NBER WORKING PAPER SERIES

THE EFFECT OF INSURANCE EXPANSIONS ON SMOKING CESSATION MEDICATION USE: EVIDENCE FROM RECENT MEDICAID EXPANSIONS

Johanna Catherine Maclean
Michael F. Pesko
Steven C. Hill

Working Paper 23450
http://www.nber.org/papers/w23450

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
May 2017

Johanna Catherine Maclean and Michael Pesko were supported by a Research Scholar Grant – Insurance, RSGI-16-019-01 – CPHPS, from the American Cancer Society. We thank Keisha Solomon for excellent research assistance. We thank David Bradford for kindly sharing data. The views expressed in this paper are the authors' and do not reflect the views of the Agency for Healthcare Research and Quality, the U.S. Department of Health and Human Services, or the National Bureau of Economic Research. All errors are our own.

The Effect of Insurance Expansions on Smoking Cessation Medication Use: Evidence from Recent Medicaid Expansions

Johanna Catherine Maclean, Michael F. Pesko, and Steven C. Hill

NBER Working Paper No. 23450
May 2017
JEL No. I1,I13,I18

ABSTRACT

In this study we explore the early effects of recent Medicaid expansions on prescriptions and Medicaid payments for evidence-based smoking cessation prescription medications: Zyban, Chantix, and Nicotrol. We estimate differences-in-differences models using data on the universe of prescription medications sold in retail and online pharmacies for which Medicaid was a third-party payer. Our findings suggest that expansions increased prescriptions for smoking cessation medications by 36% and total payments for these medications increased by 28%. We provide evidence these payments were financed by state Medicaid programs and not patients themselves. Overall our findings suggest that the recent Medicaid expansions allowed low-income smokers to access effective cessation medications.

Johanna Catherine Maclean
Department of Economics
Temple University
Ritter Annex 869
Philadelphia, PA 19122
and NBER
catherine.maclean@temple.edu

Michael F. Pesko
Weill Cornell Medical College
Cornell University
402 East 67th Street
LA-216
New York, NY 10065
mip2037@med.cornell.edu

Steven C. Hill
Center for Financing, Access and Cost Trends
Agency for Healthcare Research and Quality
540 Gaither Road
Rockville, MD 20850
shill@ahrq.gov

1. Introduction

Smoking is the largest preventable cause of morbidity and mortality in the United States, leading to more than 480,000 deaths each year and accounting for 30% of all cancer deaths annually (Centers for Disease Control and Prevention, 2017). Despite the well-established health harms of smoking and numerous anti-smoking campaigns undertaken by all levels of government over the past several decades, the adult smoking rate in the U.S. remains stubbornly high at 15% (National Center for Health Statistics, 2017). Moreover, there is a clear socioeconomic disparity in smoking. Broadly, lower income groups are more likely to smoke than higher income groups (National Center for Health Statistics, 2017). In particular, within Medicaid, a public health insurance program that finances healthcare services for low-income individuals in the U.S., the smoking rate is 30%, substantially above the national average (National Center for Health Statistics, 2017).

This high smoking rate within the Medicaid population is troubling from a public finance perspective as smoking-attributable Medicaid costs (e.g., cancer treatments, emphysema and chronic bronchitis, asthma) will be borne predominately by American taxpayers. These costs are non-trivial: smoking-related diseases accounted for 15%, or $45B,[1] of annual Medicaid expenditures between 2006 and 2010 (Xu, Bishop, Kennedy, Simpson, & Pechacek, 2015). Smoking cessation has been shown to both improve health and reduce healthcare expenditures (Centers for Disease Control and Prevention, 2010; Richard, West, & Ku, 2012; Warren, Alberg, Kraft, & Cummings, 2014), suggesting that promoting cessation within Medicaid broadly could lead to substantial benefits for both states and beneficiaries.

[1] The authors inflated this number was inflated from the original estimate, $39B in 2010 dollars, to 2017 dollars using the Consumer Price Index.

Beginning in 2014, the Affordable Care Act (ACA) provided substantial federal matching funds for states to expand their Medicaid programs to low-income (up to 138% of the federal poverty level [FLP]), non-elderly, non-disabled adults.[2] Prior to the ACA, Medicaid eligibility was generally limited to children, poor parents, pregnant women, and the disabled. Childless adults, in particular, gained eligibility, as well as parents in states that had low income-eligibility thresholds for this group. Newly eligible populations have higher smoking rates and less experience with the healthcare system than populations traditionally covered by Medicaid (DiGiulio et al., 2016; National Center for Health Statistics, 2014),[3] suggesting that these populations may benefit substantially from coverage obtained through the ACA-related expansions. For all adults, Medicaid now generously covers FDA-approved tobacco cessation products (DiGiulio et al., 2016). Importantly, a series of studies suggest that improving Medicaid coverage for smoking cessation medications can increase the use of these medications and reduce smoking within the traditionally covered Medicaid population (e.g., Adams, Markowitz, Dietz, and Tong (2013) and Richards, Marti, Maclean, Fletcher, and Kenkel (2014)).

In this study, we examine the impact of Medicaid eligibility expansions on utilization of Medicaid-financed prescription medications for smoking cessation approved by the Food and Drug Administration (FDA).[4] These Medicaid expansions provided newly insured patients with access to Zyban, Chantix, Nicotrol, and their generics with little to no cost-sharing. Basic

[2] In particular, for states that expanded Medicaid, the federal government financed 100% of the costs for newly eligible beneficiaries between 2014 and 2016. After that time, the federal contribution declines to 90% by 2020 and remains at that level (Kaiser Family Foundation, 2014b).

[3] According to the National Center for Health Statistics official estimates, in 2013 (thus in advance of January 1st, 2014 when the majority of expansion states increased Medicaid coverage) the smoking rate within Medicaid was 30%. This number should predominately reflect the smoking rate among traditional and Medicaid eligible populations. DiGuilio and colleagues report a smoking rate of 38% among new enrollees made eligible by the ACA Medicaid expansions, this number provides an estimate of the smoking rate among the newly eligible.

[4] While we emphasize the effect of the Medicaid expansions on previously ineligible populations, we note that, through welcome mat effects, individuals previously eligible may opt to take up Medicaid (Sonier, Boudreaux, & Blewett, 2013). The ACA also required that these enrollees have access to smoking cessation products.

demand theory predicts that a reduced out-of-pocket cost should increase the quantity of healthcare services demanded by beneficiaries. Recent estimates document that 2.3 million smokers gained access to Medicaid through the ACA expansions (DiGiulio et al., 2016), suggesting that these expansions have substantial scope to increase use of cessation medications within populations that had little insurance access previously.

To estimate the effects of these recent Medicaid expansions, we draw rich and novel administrative data from the Medicaid State Drug Utilization Database (SDUD) between 2011 and 2015. These data cover the universe of prescription medication claims purchased from retail and online pharmacies for which Medicaid was a third-party payer. These data allow us to study the effect of Medicaid expansions on utilization of these medications and the financial responsibility of both state Medicaid programs and patients themselves.

We contribute to the relatively small literature that examines the impact of expanding access to effective cessation medications within Medicaid in four important ways. (i) We are able to examine the effect of expanding coverage to newly eligible Medicaid populations, which have very high smoking rates. (ii) Our use of the SDUD offers us access to the universe of Medicaid-financed prescription medications, while previous studies have relied on survey data or claims data that lack detailed payer information. (iii) Our data contain information on Medicaid payments which we leverage to estimate program costs associated with changes in medication use. (iv) Because the medications we study require a formal prescription from a healthcare provider, we are able to indirectly explore the newly Medicaid-insured smokers' ability to access primary care services – a concern among policymakers is that providers will not accept new Medicaid patients (Decker, 2012) – and to navigate the changing U.S. healthcare delivery system, with which they have little experience.

Our results suggest that expanding Medicaid to newly eligible populations increased utilization of smoking cessation medications: post expansion Medicaid-financed prescription medications for smoking cessation increased by 36% in expansion states relative to non-expansion states. Medicaid payments for these medications increased by 28%. The costs of these medications were primarily paid for by state Medicaid programs and not patients. This finding is important as the price of medications we examine ranges between $100 and $500 per prescription, which is likely cost-prohibitive for low-income, uninsured smokers.

This manuscript is organized as follows. Section 2 provides a review of the Medicaid program history and recent expansions, outlines the conceptual model that motivates our study, and briefly discusses the related literature. Data, variables, and methods are presented in Section 3. Our main results are reported in Section 4, and extensions and sensitivity analyses are presented in Section 5. Finally, Section 6 provides a discussion and policy implications.

2. Medicaid, a conceptual framework, and prior literature

2.1 A brief review of the Medicaid program

The Medicaid program finances healthcare services, including smoking cessation services, for low income people. Medicaid is a federal and state program, with states setting policies within a set of federal laws and regulations. Before the passage of the ACA, Medicaid eligibility for non-elderly adults in most states was limited to people with disabilities, pregnant women, and parents of poor children.

Outside of a small number of states using federal waiver programs,[5] the ACA provided Medicaid coverage to able-bodied adults without minor children for the first time. Originally,

[5] Section 1115 Waivers allow states to alter their Medicaid program by, for example, expanding coverage to groups not historically eligible. https://www.medicaid.gov/medicaid/section-1115-demo/index.html (accessed April 4th, 2017).

the ACA mandated that all states expand Medicaid or lose all federal Medicaid funding. In 2012 the Supreme Court ruled that states were not required to expand eligibility to retain federal funding. This ruling left Medicaid expansion optional to states, and we leverage the variation afforded by states' discretion in our empirical models.

