positive welfare implications are much less ambiguous.

6. Discussion and Conclusion

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found that state use of Medicaid family planning waivers led to an increase in cancer screenings.

[32] Appendix Table 7 shows these DDD estimates for both breast (top panel) and cervical (bottom panel) cancers and also shows that these models continue to suggest that NBCCEDP was associated with statistically significant increases in diagnoses of in-situ pre-cancers of the breast.

[33] Within the economics literature, Kowalski (2018) studies selection into mammography within the context of a randomized clinical trial and finds that: 1) women who are more likely to receive mammograms are healthier; and 2) women who are more likely to receive mammograms are more likely to experience harms from them.

The results above suggest that the National Breast and Cervical Cancer Early Detection Program (NBCCEDP) and, to a lesser extent, the Breast and Cervical Cancer Treatment Program (BCCTP) played an important role at increasing preventive cancer-related health utilization for women without a health plan over the 1990s and early 2000s, a period of unprecedented increases in women's preventive health behaviors. Specifically, we estimate that the program significantly increased past-year mammography, clinical breast exams, and Pap tests among 40-64 year old women without a health plan. We did not find large NBCCEDP effects for same age women with a health plan, which is expected since NBCCEDP originally required lack of insurance as a key eligibility criterion. A variety of other falsification and robustness tests – including an event-study model – support our interpretation that NBCCEDP was causally responsible for significant improvements in the breast and cervical cancer prevention outcomes among the uninsured. We estimate that NBCCEDP accounts for approximately half the increase in past-year mammography among the uninsured over the 1990s. Moreover, we find evidence that NBEEDP increased detection of early stage breast cancers (local as well as in-situ). For the BCCTP that allowed states to pay for cancer treatment using state Medicaid funds, we find less consistent evidence of effects on outcomes except for a significant increase in clinical breast exams among 50-64 year old women without a health plan.

Notably, we find consistently weaker evidence that NBCCEDP increased Pap tests relative to clinical breast exams and mammograms. For example, among uninsured 50-64 year old women, we find robust evidence that NBCCEDP increased mammograms but not Pap tests. There are several possible reasons for this. First, recommendations regarding Pap tests are declining with age – the exact opposite of mammograms. Since 50-64 year olds are much less likely to be having pelvic exams as part of a standard well-woman visit, it is perhaps not surprising that we find weaker evidence on the relationship between NBCCEDP and Pap tests. Second, Pap tests are much cheaper than mammograms (e.g., $15 vs. $150) such that even without health insurance it is more likely that a woman could afford to get a Pap test without the help of public programs (though CBEs are also much cheaper than mammograms, and we do find effects on CBEs).

We also find much less evidence that BCCTP increased screenings compared to NBCCEDP: we only find effects of BCCTP at increasing CBEs among uninsured 50-64 year old women. It could be that the cancer treatment payment program gets these women 'in the door' to get a CBE but does not induce more screening mammograms. As screening mammograms require special equipment and are generally performed in a separate facility, this could explain the lack of effects of BCCTP on mammography for the group where we find the program induced large increases in clinical breast exams. Overall, however, the general lack of effects of BCCTP on screening take-up suggests that

– to the extent women understand what each program does – the inability to pay for treatment if a tumor is found is not the key factor in low screening take-up among uninsured low-income women.

Our results are not without limitations, many owing to limitations of the data. For example, all of our BRFSS outcomes are self-reported, and there is evidence that social disadvantage is positively related to over-reporting of preventive service use such as cervical cancer screening (e.g., Lofters et al. 2013). We think it unlikely that such reporting bias would be systematically correlated with the extensive variation in the timing of NBCCEDP rollout across states, but it is not something we can directly test. Of course, our complementary results on cancer diagnoses are not susceptible to such biases. Another data limitation is that we do not observe the sequencing of various outcomes, such as check-ups and cancer screenings or the ordering of when a woman received, say, a mammogram and a Pap test. This information would be helpful for more credibly measuring spillover effects of direct funding provision, for example.

Despite these limitations, our results significantly advance our understanding of one of the most remarkable public health improvements of the past several decades and suggest that direct government provision of cancer screenings was responsible for a substantial share of the increase in preventive health behaviors among uninsured women in the 1990s.