Starting in 2014, the federal government generously subsidized states' expansions of Medicaid eligibility to most residents with incomes below 138% of the FPL; the threshold is 133% and there is an additional 5 percentage point disregard in both expansion and non-expansion states.[6] By 2017, 32 states, including the District of Columbia, had expanded their Medicaid programs under the ACA, and adults covered under this provision are referred to as 'newly eligible.' For the states that did not expand, the additional 5 percentage point disregard increased income eligibility thresholds for traditional groups by 5 percentage points of FPL over the state's March 2010 income thresholds, but populations that gained coverage through this increase are not termed 'newly eligible.'

Prior to the ACA, states had substantial discretion in deciding what services to cover in their Medicaid programs, and coverage of smoking cessation products varied considerably. The ACA attempted to increase and standardize covered medications within Medicaid. Of relevance to our study, the Act increased Medicaid coverage for prescription smoking cessation medications. Starting in January 2014, section 2502 of the Act required states to cover FDA-

[6] In most states, childless adults of any income level were not eligible for Medicaid prior to the ACA. At the start of 2010, only six states (Arizona, Delaware, Hawaii, Massachusetts, New York, and Vermont) were using federal waivers to offer full Medicaid benefits to childless adults, and although twelve states offered limited benefits to this population, many of these latter programs were closed to new applicants (Kaiser Commission on Medicaid and the Uninsured, 2009). Using the early expansion option of the ACA, five additional states (California, Connecticut, Minnesota, New Jersey and Washington) expanded eligibility to childless adults before 2014. In 2010, the District of Columbia, however, was the only jurisdiction to use the early expansion option to provide for full benefits to 200% of FPL; others had income thresholds below 138% FPL or limited eligibility to adults who were in older state-funded programs.

approved smoking cessation products for all Medicaid enrollees, both prescription and over-the-counter drugs. These products include the prescription drugs Zyban/bupropion (henceforth, 'Zyban') and Chantix/varenicline (henceforth, 'Chantix'), and nicotine replacement therapies (NRT) such as patches, gum, lozenges, nasal sprays, and inhalers (Food and Drug Administration, 2015). NRTs, depending on the specific drug, are available both over-the-counter and through formal prescriptions. The ACA does not regulate states' use of utilization management techniques, such as cost-sharing and pre-authorization, but it does encourage removing cost-sharing for tobacco cessation medications and services. Starting in January 2013, states that cover a full list of preventive services, including smoking cessation medications and services, without patient cost-sharing receive a small increase in federal funding for those services (Kaiser Commission on Medicaid and the Uninsured, 2012).

During the late 2000s and early 2010s, states increasingly covered smoking cessation counseling; counseling may change the use of medications, either by substituting for or encouraging medication adherence. In 2008, 24 states covered individual or group cessation counseling for all adults (Singleterry et al., 2014), rising to 38 states in 2012, typically without cost-sharing (Kaiser Commission on Medicaid and the Uninsured, 2012). In 2016, 17 of 32 expansion states covered counseling for the newly eligible (DiGiulio et al., 2016).[7] We explore the implications of these benefit expansions on our findings in a sensitivity analysis.

2.2 Conceptual framework

The Grossman (1972) model of the demand for health and healthcare services motivates our study. This model is a standard starting point for economic analyses of addictive goods, such

[7] Two additional changes over our study period in Medicaid are unlikely to confound our analysis. Free quitlines were available to all smokers, including Medicaid enrollees, so new Medicaid funding for quitlines may not be a confounder. The ACA also included funding for Medicaid Incentives for the Prevention of Chronic Disease (MIPCD) demonstration programs, which are too small to confound the results (RTI International, 2016).

as cigarettes (Maclean, Kessler, & Kenkel, 2016), and demand for related healthcare services (Cawley & Ruhm, 2012).[8] We focus on use of evidence-based smoking cessation prescription medications purchased through retail and online pharmacies.

In the Grossman model consumers do not demand healthcare services *per se*, but instead they demand the health improvements attributable to utilization of such services. In our study, consumers seeking to improve health by quitting their smoking addiction would plausibly demand smoking cessation prescription medications. Consumers maximize a utility function given the price of healthcare services (i.e., smoking cessation medications in our study) and other goods, preferences, a health endowment, a health production function, other factors that determine health such as education, and a budget constraint. Consumers are assumed to respond to healthcare price changes in a manner comparable to other goods and services. We investigate the effect of recent Medicaid expansions on demand for smoking cessation medications. Medicaid coverage – by reducing the out-of-pocket price – should, all else equal, increase the quantity of smoking cessation medications demanded by consumers.

While theory is clear that an insurance expansion, through the above-noted price mechanism, should increase the quantity of covered services demanded by consumers, there are several factors which may mute these effects. (i) Insurance does not always improve access as many providers do not accept Medicaid (Decker, 2012). While post-ACA evidence suggests access improved among the newly insured (Kirby & Vistnes, 2016) and low-income adults in general (Miller & Wherry, 2017; Simon, Soni, & Cawley, 2017; Sommers, Blendon, Orav, & Epstein, 2016; Wherry & Miller, 2016), physician participation in Medicaid continues to lag behind participation in private insurance (Polsky, Candon, Saloner, & et al., 2017). (ii) Among

[8] More recent studies that rely on the Grossman model apply economic insight offered by this model rather strictly adhering to the model specification (Cawley & Ruhm, 2012). We follow this recent tradition in our study.

providers that are willing to accept Medicaid patients, there is pre-ACA evidence that these providers have limited knowledge regarding the benefits covered by Medicaid (McMenamin, Halpin, Ibrahim, & Orleans, 2004). Relatedly, Medicaid patients themselves are largely unware of the smoking cessation medications covered by their insurance (McMenamin, Halpin, & Bellows, 2006). (iii) While smoking cessation can lead to health improvements, many smokers – for myriad reasons including utility derived from smoking – are simply not willing to stop smoking. (iv) *Ex ante* moral hazard suggests that by lowering smoking-attributable healthcare costs, insurance may incentivize individuals – who no longer face the full costs of their health behaviors – to delay or deter smoking cessation (Klick & Stratmann, 2006). However, the available evidence does not suggest that the ACA Medicaid expansions induced such *ex ante* moral hazard (Courtemanche, Marton, Ukert, Yelowitz, & Zapata, 2017; Simon et al., 2017). (v) If insurance acts as an in-kind income transfer to the newly insured, and if smoking is a normal good within this population (Kenkel, Schmeiser, & Urban, 2014), the newly insured may in fact *increase* smoking through standard income effects.

Thus, the question of whether, and to what extent, the recent ACA-related Medicaid expansions lead to increases in utilization of prescription smoking cessation medications is an empirical question. While our differences-in-differences methods will not allow us to explore these specific pathways, our objective is to provide evidence on the net effect. However, for policy purposes, understanding the net effect of Medicaid expansions is essential to assessing how well the ACA may have increased healthcare access and improved health.

2.3 Related literature

We review literature on the price elasticity of demand for smoking cessation medications, the effectiveness of smoking cessation medications, and briefly the related Medicaid literature.

2.3.1 Price-elasticity of demand for smoking cessation medications

While there is a substantial economic literature that estimates the elasticity of demand for cigarettes (Chaloupka & Warner, 2000; Decicca, Kenkel, Mathios, Shin, & Lim, 2008; Gallet & List, 2003; Maclean, Webber, & Marti, 2014; Pesko, Tauras, Huang, & Chaloupka, 2016; Tauras, Pesko, Huang, Chaloupka, & Farrelly, 2016), a relatively small set of studies has estimated price elasticities for smoking cessation medications. Tauras and Chaloupka (2003) estimate that the average own-price elasticity of demand for a nicotine patches and gum were -2.3 and -2.5 respectively, suggesting that smokers' demand for these products is highly elastic. Paterson, Boyle, Parmeter, Neumann, and De Civita (2008) and Marti (2012) show, using choice experiments, that smokers were less likely to choose a smoking cessation medication when its price was experimentally increased. While not formally estimating a price elasticity of demand, Keeler et al. (2002) document that when a smoking cessation medication became available over-the-counter, rather than requiring a prescription from a healthcare provider, the quantity demanded of this product increased. The authors hypothesize that the requirement of obtaining a prescription from a healthcare provider imposes costs on the smoker (e.g., healthcare provider fees, time) and that removing these costs acts to reduce the full price faced by patients.

2.3.2 Smoking cessation medication effectiveness

The effectiveness of medications in cessation attempts is well-established; therefore, expanding Medicaid eligibility may reduce smoking by increasing access to such medications. Without medications, most smokers attempt to quit using the 'cold turkey' method (i.e., without substantial preparation and unassisted by medication or counselling), which perhaps contributes to a long-term smoking cessation success rate of only 2.5% each year (Lillard, Plassmann, Kenkel, & Mathios, 2007). Indeed, a recent longitudinal study suggests that a current smoker

attempts to quit on average 30 times or more before successfully quitting for 1 year or longer (Chaiton et al., 2016).

The use of smoking cessation medications is known to lead to greater smoking abstinence than unassisted cessation – with prescriptions generally outperforming over-the-counter medications such as nicotine patches (Aubin et al., 2008; Biazzo et al., 2010; Cummings & Hyland, 2005; Ruger & Lazar, 2012; Stead et al., 2012; Zhu, Melcer, Sun, Rosbrook, & Pierce, 2000). Zyban and Chantix appear to be more effective than prescription NRTs: a recent meta-analysis found that Zyban (Chantix) helped 80% (50%) more tobacco users to quit than a placebo (Cahill, Stevens, Perera, & Lancaster, 2013).

While smoking cessation medications are more efficacious than non-prescription NRTs and informal cessation techniques (e.g., cold turkey), these medications are also expensive. In particular, they range from approximately $100 to $500 per prescription for an uninsured smoker, and generally require a formal prescription from a healthcare provider. Thus, lower income and uninsured smokers may have limited ability to access to these medications.[9]

2.3.3 Pre-ACA Medicaid expansions, prescription medication use, and smoking

Several studies have evaluated the effects of changes in pre-ACA Medicaid coverage on the use of smoking cessation medications and smoking outcomes. Collectively these studies suggest that Medicaid expansions increased utilization of smoking cessation medications and, in turn, reduced smoking. Importantly, because these studies have relied on Medicaid expansions that occurred prior to the ACA, and thus estimated effects among traditional Medicaid

[9] We conducted a non-systematic review of online sales of these medications for an uninsured smoker to retrieve our price estimates (e.g., https://www.goodrx.com/zyban; https://www.goodrx.com/chantix; https://www.goodrx.com/nicotrol; accessed April 26th, 2017).

populations, the extent to which these findings can generalize to the ACA's newly eligible adults is unclear. Nonetheless, these studies offer an important premise for our analysis.

Liu (2009) documents higher smoking cessation rates among non-elderly adult women residing in states with a higher composite index of Medicaid coverage for smoking cessation medications. Among current smokers, Liu (2010) shows that Medicaid coverage increased quit attempts while Greene, Sacks, and McMenamin (2014) find that reduced cost-sharing led to higher cessation rates among Medicaid recipients. Adams et al. (2013) and Jarlenski, Bleich, Bennett, Stuart, and Barry (2014) show that Medicaid participation and related enrollment and coverage policies reduced maternal smoking. Witman (2013) documents that expanded Medicaid coverage reduced smoking by 6% among low-income individuals who report ever smoking, with effects concentrated among mothers.

Finally, in arguably the most similar paper to our study, Richards et al. (2014) use all-payer insurance claims data from IMS Health between 1999 and 2012 to study how coverage expansions affect prescriptions for Zyban and Chantix. Specifically, the authors use variation in Medicaid coverage of smoking cessation prescription medications to identify that coverage increased utilization by 20 prescriptions per 10,000 persons.[10]

2.3.4 ACA Medicaid expansions, prescription medication use, and smoking

The early literature evaluating the ACA-related Medicaid expansions finds evidence that utilization of prescription medications increased, but there are no studies focused on smoking cessation medications.[11] In the first 15 months of expansion, Medicaid-financed prescription

[10] A limitation of the Richards study is that, due to data availability, the authors were not able to explore payer source (specifically, payer source was only available for a sub-set of the study period). Thus, the extent to which Medicaid, and not patients, financed these medications is unclear.

[11] We note that Young-Wolff et al. (2017) leverage a pre-post design to provide descriptive evidence that smoking cessation medication use increased post-expansion among Medicaid enrollees in the Kaiser Permanente Northern California system.

utilization increased by 19% in expansion states relative to non-expansion states (Ghosh, Simon, & Sommers, 2017). Wen, Hockenberry, Borders, and Druss (2017) show that utilization of Medicaid-financed buprenorphine (a medication used to treat opioid use disorder) prescriptions increased by 70% in expansion states relative to non-expansion states, after 2014. Maclean and Saloner (2017) find that use of Medicaid-financed medications used to treat a wider set of substance use disorders, all FDA-approved medications to treat alcohol and drug use disorders (but not tobacco use), increased by 33% in expansion states relative to non-expansion states.

In terms of smoking itself, the effects of the ACA Medicaid expansions are less clear. Simon et al. (2017) use a differences-in-differences design to examine the effects of expansion Medicaid over the first two years of the expansion. The Medicaid expansion reduced past 30-day smoking among childless adults by 6% in expansion states relative to non-expansion states. The authors hypothesize, but did not test, that coverage of smoking cessation medications contributed to this decline. Courtemanche et al. (2017), using the same data but a different identification strategy,[12] find no evidence that these expansions affected smoking.

3. Data, variables, and methods

3.1 Prescription medication data

Our primary dataset is the Medicaid State Drug Utilization Database (SDUD). The SDUD is compiled by the Centers for Medicaid and Medicare (CMS) from administrative data submitted by state Medicaid programs. The SDUD includes all states' data for outpatient prescription medications (initial fills and refills) covered under the Medicaid Drug Rebate Program for which Medicaid serves as a third-party payer (U.S. Department of Health and Human Services, 2012). Since 1992, state Medicaid programs have been required to submit data

[12] More specifically, the authors take a third difference based on pre-ACA insurance rates within a local area.

on the number and type of prescriptions filled and refilled each quarter to the Centers for Medicare & Medicaid Services (CMS) in exchange for federal matching funds.

We use data from 2011 to 2015 in our study, and thus we have 20 periods of data for each state: 12 pre-2014 and 8 post-2014.[13] While the SDUD has data from fee-for-service (FFS) Medicaid since 1992, prescription fills and refills obtained through managed care (MC) plans were added in March, 2010. We use data from 2011 onward in our analysis to ensure that we are able to include both FFS and MC data.[14] The ability to accurately measure MC data when analyzing the ACA Medicaid expansions is imperative, as a substantial share of the newly eligible were enrolled in MC plans (Kaiser Family Foundation, 2014a). We exclude five states – Arizona, Hawaii, Ohio, Rhode Island, and Virginia – that display odd missing data patterns.[15]

We focus on prescription medications approved by the FDA for smoking cessation (Food and Drug Administration, 2015): Zyban, Chantix, and Nicotrol (an NRT with inhaler and spray versions).[16,17] We create these categories using crosswalks between National Drug Codes (NDCs) for brand name and multiple generics obtained from the National Bureau of Economic Research.[18] Our main analysis combines all three drugs, but we also study each drug separately in an extension reported later in the manuscript.

---

[13] Only the first two quarters of 2016 were available, and we excluded them from the analysis to allow for data reporting lags (more details available on request from the authors); however, the results did not change when we included these quarters (not reported).
[14] Specifically, we aggregate data from both FFS and MC Medicaid to create a single quarter of data.
[15] Including the five states did not change our results in a meaningful way. Details available on request.
[16] Specific drug classifications that we use to identify these drugs are available on request from the corresponding author. Zyban can be used for multiple purposes including smoking cessation, depression, attention deficit disorder, obesity, and substance use (https://www.fda.gov/downloads/drugs/drugsafety/ucm089835.pdf (accessed March 31st, 2017). We wish to focus on Zyban that is prescribed to aid smoking cessation. Thus, in our main analyses we include the following drugs: proprietary name Zyban, Buproban, or bupropion, extended release, with the strength 150mg. In unreported analyses, we have applied more inclusive definitions which, we suspect, include Zyban prescriptions for other purposes. Results, available on request, are comparable, but less precisely estimated.
[17] The FDA has also approved several over-the-counter medications for smoking cessation. However, these medications are not regularly recorded in the SDUD as they do not require a formal prescription from a healthcare provider. Thus, we do not examine utilization of these medications in our study.
[18] http://www.nber.org/data/national-drug-code-data-ndc.html (accessed April 14th, 2017).

There are two main limitations of the SDUD data. (i) They capture aggregate counts of prescription initial fills and refills, and they do not provide information on patient or provider characteristics. (ii) They do not include rebates by manufacturers to the states. Nonetheless, these data allow us to study broad-level changes in prescription drug medication utilization within the Medicaid population.

3.2 Medicaid expansion data

Table 1 summarizes our classification of expansion states. The majority of expansion states implemented their expansion on January 1st, 2014, corresponding to the start of generous federal funding to states under the ACA. Two states expanded Medicaid later in 2014 (Michigan and New Hampshire). In addition, five states expanded in 2015 or 2016 (Alaska [9/1/2015], Indiana [2/1/2015], Louisiana [7/1/2016], Montana [1/1/2016], and Pennsylvania [1/1/2015]) and we refer to these states as 'late expansion states'. Prior to 2011, 4 states (Delaware, Massachusetts, New York, and Vermont) and the District of Columbia substantially expanded their Medicaid eligibility to cover both parents and childless adults with full Medicaid benefits up to 100% FPL or higher and remained open to new enrollees. The SDUD data are available at the quarter level, and thus we match Medicaid expansion dates to this dataset based on state-year-quarter. Our classification of expansion states follows Wherry and Miller (2016) and Simon et al. (2017), who conducted sensitivity analyses related to the states with substantial expansions before 2011.[19]

3.3 Outcome variables

[19] We also tested alternative specifications. We coded the states that had substantial pre-2011 expansions as expanding in 2014. We also use a coding scheme outlined in Maclean and Saloner (2017) and dropped states with substantial pre-2011 expansions (Wherry & Miller, 2016). Results are comparable and available on request.

We construct several variables that reflect Medicaid-financed use of FDA-approved smoking cessation prescription medications and program costs. More specifically, we construct the number of prescriptions filled and refilled for all three medications, Zyban, Chantix, and Nicotrol.[20] For these medications we construct total payments and Medicaid payments, which allows us to test medication financing. We convert all monetary variables to 2015 dollars using a Gross Domestic Product (GDP) deflator for healthcare costs (Dunn, Grosse, & Zuvekas, 2016).

We standardize the totals in a way that would help policymakers, regardless of the size of their own state, see the applicability of the results. For each state, we divide each outcome variable by the total population between the ages of 18 to 64 years of age[21] using data drawn from the American Community Survey (ACS) (Flood, King, Ruggles, & Warren, 2017) and the University of Kentucky Center for Poverty Research Center (2016). We first calculate the share of each states' population that is 18 to 64 years in the ACS, and second we multiply that share by the states' total population. We then use this number to construct the rate per 100,000 18-64 year olds in the state. Thus, state-specific estimated effect sizes can be obtained from our study by multiplying our estimated effects by each states' non-elderly adult population.