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Figure 1
Trends in Past Year Mammography by Insurance Status, 50-64 year old women, 1991-2005 BRFSS

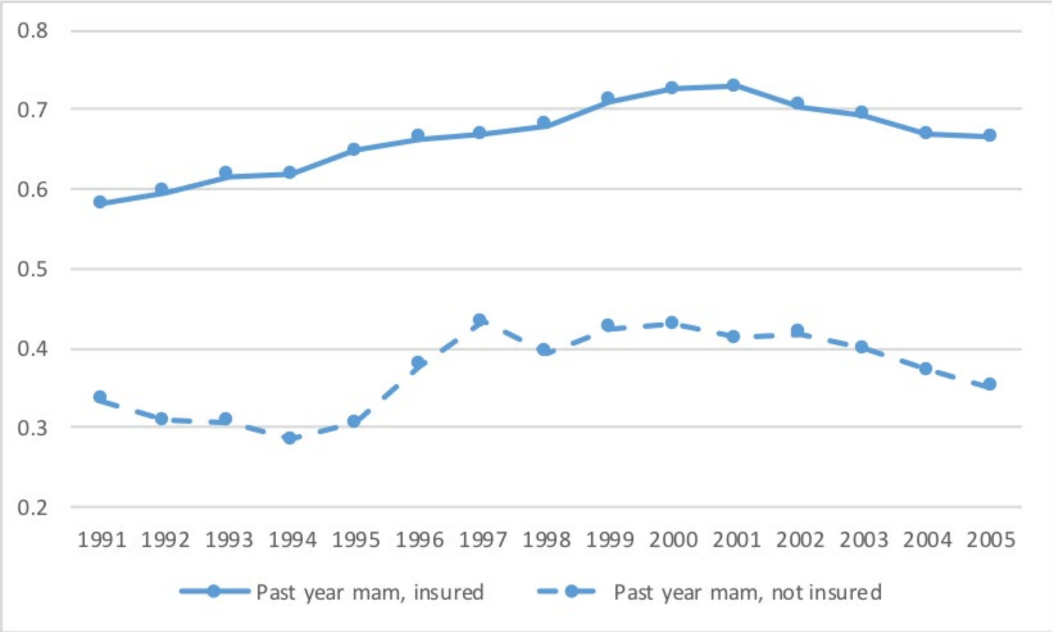

Figure 2
Trends in Past Year Clinical Breast Exams, 50-64 year old women, 1991-2005 BRFSS