3.4 Control variables

Utilization of the smoking cessation medications is likely determined by a wide-range of factors that are independent of public health insurance expansions such as occurred with the ACA. We attempt to control for such factors in our empirical models (outlined later in the manuscript). Our primary objective of including these additional variables is to minimize concerns around omitted variable bias. Thus, our focus is on including variables that are

[20] The specific NDCs used for these outcomes are available on request.
[21] While children and elderly adults are also eligible for Medicaid, the 18-64 year-old population was the target population for the recent ACA Medicaid expansion.

plausibly associated with both our outcomes and the propensity of states to expand their Medicaid programs in conjunction with the ACA.

First, we merge in tobacco cigarette and electronic cigarette regulations: taxes and bans on use in public places (restaurants, bars, and private worksites) from the Centers for Disease Control and Prevention (2016) STATE System. These variables reflect the costs (both financial and non-financial) of related goods. For tobacco cigarettes we use the tax in dollars per package of 20 cigarettes. States that have chosen to implement an e-cigarette tax have not done so in a standardized method: some states levy excise taxes while other states levy ad valorem taxes. Thus, we simply consider an indicator for any e-cigarette tax. For public use bans, we construct separate variables for tobacco cigarettes and e-cigarettes that capture the count of the number of venues (restaurants, bars, and private worksites) in which a state imposes a ban on product use (thus, these variables range from zero to three).

Second, we merge in data on state-level demographics from the Annual and Social and Economic Supplement to the Current Population Survey (CPS): average age, sex (male and female), race (white, African American, and other race), Hispanic ethnicity, and education (less than college and some college). Third, we link the annual seasonally adjusted unemployment rate in the state from the Bureau of Labor Statistics Local Area Unemployment Database and the poverty rate (University of Kentucky Center for Poverty Research Center, 2016) to the SDUD.

Fourth, we control for state social policies that target lower income populations. These variables arguably proxy for state-level sentiment towards public programs aimed at these populations. To this end, we turn to the University of Kentucky Center for Poverty Research Center (2016) and we control for the maximum Temporary Assistance for Needy Families (TANF) benefit for a family of four, the maximum Supplementary Nutrition Assistance Program

(SNAP) benefit for a family of four, and the effective state minimum wage (i.e., the higher of the federal or state minimum wage). We also include an indicator for a Democratic governor (we treat the mayor of the District of Columbia as the *de facto* governor of this locality). We convert all financial variables to constant 2015 dollars using the above-noted GDP deflator.[22]

3.5 Empirical model

We follow the literature that investigates the effect of ACA-related Medicaid expansions on health and healthcare outcomes (Ghosh et al., 2017; Simon et al., 2017; Wherry & Miller, 2016), and apply a differences-in-differences (DD) regression model.

Our empirical model is outlined in Equation (1):

$$(1) \qquad C_{st} = \alpha_0 + \alpha_1 Expand_{st} + \alpha_2' X_{st} + S_s + \tau_t + \Omega_{st} + \varepsilon_{st}$$

C_{st} is a smoking cessation prescription medication variable in state *s* in period *t*. $Expand_{st}$ is an indicator for whether or not a state has expanded its Medicaid program under the ACA in quarter *t*. As described in Table 1, 5 states substantially expanded their Medicaid programs prior to 2011 and are classified as treated throughout the full period of our study, 22 states expanded in 2014, 5 states expanded in 2015, 19 states did not expand by 2015 and are classified as non-treated throughout the full time period, and 5 states are dropped due to data limitations.

X_{st} is a vector of state-year level characteristics.[23] S_s and τ_t are vectors of state and year-by-quarter fixed effects. Inclusion of state fixed effects allows us to control for time-invariant state-level factors that are unobservable (to the researcher) and implies that our regression models are identified off within state variation in Medicaid expansions (i.e., the changes outlined in Table 1) such as underlying state smoking propensity. Year-by-quarter fixed effects control

[22] We do not attempt to control for state-year smoking rates, a determinant of demand for smoking cessation, because smoking rates are very likely endogenous to the policy we study.

[23] Results are robust to excluding these state-year level controls, although not surprisingly the coefficient estimates generated in these more parsimonious models are larger in magnitude. These results are available on request.

for secular trends in smoking cessation medication utilization and expenditures that affect the nation as a whole (e.g., national anti-smoking campaigns and changes in the prices of cessation medications). We also include a vector of state-specific linear time trends (Ω_{st}). That is, we interact each state fixed effect with a linear time trend (1 for Q1 2011, 2 for Q2 2011, and so forth). Including these state trends allows each state to follow a separate, albeit linear, trend in outcomes and allows us to control for time-varying state-level unobservable (again to the researcher) factors. ε_{st} is the error term.

All regressions are unweighted (Solon, Haider, & Wooldridge, 2015). We cluster standard errors around the state (Bertrand, Duflo, & Mullainathan, 2004). The 46 clusters in our data (after dropping the above-noted 5 states with missing data) allow us to consistently estimate standard errors (Cameron & Miller, 2015). We estimate all regressions using OLS.

3.6 Validity of the research design

A necessary assumption for the DD model to recover causal estimates is that the treatment group (i.e., states with substantial expansions) and the comparison group (i.e., states without expansions) would follow the same trend in the post-treatment period, had the treatment states not been treated. However, this assumption is inherently untestable. We instead attempt to provide suggestive evidence on this assumption in two ways.

(i) We examine unadjusted trends in the pre-treatment period in our outcome variables for the treatment and comparison groups. If we find that the outcomes appear to trend similarly in the pre-treatment period across these groups, such trends provide suggestive evidence that the SDUD data satisfy the parallel trends assumption. (ii) Using only pre-treatment data, we estimate regression models similar to Equation (1), except that we replace the $Expand_{st}$

variable with an interaction between the treatment group ($Treat_s$) and a linear time trend ($Time_t$) (Akosa Antwi, Moriya, & Simon, 2013). This regression model is Equation (2):

$$(2) \qquad C_{st} = \gamma_0 + \gamma_1 Treat_s * Time_t + \gamma_2' X_{st} + S_s + \tau_t + \mu_{st}$$

If we cannot reject the null hypothesis that γ_1 is zero, then this finding provides further support that our SDUD data can satisfy the parallel trends assumption. Neither analyses, however, can assess pre-implementation trends in the states that expanded before 2011 (all the pre-ACA and early expansion states), because we lack reliable MC SDUD data before 2011. In both validity tests, we exclude states with substantial expansions before 2011 (see Table 1).

4. Results

4.1 Summary statistics

Table 2 reports summary statistics for both expansion and non-expansion states in the period 2011-2013. States with substantial expansions before 2011 are excluded from this comparison (see Table 1). We also report *p*-values from *t*-tests assessing the statistical significance of the differences between the two groups. The annual number of total smoking cessation medication prescription fills and refills per 100,000 non-elderly adults was 250 per quarter in expansion states and 208 per quarter in non-expansion states. Total payments per quarter on these medications was $15,375 per 100,000 in expansion states and $12,211 per 100,000 in non-expansion states. Medicaid paid the vast majority – 99% in expansion states and 98% in non-expansion states – of the costs of FDA-approved smoking cessation medications. The financial responsibility of Medicaid in the utilization of these medications is perhaps not surprising as the program is characterized by low patient cost-sharing.

We also report state-year level policies and demographics for expansion and non-expansion states in Table 2. While obviously not identical, the two groups of states look broadly

similar across these observed characteristics. However, there are some notable exceptions. On average, expansion states had higher tobacco cigarette taxes, more venue-specific smoking bans, lower poverty rates, and more generous social policies (e.g., higher effective minimum wages) and were more likely to have a Democrat governor than non-expansion states. We account for these state characteristics in all regression models.

4.2 Validity of the research design

We examine the key assumption of our DD models – parallel trends – in two ways. (i) We investigate unadjusted trends in each of our outcomes using graphical analysis. (ii) We estimate regression models described in Equation (2).

Figures 1 through 3 provide graphical analysis of trends in our three outcome variables: (i) smoking cessation prescription fills and refills, (ii) total payments, and (iii) Medicaid payments. We aggregate the data to the year-treatment level to smooth out noise (our regression analysis is conducted at the state-year-quarter-level, however).

In 2011-2013, the three variables appear to have moved broadly in parallel in the expansion and non-expansion states, which supports the hypothesis that the SDUD data satisfy the parallel trends assumption. However, in 2014-2015, we observe that the expansion and non-expansion states appeared to follow different trends. Overall, expansion states were relatively stable in terms of the number of prescription fills and refills reimbursed by Medicaid in the first and second year of the treatment, while non-expansion states appeared to trend *downwards* in reimbursed fills and refills in the second year of the treatment. On the other hand, beginning in 2014, both total and Medicaid payments appear to have increased in expansion states and decreased in non-expansion states.

We report regression-based parallel trends testing in Table 3, which shows estimates of Equation (2) for each outcome. We cannot reject the null hypothesis that expansion states and non-expansion states followed similar trends in outcomes in 2011-2013: γ_1 is not statistically different from zero in any regression. Moreover, the estimates of γ_1 are all small and relatively precise, which allows us to rule out moderate violations of the parallel trends assumption in 2011-2013. For example, in the prescription medication regression the estimate of γ_1 is 2, relative to a baseline mean of 250, and the standard error estimate is 2.

4.3 Regression results

Table 4 reports our main DD results for our outcome variables. We find that, post expansion, expansion states experienced an increase of 89 prescription fills and refills per 100,000 non-elderly adults per quarter relative to non-expansion states. Compared to the baseline mean in expansion states before expansion, this estimate reflects a 36% increase in utilization. In expansion states relative to non-expansion states, total payments on these medications per 100,000 per quarter increased by $4,241, or 28% after the expansion.

The costs of these medications were predominantly financed by state Medicaid programs and not patients: post expansion Medicaid payments rose by $4,295 per 100,000 non-elderly adults per quarter, or 28%, in expansion states relative to non-expansion states. In un-reported analyses, we have estimated the effect of these expansions on non-Medicaid payments, which largely capture patient copayments and other cost-sharing. The estimate on the expansion variable is small, negative, and imprecise, suggesting that the expansions did not lead to substantially increased payments for Medicaid patients.[24] Collectively, our findings from the

[24] However, the parallel pre-trends test was rejected for non-Medicaid payments; in particular, in 2011-2013, expansion states experienced moderate increases in non-Medicaid payments relative to non-expansion states ($21 per 100,000 state residents 18-64 years per quarter). Thus, we chose not to report these findings and encourage readers to interpret the findings with some caution.

SDUD show increased smoking cessation prescription use among the newly insured and that the newly insured were sheltered from bearing the full financial responsibility of these prescriptions.

While it is surprising that our estimates imply that Medicaid payments increased by $54 more than total payments, 95% confidence intervals for these estimates overlap, and therefore we cannot rule out the possibility that total payments increased more than Medicaid payments.[25]

4.4 Policy simulation

We next apply our coefficient estimates for total payments to simulate the direct financial impact of expanding coverage for smoking cessation medications to newly eligible populations for states that have not expanded Medicaid.[26] Specifically, we calculate the total payments for all three FDA-approved smoking cessation medications for these states in the 4th quarter of 2015 and multiply that number by our estimate for changes in total payments estimated in Table 4 (28%). This analysis, available on request, suggests that if all non-expansion states expanded eligibility, the increase in payments would be about $1.4 million per quarter.

5. Extensions and sensitivity analyses

We next estimate several extensions to the main analyses and conduct sensitivity analyses to explore the stability of our findings across a range of reasonable specifications.

5.1 Heterogeneity by prescription medication type

The three drugs in our analyses vary in how much state Medicaid programs pay pharmacies – the average cost for Zyban, Chantix, and Nicotrol is $42, $191, and $235, respectively, per fill or refill in the SDUD during our study period. The drugs also have different

[25] Results are not appreciably different, although somewhat larger in magnitude, if we remove the state-specific linear time trends from the regression model. Alternatively, if we include state-specific quadratic time trends in the regression model, results are largely unchanged, although the coefficient estimates are somewhat smaller and are less precise. Results are available on request. We lack sufficient degrees of freedom in the SDUD to include state-by-period fixed effects in the regression model.

[26] We do not include Virginia in as we found that this state displayed odd missing data patterns (see Section 3.1).

effectiveness (see Section 2.3.2), and side effects (Food and Drug Administration, 2015). These differences may lead to different effects of Medicaid expansion on medication utilization. We next explore such heterogeneity by estimating separate regressions for each medication.

Before we proceed to our heterogeneity analysis, we provide suggestive evidence that the SDUD can satisfy the parallel trends assumption for each smoking cessation medication separately.[27] Table 5A reports regression-based parallel trend testing – Equation (2) – for each medication-specific outcome we examine. As in the full sample (Table 3), we are unable to reject the null hypothesis that the expansion states and non-expansion states followed the same trend in these outcomes in the pre-expansion period. Moreover, the estimated coefficients on the interaction between Medicaid expansion variable and the linear time trend are again all small in magnitude relative to the baseline means.

DD regression model results are reported in Table 5B. Overall, we find that, relative to non-expansion states, prescription fills and refills and payments (total and Medicaid) for Zyban increased in expansion states, while the findings for Chantix and Nicotrol are more ambiguous.

In terms of Zyban, we find that, post-expansion, prescription fills and refills increased 40% in expansion states relative to non-expansion states while total (Medicaid) payments increased by 26% (28%). We note, as in the full sample results, while it is surprising that Medicaid payments increased by more than total payments, 95% confidence intervals surrounding the estimates do not allow us to reject the hypothesis that the increase was larger for total payments than Medicaid payments. Turning to Chantix, we find (albeit imprecise) evidence that, post-expansion, fills and refills increased by 17% in expansion states relative to non-expansion states. We also identify evidence that post-expansion both total and Medicaid

[27] Comparable to our testing of validity outlined in Section 3.6, we exclude states with substantial expansions prior to 2011 (see Table 1).

payments for Chantix increased by 32%. We find no statistically significant evidence that prescription fills or refills, or payments for Nicotrol increased in expansion states.

5.2 Event study

A general concern in analyses of health and healthcare policies, such as the ACA Medicaid expansions we investigate, is that state legislatures, concerned with deteriorating health or underutilization of healthcare services within the population, may implement policies to address these trends. In such a scenario, outcomes may lead to changes in policies rather than policies leading to changes in outcomes (i.e., a form of reverse causality at the state-year level).

To explore this possibility, we estimate an event study (Autor, 2003). More specifically, we estimate a variant of Equation (1) in which we include in the regression model a series of variables for each time period before and after expansion (policy leads and lags, respectively). More specifically, our policy leads and lags consist of interactions between period indicators for Q1 2011 through Q4 2015, and an indicator for expansion states. Q4 2013 is the omitted period in the event study. We omit the state-specific linear time trends following Wolfers (2006). We exclude states with substantial expansions before 2011 from this analysis (see Table 1).

If we find evidence that the coefficients on each quarter in the post period are statistically different from zero, this pattern in the data might suggest that our data are subject to policy endogeneity. However, in the event-study specification we condition on such endogeneity through the inclusion of the policy lead variables, thereby minimizing concerns regarding reverse causality bias and allowing us to recover causal estimates for the lags (i.e., treatment effects).

We report event study results graphically in Figures 4 (prescription fills and refills), 5 (total payments), and 6 (Medicaid payments). We report the coefficient estimates and associated 95% confidence intervals (which account for within state clustering) for each lead/lag. We use a

vertical line at Q1 2014 to separate the pre- and post-expansion periods. Specific coefficient and standard error estimates for each lead/lag variable are reported in Appendix Table 1.

Broadly, the event study findings are in line with estimates generated in the DD regression models. The coefficient estimates are in general small in magnitude before 2014 and then increase in magnitude beginning in 2014. Some of the 2011-2013 coefficients in the regressions rise to statistical significance; however, the estimates are both positive and negative, and are in nearly all cases only marginally statistically significant. Given the changes in sign of effects across regressions, we hypothesize that any trends are unrelated to the expansions.

Nonetheless, even if the data are subject to policy endogeneity, our event study allows us (as noted above) to control for this source of bias and recover causal estimates on the lags, which are the objects of interest. In terms of the post-expansion period, prescription fills and refills, and payments (total and Medicaid) appear to increase at the time of expansion, or shortly thereafter, perhaps as patients and providers take advantage of the expansion benefits. Use and payments appear to remain stable at the higher level beginning with the third quarter of 2014.

5.3 Population weighting

Our results thus far are unweighted following Solon et al. (2015). However, there is some controversy as to whether weighting is appropriate in studies that seek to estimate causal effects (Angrist & Pischke, 2009). Given this controversy, we re-estimate Equation (1) using population weights: specifically, we weight the regressions with the population ages 18 to 64 in each state. Results are reported in Table 6 and are not appreciably different from the unweighted results generated in our core model (Table 4).

5.4 Over-the-counter smoking cessation medications and counselling services

As mentioned earlier in the manuscript, the ACA Medicaid expansions increased coverage for both prescription and over-the-counter (OTC) smoking cessation medications, and counselling services. OTC medications and counselling services may act as compliments or substitutes to the prescription medications we study here. We are only able to measure prescription medications reliably in the SDUD. Therefore, our analysis thus far may be vulnerable to omitted variable bias.

To explore the potential importance of OTC medications and counselling services, we next re-estimate Equation (1) including an indicator variable for whether a state-year-quarter covers at least one FDA-approved over-the-counter cessation medication (i.e., nicotine gum, lozenge, or patch) or counselling service (individual or group). A concern with including this variable is that it may be an outcome of the expansions we study, and thus the estimates generated in these augmented regressions may be vulnerable to over-controlling bias (Angrist & Pischke, 2009). Such possible bias from over-controlling is a caveat to interpreting results generated in this analysis. Table 7 reports selected results. The coefficient estimates are not appreciably different from our core findings (Table 4).

5.5 Utilization management techniques

The ACA did not regulate state Medicaid program use of utilization management techniques (see Section 2.1). According to the CDC (2016), the most common forms of utilization management are copayments, annual duration limits, and prior authorization. There is concern among healthcare scholars that the use of such techniques may offset expansion effects (McAfee, Babb, McNabb, & Fiore, 2015). To explore this possibility, we estimate a variant of Equation (1) that includes an indicator that takes on a value of one if the state applies one of the above-noted utilization management techniques, and zero otherwise. Results, reported in Table

8, are not appreciably different from our core findings (Table 4), and suggest that utilization management techniques do not substantially offset expansion effects.[28,29]

6. Discussion

In this study we offer new evidence on the effects of the Affordable Care Act (ACA) Medicaid expansions, specifically we examine the use of prescription medications for smoking cessation. The ACA-related expansions increased Medicaid enrollment by 27% (Gates, Rudowitz, Artiga, & Snyder, 2016), and 38% of this population may smoke (DiGiulio et al., 2016). The expansions were therefore targeted at a group of adults with a high rate of uninsurance and smoking risk, and included a generous set of cessation medications. Our findings imply that, post-expansion, cessation medication fills and refills for which Medicaid was a third-party payer increased 36% in expansion states relative to non-expansion states, and this change was primarily driven by increased prescriptions for Zyban. In turn, payments for these medications increased by 28% in expansion states. These costs appear to be borne primarily by state Medicaid programs and not patients. Because the medications that we study require a formal prescription from a healthcare provider, our findings suggest that newly eligible smokers were able to see providers and effectively navigate the healthcare delivery system.