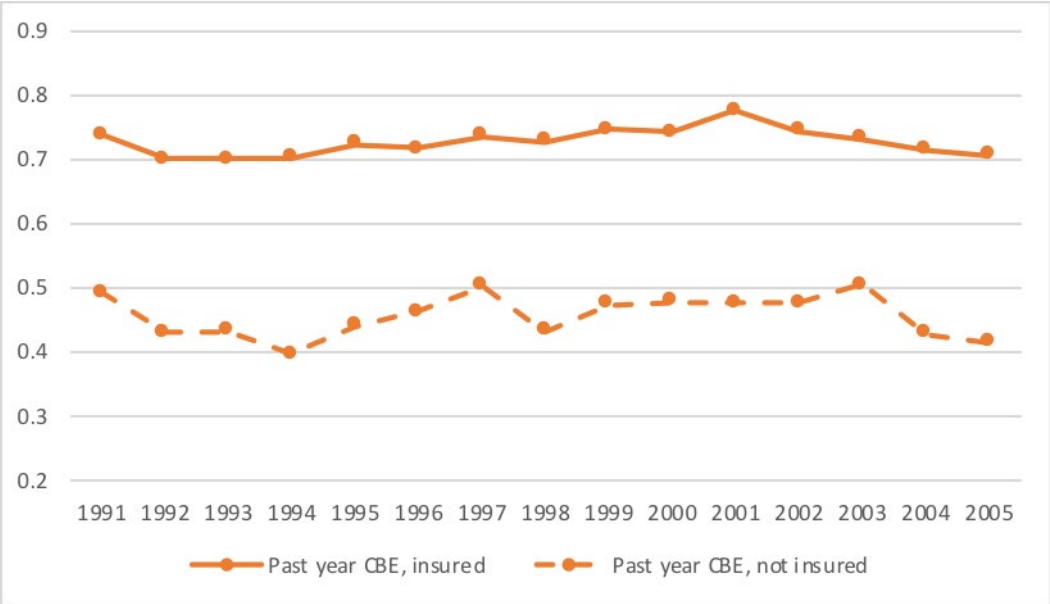

Figure 3

Trends in Past Year Pap Tests, 50-64 year old women, 1991-2005 BRFSS

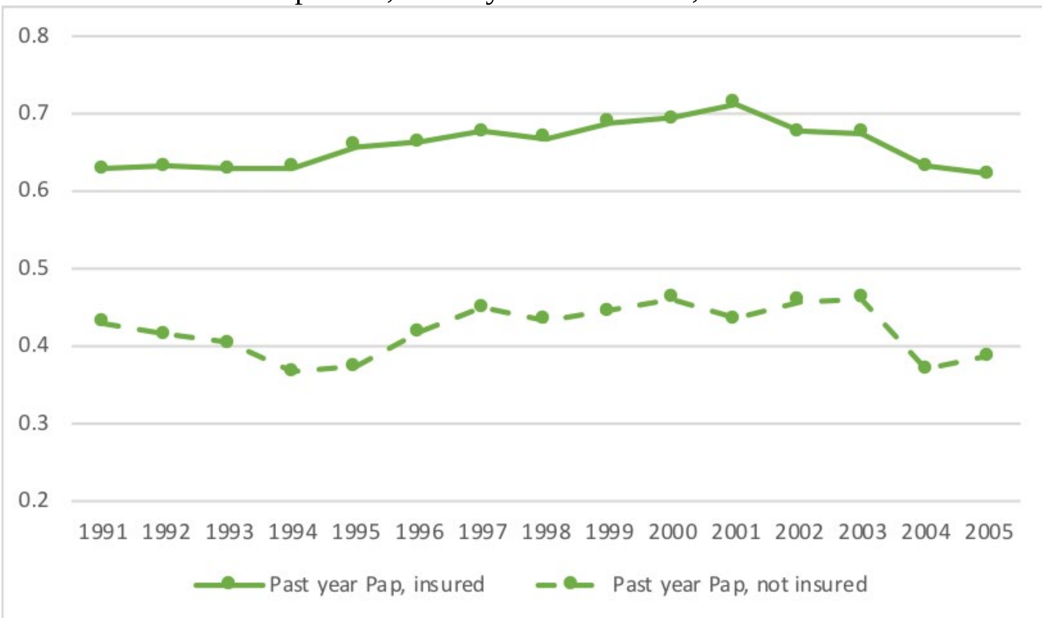

Figure 4

State NBCCEDP Rollout

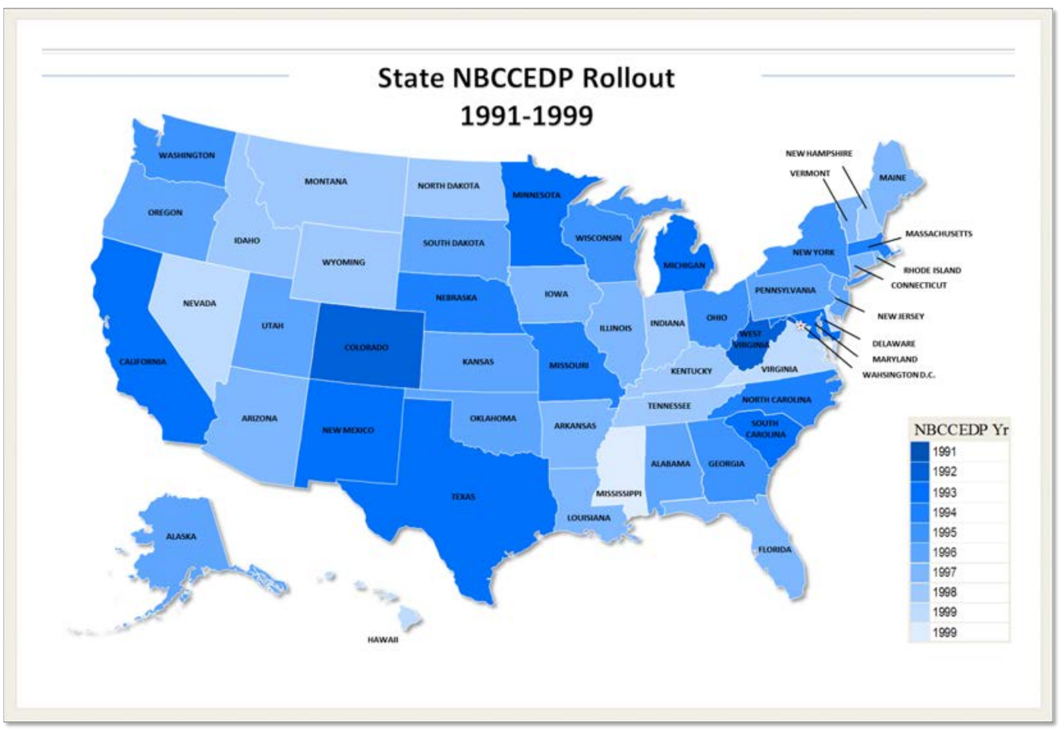

Figure 5
State BCCTP Rollout

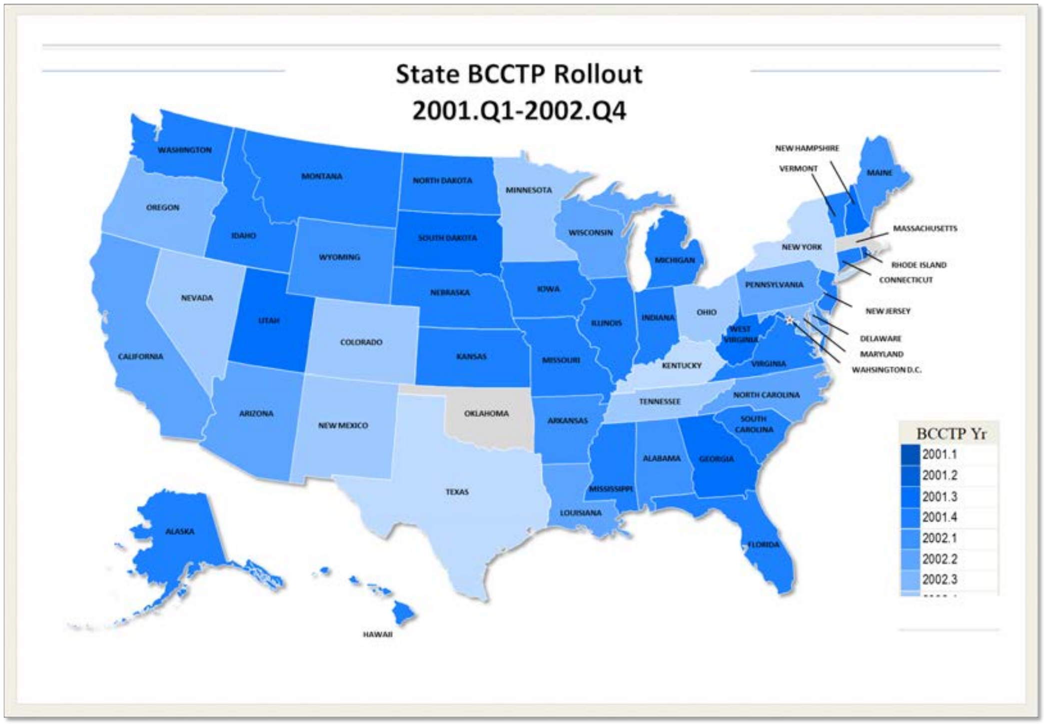

Table 1
Descriptive Statistics, BRFSS Females, 1990-2005

Variable	21-39 year old women	40-49 year old women	50-64 year old women
White non-Hispanic	.703 (.457)	.749 (.434)	.794 (.405)
Black non-Hispanic	.115 (.319)	.107 (.309)	.096 (.295)
Other race non-Hispanic	.044 (.206)	.040 (.196)	.030 (.172)
Hispanic	.133 (.340)	.097 (.296)	.074 (.261)
Less than high school degree	.096 (.294)	.099 (.298)	.154 (.361)
HS degree	.299 (.458)	.316 (.465)	.363 (.481)
Some college	.305 (.461)	.282 (.450)	.247 (.432)
Bachelor's degree or more	.299 (.458)	.301 (.459)	.233 (.423)
Married	.591 (.492)	.700 (.458)	.672 (.469)
Widowed/Divorced/Separated	.117 (.321)	.210 (.407)	.276 (.447)
Never married	.245 (.430)	.069 (.253)	.041 (.198)
Living with a partner	.046 (.209)	.018 (.135)	.008 (.089)
Has any health insurance	.812 (.390)	.867 (.339)	.880 (.325)
Ever had a mammogram	.244 (.429)	.774 (.418)	.840 (.367)
Had mammogram in past year	.128 (.328)	.479 (.500	.597 (.491)
Ever had a clinical breast exam	.903 (.296)	.932 (.251)	.919 (.273)
Had clinical breast exam in past year	.703 (.457)	.681 (.466)	.692 (.462)
Ever had a Pap test	.952 (.214)	.977 (.150)	.967 (.179)