We can compare our findings with previous studies that have explored the early effects of the ACA Medicaid expansions. In perhaps the most related study in this line of literature, Simon et al. (2017), using a similar identification strategy, document a decline in past 30-day smoking of 6% among childless non-disabled adults in states that expanded Medicaid, relative to states

[28] In unreported analyses we have used different coding schemes for utilization management and the results, which are available on request, are not appreciably different.

[29] Using data from the CDC STATE system, we have explored the extent to which expansion states have complied with the ACA regulation that, post January 1st 2014, Medicaid must cover all three drugs that we study here. Overall, states appear to be broadly in compliance with this requirement. However, we did find evidence that several states were not fully compliant (i.e., did not cover all medications). In unreported analyses, we excluded non-compliant states from the analysis sample. Results are robust to this exclusion and are available on request.

that did not, over the first two years of the Medicaid expansion. Our study identifies increases in the utilization of evidence-based, FDA-approved smoking cessation medications as one possible mechanism explaining these declines in smoking; this pathway was hypothesized, but not tested, by Simon et al. (2017). Combining our estimate of a 36% increase in smoking cessation medications with the 6% reduction in smoking estimated by Simon and colleagues suggests a successful 30-day quit rate of 17%, which is within the range of successful 30-day quitting estimates derived from a meta-analysis (Hughes, Keely, & Naud, 2004). Thus, increased use of smoking cessation medications may explain some of the relationship between Medicaid expansion and smoking cessation identified by Simon et al. (2017).[30] Any such gains could increase over time as smoking cessation takes time, with many smokers requiring numerous cessation attempts before reaching smoking abstinence (Chaiton et al., 2016).

We can also compare our estimates to three recent studies that have explored the effect of Medicaid expansion on prescription drug use. Our finding of a 36% increase in Medicaid-financed smoking cessation medications is in the middle of estimates for the impact of the Medicaid expansion on prescription drugs in general and specific types of prescription drugs. Our finding is larger than an increase of 19% found for all Medicaid-financed prescriptions (in the first 15 months after the expansion) (Ghosh et al., 2017), but less than a 70% increase found for prescription drugs used to treat opioid use disorders (in the first 12 months post-expansion) (Wen et al., 2017) and comparable to a 33% increase found for all FDA-approved medications used to treat substance use disorders -- but not including tobacco use -- in the first 24 months post-expansion (Maclean & Saloner, 2017).

[30] We note that Courtemanche et al. (2017), using a third difference based on pre-ACA insurance rates within a local area, find no evidence that the Medicaid expansions led to changes in smoking outcomes. Our findings are more directly analogous to Simon et al. (2017) as both our study and this latter study apply a DD design.

Although several studies suggest Medicaid expansions have led to reductions in uninsurance, increased healthcare access and service use, improved health, and reduced financial instability (Hu, Kaestner, Mazumder, Miller, & Wong, 2016; Miller & Wherry, 2017; Simon et al., 2017; Wherry & Miller, 2016), the future direction of Medicaid is uncertain. Our study suggests that constraining Medicaid eligibility for the populations that gained access through the ACA-related expansions may reduce the use of smoking cessation medications. Reducing the use of such medications may in turn increase the total economic costs of smoking, currently estimated at $300B annually (Centers for Disease Control and Prevention, 2017).

In summary, our findings offer new evidence on the early effects of Medicaid expansions on smokers. In combination with previous analyses that have explored the effects of expansions on other behavioral health outcomes, Medicaid expansions appear to have been associated with increased access to evidence-based services to a particularly policy-relevant group: low-income Americans who suffer from tobacco use, a chronic, costly, and harmful health conditions. As the federal and state governments chart a new course for Medicaid, these results may help inform policymakers with respect to their decisions on the program.

Table 1. Substantial state Medicaid expansions: 2011-2017

State	Medicaid expansion date
States with substantial expansions before 2011	
Delaware	Before 2011
District of Columbia	Before 2011
Massachusetts	Before 2011
New York	Before 2011
Vermont	Before 2011
States with substantial expansions in 2011-2014	
Arizona [a,b]	1/1/2014
Arkansas	1/1/2014
California [c]	1/1/2014
Colorado	1/1/2014
Connecticut [d]	1/1/2014
Hawaii [b]	1/1/2014
Illinois	1/1/2014
Iowa	1/1/2014
Kentucky	1/1/2014
Maryland	1/1/2014
Michigan	4/1/2014
Minnesota [d]	1/1/2014
Nevada	1/1/2014
New Hampshire	8/15/2014
New Jersey [d]	1/1/2014
New Mexico	1/1/2014
North Dakota	1/1/2014
Ohio [b]	1/1/2014
Oregon	1/1/2014
Rhode Island [b]	1/1/2014
Washington [e]	1/1/2014
West Virginia	1/1/2014
Late expansion states (post-2014)	
Alaska	9/1/2015
Indiana	2/1/2015
Montana [f]	1/1/2016
Louisiana [f]	7/1/2016
Pennsylvania	1/1/2015

Notes: Medicaid expansion dates derived from Wherry and Miller (2016) and Simon et al. (2017). 'Substantial' expansions covered both parents and childless adults up to at least 100% FPL, were open to new enrollees, and provided full Medicaid benefits.

[a] Expanded eligibility prior to 2011 but closed to new enrollees in 2011.

[b] Excluded, with Virginia, from the analysis due to data quality issues.

[c] From 2011 through 2013, some but not all California counties expanded eligibility, and income eligibility thresholds varied by county.

[d] Expanded eligibility prior to 2014 but with low eligibility thresholds.

[e] Expanded eligibility prior to 2014 but only to people who had previously enrolled in a state program.

[f] Non-expansion during the entire study period, 2011-2015.

Table 2. Summary statistics for expansion and non-expansion states: SDUD 2011-2013

Sample:	Expansion states	Non-expansion states	Difference (*p*-value)*
*Outcome variables:***			
Prescription fills and refills per 100,000	250	208	0.0011
Total payments per 100,000 ($)	15,375	12,211	0.0009
Medicaid payments per 100,000 ($)	15,188	11,951	0.0006
State-year level regulations and characteristics			
Tobacco cigarette taxes per package ($)	1.588	1.019	0.0000
Smoking bans (restaurants, bars, and private worksites)	2.333	2	0.0006
Any e-cigarette tax	0.048	0	0.0006
Vaping bans (restaurants, bars, and private worksites)	0.238	0.100	0.0276
Age	37.70	37.30	0.0033
Female	0.508	0.510	0.0291
Male	0.492	0.490	0.0291
White	0.824	0.805	0.0250
African American	0.082	0.131	0.0000
Other race	0.094	0.064	0.0000
Hispanic	0.122	0.089	0.0003
College degree	0.271	0.241	0.0000
Unemployment rate	7.738	7.080	0.0001
Poverty rate	13.43	15.05	0.0000
Maximum monthly TANF benefit for a family of four ($)	593.7	424.0	0.0000
Maximum monthly SNAP benefit for a family of four ($)	705.4	698.9	0.0019
Effective minimum wage ($)	7.994	7.635	0.0000
Democratic governor	0.571	0.133	0.0000
Observations	252	240	

Notes: Unit of observation is the state-year-quarter. States with substantial expansions before 2011 excluded from the analysis (see Table 1).

*Two-tailed *t*-tests applied.

**All outcomes are converted to a rate per 100,000 persons 18 to 64 years.

Table 3. Parallel trends test for smoking cessation prescription medication outcomes: SDUD 2011-2013

Outcome:	Prescription fills and refills	Total payments	Medicaid payments
Mean value in expansion states, pre-expansion	250	$15,375	$15,188
Expansion state*time trend	2	141	120
	(2)	(227)	(225)
Observations	492	492	492

Notes: Unit of observation is the state-year-quarter. All outcomes are converted to a rate per 100,000 persons 18 to 64 years. All models control for smoking policies, demographics, social policies, and state and period fixed effects. Standard errors are clustered at the state level and are reported in parentheses. States with substantial expansions before 2011 excluded from the analysis (see Table 1).
***,**,* = statistically different from zero at the 1%,5%,10% level.

Table 4. Effect of Medicaid expansions on smoking cessation prescription medication outcomes using differences-in-differences model: SDUD 2011-2015

Outcome:	Prescription fills and refills	Total payments	Medicaid payments
Mean value in expansion states, pre-expansion	250	$15,375	$15,188
Expansion	89***	4,241**	4,295***
	(19)	(1,634)	(1,590)
Observations	920	920	920

Notes: Unit of observation is the state-year-quarter. All outcomes are converted to a rate per 100,000 persons 18 to 64 years. All models control for smoking policies, demographics, social policies, state-specific linear time trends, and state and period fixed effects. Standard errors are clustered at the state level and are reported in parentheses.
***,**,* = statistically different from zero at the 1%,5%,10% level.

Table 5A. Heterogeneity in parallel trends test for smoking cessation prescription medication outcomes: SDUD 2011-2015

Outcome:	Prescription fills and refills	Total payments	Medicaid payments
Mean value in expansion states, pre-expansion	205	$74,56	$73,44
Zyban	1	-5	-13
	(1)	(94)	(95)
Mean value in expansion states, pre-expansion	42	$7,351	$7,281
Chantix	1	134	119
	(2)	(194)	(190)
Mean value in expansion states, pre-expansion	3	$568	$563
Nicotrol	0	12	14
	(0)	(13)	(11)
Observations	492	492	492

Notes: Unit of observation is the state-year-quarter. All outcomes are converted to a rate per 100,000 persons 18 to 64 years. All models control for smoking policies, demographics, social policies, and state and period fixed effects. Standard errors are clustered at the state level and are reported in parentheses. States with substantial expansions before 2011 excluded from the analysis (see Table 1).
***,**,* = statistically different from zero at the 1%,5%,10% level.

Table 5B. Heterogeneity in Medicaid expansion effects on smoking cessation prescription medication outcomes using differences-in-differences models: SDUD 2011-2015

Outcome:	Prescription fills and refills	Total payments	Medicaid payments
Mean value in expansion states, pre-expansion	205	$7,456	$7,344
Zyban	83***	1,967***	2,023***
	(16)	(700)	(687)
Mean value in expansion states, pre-expansion	42	$7,351	$7,281
Chantix	7	2,335**	2,336**
	(7)	(1,112)	(1,085)
Mean value in expansion states, pre-expansion	3	$568	$563
Nicotrol	0	-61	-64
	(0)	(91)	(89)
Observations	920	920	920

Notes: Unit of observation is the state-year-quarter. All outcomes are converted to a rate per 100,000 persons 18 to 64 years. All models control for smoking policies, demographics, social policies, state-specific linear time trends, and state and period fixed effects. Standard errors are clustered at the state level and are reported in parentheses.
***,**,* = statistically different from zero at the 1%,5%,10% level.

Table 6. Effect of Medicaid expansions on smoking cessation prescription medication outcomes using differences-in-differences model and applying population weights: SDUD 2011-2015

Outcome:	Prescription fills and refills	Total payments	Medicaid payments
Weighted mean value in expansion states, pre-expansion	220	$13,436	$13,239
Expansion	85***	3,905**	3,989**
	(19)	(1,761)	(1,736)
Observations	920	920	920

Notes: Unit of observation is the state-year-quarter. All outcomes are converted to a rate per 100,000 persons 18 to 64 years. All models control for smoking policies, demographics, social policies, state-specific linear time trends, and state and period fixed effects. Regressions are weighted by the state population ages 18 to 64 years. Standard errors are clustered at the state level and are reported in parentheses.
***,**,* = statistically different from zero at the 1%,5%,10% level.

Table 7. Effect of Medicaid expansions on smoking cessation prescription medication outcomes using differences-in-differences model and controlling for other-the-counter medication and counselling service coverage+: SDUD 2011-2015

Outcome:	Prescription fills and refills	Total payments	Medicaid payments
Mean value in expansion states, pre-expansion	250	$15,375	$15,188
Expansion	91***	4,349**	4,398***
	(18)	(1,627)	(1,582)
Observations	916	916	916

Notes: Unit of observation is the state-year-quarter. All outcomes are converted to a rate per 100,000 persons 18 to 64 years. All models control for smoking policies, demographics, social policies, state-specific linear time trends, and state and period fixed effects. Over-the-counter medication policy data is missing for the District of Columbia. Standard errors are clustered at the state level and are reported in parentheses.
+ Over-the-counter medications include nicotine gum, patches, and lozenges. Counselling services include individual and group counselling.
***,**,* = statistically different from zero at the 1%,5%,10% level.

Table 8. Effect of Medicaid expansions on smoking cessation prescription medication outcomes using differences-in-differences model and controlling for utilization management techniques+: SDUD 2011-2015

Outcome:	Prescription fills and refills	Total payments	Medicaid payments
Mean value in expansion states, pre-expansion	250	$15,375	$15,188
Expansion	89***	4,240**	4,295***
	(19)	(1,630)	(1,587)
Observations	920	920	920

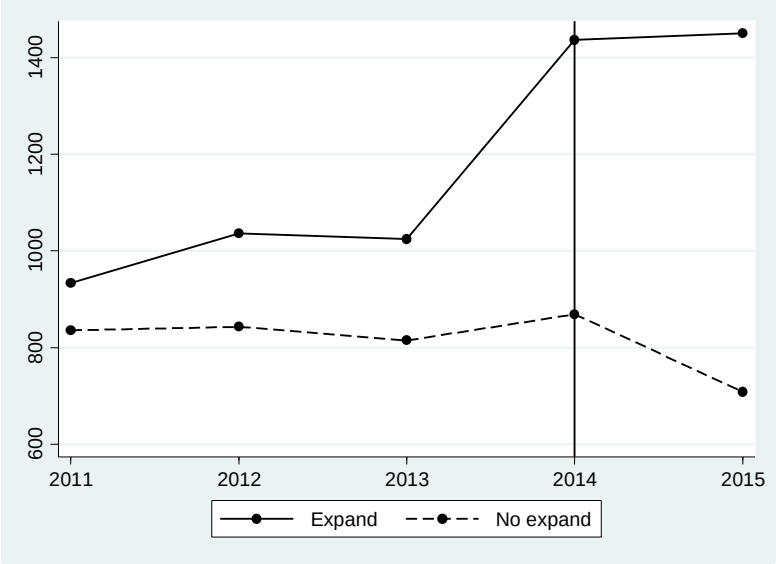
Notes: Unit of observation is the state-year-quarter. All outcomes are converted to a rate per 100,000 persons 18 to 64 years. All models control for smoking policies, demographics, social policies, state-specific linear time trends, and state and period fixed effects. Standard errors are clustered at the state level and are reported in parentheses.
+Utilization management techniques include co-payments, annual limits on duration, and prior authorization.
***,**,* = statistically different from zero at the 1%,5%,10% level.

Appendix Table 1. Effect of Medicaid expansions on smoking cessation prescription medication outcomes using an event study model: SDUD 2011-2015

Outcome:	Prescription fills and refills	Total payments	Medicaid payments
Mean value in expansion states, pre-expansion	250	$15,375	$15,188
Q1 2011	-20	-636	-508
	(27)	(2,818)	(2,789)
Q2 2011	-11	-480	-322
	(26)	(2,547)	(2,507)
Q3 2011	-56***	-3,899*	-3,731*
	(20)	(2,220)	(2,192)
Q4 2011	-25	-1,849	-1,699
	(19)	(2,235)	(2,211)
Q1 2012	3	-31	42
	(19)	(1,753)	(1,714)
Q2 2012	12	655	663
	(20)	(1,688)	(1,674)
Q3 2012	4	69	0
	(18)	(1,540)	(1,473)
Q4 2012	-6	280	230
	(10)	(714)	(697)
Q1 2013	13	1,988*	1,941*
	(13)	(1,032)	(1,029)
Q2 2013	-6	1,221	1,111
	(13)	(985)	(966)
Q3 2013	10	1,567*	1,579*
	(8)	(822)	(812)
Q1 2014	34*	1,487	1,432
	(19)	(1,310)	(1,293)
Q2 2014	72**	4,071	3,998
	(35)	(2,634)	(2,577)
Q3 2014	146***	8,372***	8,220***
	(43)	(2,885)	(2,856)
Q4 2014	149***	7,662***	7,502***
	(34)	(2,664)	(2,619)
Q1 2015	143***	8,359**	8,248**
	(35)	(3,217)	(3,175)
Q2 2015	159***	9,519***	9,413***
	(35)	(2,777)	(2,763)
Q3 2015	149***	8,631***	8,562***
	(31)	(2,371)	(2,365)
Q4 2015	167***	7,122***	7,035***
	(32)	(1,759)	(1,744)
Observations	820	820	820

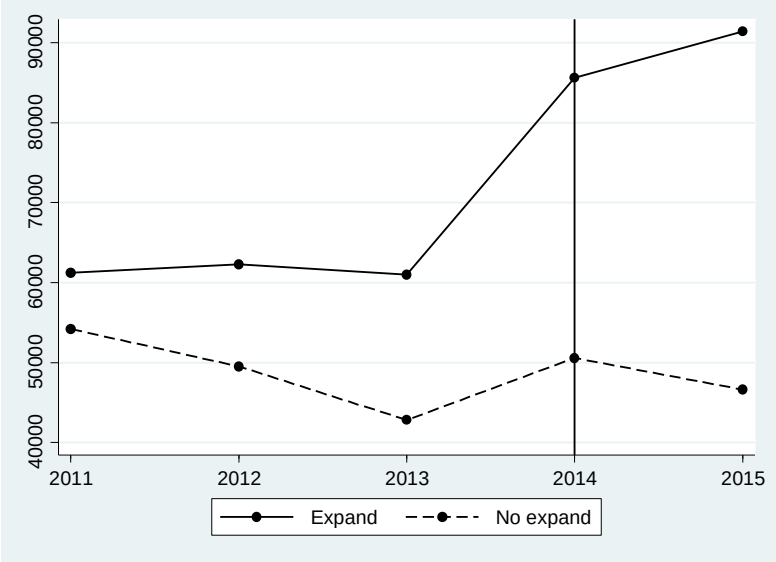
Notes: Unit of observation is the state-year-quarter. All outcomes are converted to a rate per 100,000 persons 18 to 64 years. All models control for smoking policies, demographics, social policies, and state and period fixed effects. Reference period is Q4 2013. Standard errors are clustered at the state level and are reported in parentheses. States with substantial expansions before 2011 excluded from the analysis (see Table 1).
***,**,* = statistically different from zero at the 1%,5%,10% level.