Had Pap test in past year	.751 (.432)	.673 (.469)	.624 (.484)
NBCCEDP in respondent's state	.646 (.478)	.706 (.456)	.692 (.462)
BCCTP in respondent's state	.217 (.412)	.256 (.436)	.269 (.443)
N	555807	332195	379776

Author calculations, 1991-2000 BRFSS adult females 21-64. Weighted means (standard deviations). Sample size for each variable varies slightly due to certain questions not being asked in each year. Reported sample size is the sample size for the demographic characteristics (race/ethnicity, education, and marital status) which were asked in each wave.

Table 2:
NBCCEDP and BCCTP Not Meaningfully Related to Presence of a Health Plan
BRFSS 1991-2005, 21-64 year old women

	(1) 21-39 year olds	(2) 40-49 year olds	(3) 50-64 year olds
NBCCEDP	.008*	.007	-.004
	(.005)	(.005)	(.005)
BCCTP	.002	.004	-.004
	(.005)	(.006)	(.005)
Adjusted R squared	.12	.11	.09
N	495295	308830	352737

Notes: Each panel of each column shows the results from a separate regression model. Additional controls in all models include: five-year age group dummies; laws mandating access to OB/GYNs; insurance mandates for mammography; race/ethnicity; education; marital status; 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; the presence of a CDC-funded WISEWOMAN program; share urban; share black; share Hispanic; and state, year, and month of interview fixed effects. * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors throughout are clustered at the state level and estimates are weighted.

Table 3:
NBCCEDP, BCCTPA, and mammograms
BRFSS 1991-2005, 21-64 year old women

	(1) 21-39 year olds	(2) 21-39 year olds	(3) 40-49 year olds	(4) 40-49 year olds	(5) 50-64 year olds	(6) 50-64 year olds
	Ever had a Mammogram	Had a Mamm. in Past Year	Ever had a Mammogram	Had a Mamm. in Past Year	Ever had a Mammogram	Had a Mamm. in Past Year
Full Sample						
NBCCEDP	.012**	.010**	.001	.020**	.004	.015**
	(.005)	(.004)	(.007)	(.009)	(.007)	(.008)
BCCTP	-.004	-.005	-.009	.0005	-.009	-.011
	(.008)	(.011)	(.007)	(.014)	(.007)	(.011)
Adjusted R squared	.11	.06	.05	.03	.06	.04
N	384299	383759	229205	228585	249905	248870
Women with a health plan						
NBCCEDP	.013**	.008	-.002	.012	.005	.012
	(.006)	(.005)	(.007)	(.009)	(.005)	(.009)
BCCTP	-.012*	-.0003	-.011	-.001	-.010*	-.012
	(.007)	(.010)	(.008)	(.018)	(.005)	(.009)
Adjusted R squared	.13	.07	.04	.02	.05	.03
N	318946	318506	199717	199225	220165	219342
Women without a health plan						
NBCCEDP	.007	.017*	.015	.057***	.019	.058***
	(.008)	(.008)	(.017)	(.020)	(.023)	(.014)
BCCTP	.023	-.022	-.006	.001	.009	.008
	(.022)	(.022)	(.016)	(.037)	(.027)	(.026)
Adjusted R squared	.05	.03	.05	.03	.07	.04
N	64822	64727	29222	29104	29412	29219

See notes to Table 2.

Table 4:
NBCCEDP, BCCTPA, and clinical breast exams (CBE)
BRFSS 1991-2005, 21-64 year old women

	(1)	(2)	(3)	(4)	(5)	(6)
	21-39 year olds	21-39 year olds	40-49 year olds	40-49 year olds	50-64 year olds	50-64 year olds
	Ever had a CBE	Had a CBE in Past Year	Ever had a CBE	Had a CBE in Past Year	Ever had a CBE	Had a CBE in Past Year
Full Sample						
NBCCEDP	.001	.010	-.004	.029***	.004	.020**
	(.004)	(.007)	(.005)	(.009)	(.004)	(.008)
BCCTP	.002	.007	-.001	-.004	.001	.001
	(.007)	(.010)	(.004)	(.015)	(.006)	(.011)
Adjusted R squared	.08	.04	.06	.03	.05	.03
N	383946	382907	228835	227853	249324	247552
Women with a health plan						
NBCCEDP	.005	.007	-.005	.019**	.005	.021**
	(.003)	(.007)	(.005)	(.007)	(.004)	(.008)
BCCTP	-.002	.004	-.003	-.006	-.003	-.066
	(.006)	(.010)	(.005)	(.016)	(.007)	(.013)
Adjusted R squared	.06	.03	.04	.02	.03	.02
N	318660	317868	199416	198641	219668	218246
Women without a health plan						
NBCCEDP	-.021*	.023*	-.002	.070**	.013	.038**
	(.011)	(.013)	(.014)	(.029)	(.016)	(.016)
BCCTP	.002	-.001	-.006	.005	.037*	.069***
	(.015)	(.022)	(.013)	(.029)	(.021)	(.026)
Adjusted R squared	.09	.04	.07	.03	.06	.03
N	64754	64517	29162	28963	29333	29000

See notes to Table 2.

Table 5:
NBCCEDP, BCCTPA, and Pap Tests
BRFSS 1991-2005, 21-64 year old women

	(1)	(2)	(3)	(4)	(5)	(6)
	21-39 year olds	21-39 year olds	40-49 year olds	40-49 year olds	50-64 year olds	50-64 year olds
	Ever had a Pap Test	Had Pap Test in Past Year	Ever had a Pap Test	Had Pap Test in Past Year	Ever had a Pap Test	Had Pap Test in Past Year
Full Sample						
NBCCEDP	-.001	.005	-.001	.022**	.002	.016*
	(.003)	(.006)	(.003)	(.008)	(.005)	(.008)
BCCTP	.001	.011	.0001	-.012	-.009**	-.009
	(.004)	(.011)	(.004)	(.016)	(.003)	(.013)
Adjusted R squared	.07	.03	.03	.02	.03	.03
N	383706	382503	228773	227541	249370	246850
Women with a health plan						
NBCCEDP	.001	.001	-.003	.014	.002	.015
	(.002)	(.006)	(.002)	(.008)	(.004)	(.009)
BCCTP	-.002	.007	.002	-.008	-.007*	-.009
	(.003)	(.009)	(.004)	(.014)	(.003)	(.013)
Adjusted R squared	.06	.03	.02	.02	.02	.03
N	318472	317550	199366	198364	219712	217635
Women without a health plan						
NBCCEDP	-.011	.024**	.012	.056**	.010	.035
	(.008)	(.011)	(.016)	(.027)	(.011)	(.024)
BCCTP	.005	.017	-.012	-.038	-.016	.012
	(.013)	(.026)	(.012)	(.041)	(.015)	(.029)
Adjusted R squared	.09	.04	.06	.03	.05	.04
N	64707	64437	29147	28926	29339	28911

See notes to Table 2.

Table 6:
NBCCEDP, BCCTPA, and Other Health Behaviors (Falsification Tests)
BRFSS 1991-2005, 50-64 year old women without a health plan

	(1)	(2)	(3)	(4)
Outcome is:	Always wears a seatbelt	Got a flu shot last year	Had cholesterol checked last year	Current smoker
NBCCEDP	.002 (.026)	.013 (.017)	-.025 (.034)	-.002 (.013)
BCCTP	-.003 (.021)	.015 (.021)	.008 (.027)	-.010 (.019)
Adjusted R squared	.09	.04	.04	.07
N	11234	33640	25920	41501

See notes to Table 2.

Table 7:
NBCCEDP Increased Detection of Early Stage Pre-Cancers and Cancers of the Breast
SEER 1985-2005, 25-64 year old women

	(1) In-situ pre-cancers	(2) Localized (Stage 1)	(3) Regional (Stages 2 & 3)	(4) Distant (Stage 4)	(5) Total Incidence – excluding in-situ	(6) Total Incidence – including in situ
25-39 year old women						
NBCCEDP	.043	-.002	-.020	-.004	-.045	-.027
	(.321)	(.969)	(.563)	(.896)	(.376)	(.470)
	[.290]	[.968]	[.547]	[.893]	[.348]	[.448]
R-squared	.67	.78	.79	.53	.81	.82
N	1701	1701	1701	1701	1701	1701
40-49 year old women						
NBCCEDP	.098	-.077	.029	-.130	-.060	-.002
	(.185)	(.150)	(.700)	(.084)*	(.393)	(.976)
	[.147]	[.111]	[.689]	[.049]*	[.367]	[.976]
R-squared	.85	.82	.81	.74	.80	.80
N	1134	1134	1134	1134	1134	1134
50-64 year old women						
NBCCEDP	.147	.060	-.013	.018	.041	.076
	(.018)**	(.074)*	(.641)	(.569)	(.198)	(.063)*
	[.003]***	[.040]**	[.412]	[.552]	[.160]	[.031]**
R-squared	.85	.82	.82	.80	.80	.80
N	1701	1701	1701	1701	1701	1701

Notes: Each entry shows the coefficient from a separate regression model. The dependent variable is one plus the log of the number of breast cancer diagnoses to women in various age groups using SEER-9 data. Though not shown, all models also include state and year fixed effects and dummies for 5-year age groups and race. All models include dummies for the relevant populations of women in the age group. All models also include all the state-level Xs discussed in the text. * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors throughout are clustered at the state level; p-values for this process are reported in parentheses; p-values calculated using Wild Bootstrap are in brackets.

Table 8:
NBCCEDP Did Not Meaningfully Increase Detection of Early Stage Cervical Cancers
SEER 1985-2005, 25-64 year old women

	(1) In-situ pre-cancers	(2) Localized (Stage 1)	(3) Regional (Stages 2 & 3)	(4) Distant (Stage 4)	(5) Total Incidence – excluding in-situ	(6) Total Incidence – including in situ
25-39 year old women						
NBCCEDP	-.020	.011	-.025	.005	-.033	-.013
	(.430)	(.807)	(.530)	(.916)	(.280)	(.667)
	[.403]	[.801]	[.511]	[.913]	[.246]	[.655]
R-squared	.74	.49	.42	.40	.54	.54
N	1701	1701	1701	1701	1701	1701
40-49 year old women						
NBCCEDP	-.039	.023	-.027	-.095	-.037	-.056
	(.496)	(.636)	(.726)	(.091)*	(.200)	(.203)
	[.475]	[.622]	[.717]	[.055]*	[.163]	[.166]
R-squared	.85	.59	.48	.46	.68	.69
N	1134	1134	1134	1134	1134	1134
50-64 year old women						
NBCCEDP	.053	-.017	-.006	-.114	-.059	-.076
	(.179)	(.717)	(.920)	(.012)**	(.154)	(.163)
	[.141]	[.707]	[.918]	[.001]***	[.116]	[.031]**
R-squared	.82	.84	.49	.51	.73	.73
N	1701	1701	1701	1701	1701	1701

Notes: Each entry shows the coefficient from a separate regression model. The dependent variable is one plus the log of the number of cervical cancer diagnoses to women in various age groups using SEER-9 data. Though not shown, all models also include state and year fixed effects and dummies for 5-year age groups and race. All models include dummies for the relevant populations of women in the age group. All models also include all the state-level Xs discussed in the text. * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors throughout are clustered at the state level; p-values for this process are reported in parentheses; p-values calculated using Wild Bootstrap are in brackets.

Appendix Table 1:
NBCCEDP, BCCTPA, and Past Year Checkups
BRFSS 1991-2005, 21-64 year old women without a health plan

	(1) 21-39 year olds	(2) 40-49 year olds	(3) 50-64 year olds
Full Sample			
NBCCEDP	.009	.012	.011
	(.010)	(.012)	(.012)
BCCTP	.068	.069	.070
	(.059)	(.063)	(.063)
Adjusted R squared	.38	.41	.50
N	495993	309228	353242
Women with a health plan			
NBCCEDP	.004	.006	.007
	(.010)	(.012)	(.013)
BCCTP	.079	.083	.078
	(.063)	(.067)	(.065)
Adjusted R squared	.42	.44	.53
N	410457	268857	311084
Women without a health plan			
NBCCEDP	.024*	.022	.044**
	(.012)	(.021)	(.019)
BCCTP	.056	.029	.038
	(.043)	(.038)	(.049)
Adjusted R squared	.28	.27	.32
N	84838	39973	41653

See notes to Table 2.

Appendix Table 2:
NBCCEDP Event Study Estimates for Past Year Screenings and Breast Cancer Outcomes
50-64 year old women without a health plan (BRFSS 1991-2005) and 50-64 year old women (SEER 1985-2005)

	(1) Had a mammogram in past year	(2) Had a CBE in past year	(3) In-situ pre-cancers	(4) Localized (Stage 1)	(5) Regional (Stages 2 & 3)	(6) Distant (Stage 4)	(7) Total Incidence (excluding in-situ)	(8) Total Incidence (including in situ)
5 or more years before state NBCCEDP	-.054 (.035)	-.0003 (.044)	-.160* (.075)	-.043 (.066)	.125* (.065)	-.016 (.050)	-.004 (.070)	-.030 (.071)
3-4 years before state NBCCEDP	-.012 (.033)	.021 (.035)	-.107* (.074)	-.042 (.063)	.024 (.068)	-.009 (.048)	-.051 (.058)	-.085 (.049)
2 years before state NBCCEDP	-.004 (.019)	.026 (.032)	-.121 (.057)	-.041 (.091)	-.049 (.055)	.005 (.058)	-.102 (.081)	-.140* (.073)
Year before state NBCCEDP	--	--	--	--	--	--	--	--
Year of state NBCCEDP	.040 (.024)	.056*** (.019)	.046 (.049)	.023 (.054)	-.030 (.059)	.001 (.057)	-.026 (.049)	-.025 (.044)
1-2 years after state NBCCEDP	.060*** (.019)	.065*** (.018)	.199*** (.044)	.044 (.070)	-.093** (.036)	.022 (.040)	-.024 (.053)	.014 (.045)
3-4 years after state NBCCEDP	.061*** (.021)	.057** (.026)	.344*** (.071)	.155* (.083)	-.063 (.045)	-.092 (.066)	.044* (.068)	.106 (.056)
5 or more years after state NBCCEDP	.066** (.028)	.089*** (.029)	.448*** (.121)	.094 (.079)	-.120 (.074)	-.126 (.104)	-.028 (.067)	.062 (.057)
Adjusted R squared	.04	.03	.85	.82	.82	.80	.80	.80
N	29219	29000	1701	1701	1701	1701	1701	1701

For columns 1 and 2, see notes to Table 2. For columns 3-8, see notes to Table 7.

Appendix Table 3:
NBCCEDP Event Study Estimates for Past Year Screenings and Cervical Cancer Outcomes
50-64 year old women without a health plan (BRFSS 1991-2005) and 50-64 year old women (SEER 1985-2005)

	(1) Had a Pap test in past year	(2) In-situ pre-cancers	(3) Localized (Stage 1)	(4) Regional (Stages 2 & 3)	(5) Distant (Stage 4)	(6) Total Incidence (excluding in-situ)	(7) Total Incidence (including in situ)
5 or more years before state NBCCEDP	-.051	-.082	-.124**	-.096**	-.148**	-.159**	-.179**
	(.036)	(.054)	(.052)	(.038)	(.049)	(.060)	(.059)
3-4 years before state NBCCEDP	.005	-.008	-.028	-.009	-.092*	-.038	-.065
	(.029)	(.048)	(.054)	(.029)	(.047)	(.051)	(.050)
2 years before state NBCCEDP	.037*	-.092**	-.042	.038	-.006	.016	-.007
	(.021)	(.028)	(.048)	(.044)	(.042)	(.043)	(.047)
Year before state NBCCEDP	--	--	--	--	--	--	--
Year of state NBCCEDP	.036	-.002	.002	.081	-.081	.039	-.008
	(.022)	(.046)	(.060)	(.052)	(.045)	(.037)	(.039)
1-2 years after state NBCCEDP	.063***	.116**	-.032	-.009	-.149**	-.089	-.091
	(.067)	(.042)	(.081)	(.056)	(.051)	(.061)	(.059)
3-4 years after state NBCCEDP	.067**	.130*	.003	.030	-.145**	-.062	-.085
	(.028)	(.057)	(.097)	(.072)	(.059)	(.085)	(.080)
5 or more years after state NBCCEDP	.094**	.278***	.019	.090	-.136*	-.010	.002
	(.038)	(.080)	(.127)	(.095)	(.071)	(.097)	(.096)
Adjusted R squared	.04	.82	.84	.78	.83	.78	.81
N	28911	1701	1701	1701	1701	1701	1701

For column 1, see notes to Table 2. For columns 2-7, see notes to Table 8.

Appendix Table 4:
NBCCEDP Effects by Race/Ethnicity and Education
BRFSS 1991-2005, 40-49 year old women without a health plan

	(1) White non-Hispanic	(2) Black, non-Hispanic	(3) Hispanic	(4) High school degree or less	(5) Some college or more
Mammogram in Past Year					
NBCCEDP	.042*	.057	.088	.042	.082***
	(.023)	(.039)	(.054)	(.031)	(.029)
CBE in Past Year					
NBCCEDP	.090**	-.029	.070	.030	.128***
	(.037)	(.055)	(.055)	(.040)	(.031)
Pap Test in Past Year					
NBCCEDP	.082**	-.049	.069	.046	.074**
	(.038)	(.032)	(.082)	(.033)	(.028)

See notes to Table 2.

Appendix Table 5:
NBCCEDP and BCCTPA Effects by Race/Ethnicity and Education
BRFSS 1991-2005, 50-64 year old women without a health plan

	(1) White non-Hispanic	(2) Black, non-Hispanic	(3) Hispanic	(4) High school degree or less	(5) Some college or more
Mammogram in Past Year					
NBCCEDP	.009	.232***	.113**	.033	.140***
	(.019)	(.051)	(.046)	(.019)	(.035)
CBE in Past Year					
NBCCEDP	.013	.128***	.075	.011	.127***
	(.018)	(.039)	(.056)	(.022)	(.032)
BCCTP	.107***	.075	.116	.087**	.023
	(.032)	(.088)	(.157)	(.038)	(.055)
Pap Test in Past Year					
NBCCEDP	.015	.095**	.117	.039	.036
	(.025)	(.041)	(.071)	(.027)	(.033)

See notes to Table 2.

Appendix Table 6:
FQHCs do not Amplify the Effects of NBCCEDP
BRFSS 1991-2005, Adult Women

	(1) CBE in past year	(2) Mammogram in past year	(3) Pap test in past year
40-49 year old women			
NBCCEDP	.079**	.047*	.061*
	(.035)	(.025)	(.032)
FQHC Uncompensated Care	.011	-.008	-.008
	(.011)	(.007)	(.009)
NBCCEDP * FQHC UC	-.004	.005	-.002
	(.008)	(.005)	(.006)
Adjusted R squared			
N	28963	29104	28926
50-64 year old women			
NBCCEDP	.043	.044*	.046
	(.028)	(.021)	(.028)
FQHC Uncompensated Care	.015	-.001	.008
	(.011)	(.011)	(.009)
NBCCEDP * FQHC UC	-.002	.007	-.005
	(.009)	(007)	(.007)
Adjusted R squared			
N	29000	29219	28911

See notes to Table 2.

Appendix Table 7:
DDD Estimates of the Effect of NBCCEDP on Breast and Cervical Cancers
SEER 1985-2005, 50-74 year old women

	(1) In-situ pre-cancers	(2) Localized (Stage 1)	(3) Regional (Stages 2 & 3)	(4) Distant (Stage 4)	(5) Total Incidence – excluding in-situ	(6) Total Incidence – including in situ
Breast Cancers						
NBCCEDP * Targeted	.162***	.057	.099*	.005	.115*	0.156**
(50-64 year olds)	(.006)	(.385)	(.051)	(.935)	(.051)	(.018)
	[.000]	[.358]	[.022]	[.933]	[.022]	[.003]
R-squared	.85	.82	.83	.81	.80	.79
N	2835	2835	2835	2835	2835	2835
Cervical Cancers						
NBCCEDP * Targeted	-.033	-.059	.031	-.024	-.051	-.061
(50-64 year olds)	(.425)	(.508)	(.704)	(.468)	(.552)	(.505)
	[.401]	[.488]	[.693]	[.446]	[.534]	[.485]
R-squared	.82	.85	.79	.84	.81	.81
N	2835	2835	2835	2835	2835	2835

Notes: Each entry shows the coefficient from a separate regression model. The dependent variable is one plus the log of the number of cervical cancer diagnoses to women in various age groups using SEER-9 data. Though not shown, all models also include fixed effects for state, year, and 5-year age groups, as well as each of their two-way interactions. All models also include race dummies and dummies for the relevant populations of women in the age group. * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors throughout are clustered at the state level; p-values for this process are reported in parentheses; p-values calculated using Wild Bootstrap are in brackets.