Figure 1. Trends in smoking cessation medication Prescription fills and refills per 100,000: SDUD 2011-2015



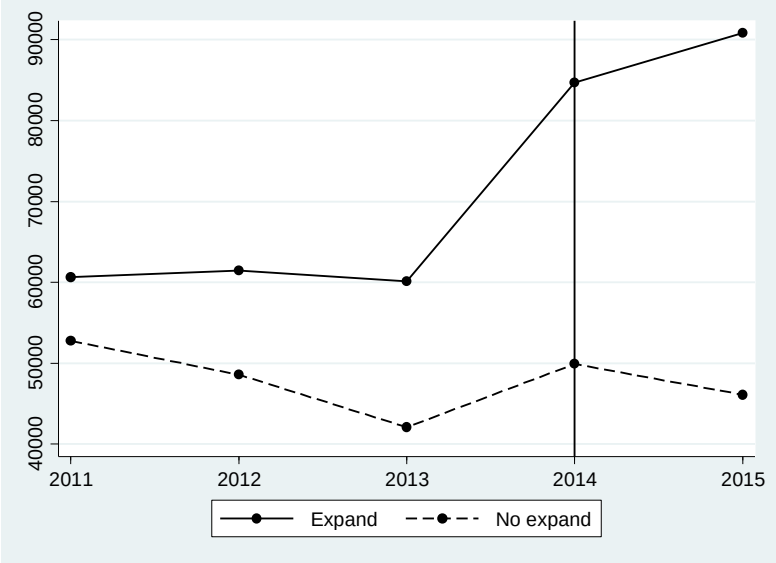
Notes: Unit of observation is the expansion-year. All outcomes are converted to a rate per 100,000 persons 18 to 64 years. States with substantial expansions before 2011 excluded from the analysis (see Table 1).

Figure 2. Trends in smoking cessation medication total payments per 100,000: SDUD 2011-2015



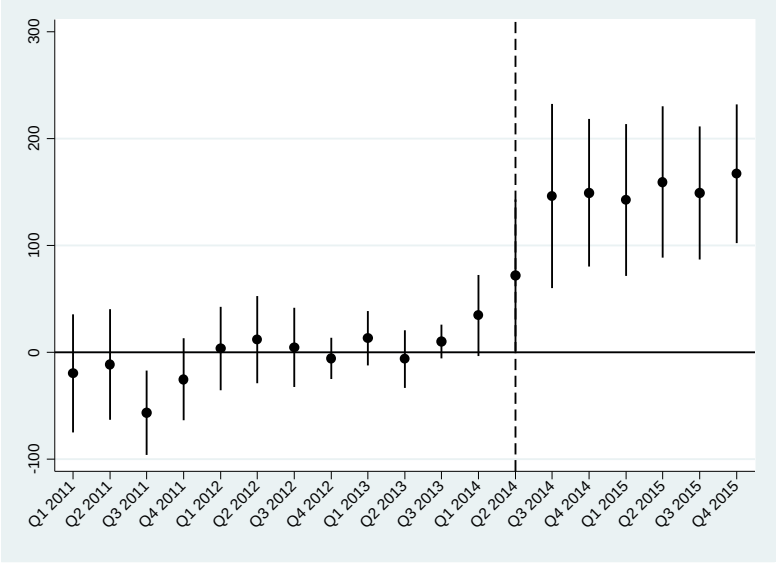
Notes: Unit of observation is the expansion-year. All outcomes are converted to a rate per 100,000 persons 18 to 64 years. States with substantial expansions before 2011 excluded from the analysis (see Table 1).

Figure 3. Trends in smoking cessation medication Medicaid program payments per 100,000: SDUD 2011-2015



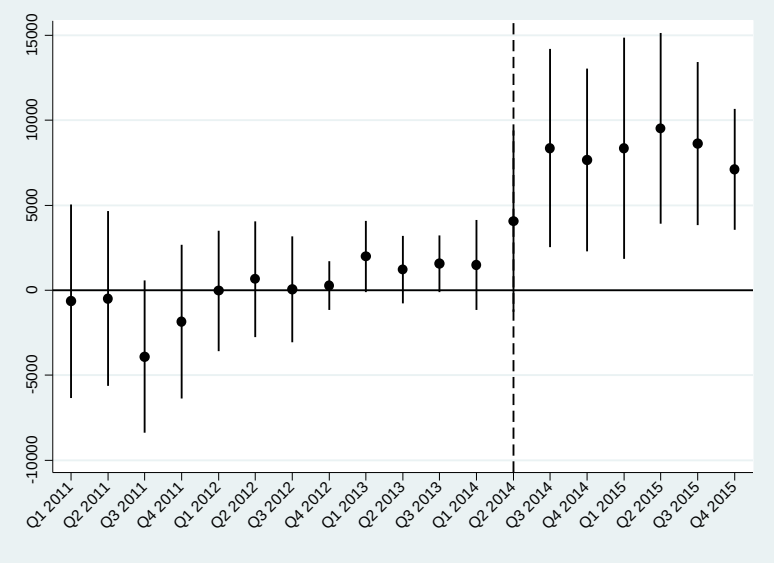
Notes: Unit of observation is the expansion-year. All outcomes are converted to a rate per 100,000 persons 18 to 64 years. States with substantial expansions before 2011 excluded from the analysis (see Table 1).

Figure 4. Effect of Medicaid expansions on smoking cessation prescription fills and refills per 100,000 using an event study model: SDUD 2011-2015



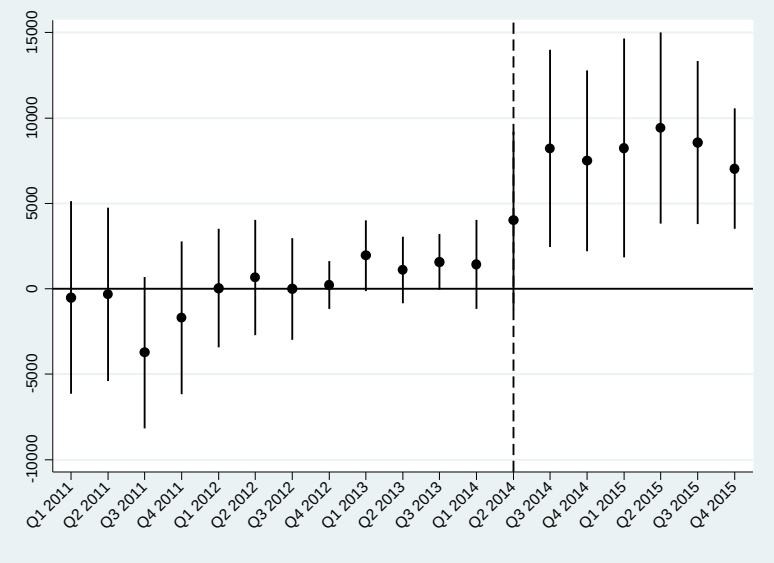
Notes: Unit of observation is a state-year-quarter. All outcomes are converted to a rate per 100,000 persons 18 to 64 years. Event dummy variables include each year-quarter cell between Q1 2011 and Q4 2014, the omitted category is Q4 2013. All models control for smoking policies, demographics, social policies, and state and period fixed effects. 95% confidence intervals account for state-level clustering and are reported in vertical bars. States with substantial expansions before 2011 excluded from the analysis (see Table 1). N=800. See Appendix Table 1 for coefficient and standard error estimates.

Figure 5. Effect of Medicaid expansions on smoking cessation total payments per 100,000 using an event study model: SDUD 2011-2015



Notes: Unit of observation is a state-year-quarter. All outcomes are converted to a rate per 100,000 persons 18 to 64 years. Event dummy variables include each year-quarter cell between Q1 2011 and Q4 2014, the omitted category is Q4 2013. All models control for smoking policies, demographics, social policies, and state and period fixed effects. 95% confidence intervals account for state-level clustering and are reported in vertical bars. States with substantial expansions before 2011 excluded from the analysis (see Table 1). N=800. See Appendix Table 1 for coefficient and standard error estimates.

Figure 6. Effect of Medicaid expansions on Medicaid payments per 100,000 using an event study model: SDUD 2011-2015



Notes: Unit of observation is a state-year-quarter. All outcomes are converted to a rate per 100,000 persons 18 to 64 years. Event dummy variables include each year-quarter cell between Q1 2011 and Q4 2014, the omitted category is Q4 2013. All models control for smoking policies, demographics, social policies, and state and period fixed effects. 95% confidence intervals account for state-level clustering and are reported in vertical bars. States with substantial expansions before 2011 excluded from the analysis (see Table 1). N=800. See Appendix Table 1 for coefficient and standard error estimates.

References

Adams, E. K., Markowitz, S., Dietz, P. M., & Tong, V. T. (2013). Expansion of Medicaid covered smoking cessation services: Maternal smoking and birth outcomes. Medicare & Medicaid Research Review, 3(3), E1–E23.

Akosa Antwi, Y., Moriya, A. S., & Simon, K. (2013). Effects of federal policy to insure young adults: Evidence from the 2010 Affordable Care Act's dependent-coverage mandate. American Economic Journal: Economic Policy, 5(4), 1-28.

Angrist, J. D., & Pischke, J. (2009). Mostly Harmless Econometrics: An Empiricist's Companion. Princeton, NJ: Princeton University Press.

Aubin, H.-J., Bobak, A., Britton, J. R., Oncken, C., Billing, C. B., Gong, J., et al. (2008). Varenicline versus transdermal nicotine patch for smoking cessation: Results from a randomised open-label trial. Thorax, 63(8), 717-724.

Autor, D. H. (2003). Outsourcing at will: The contribution of unjust dismissal doctrine to the growth of employment outsourcing. Journal of Labor Economics, 21(1), 1-42.

Bertrand, M., Duflo, E., & Mullainathan, S. (2004). How much should we trust differences-in-differences estimates? Quarterly Journal of Economics, 119(1), 249-275.

Biazzo, L. L., Froshaug, D. B., Harwell, T. S., Beck, H. N., Haugland, C., Campbell, S. L., et al. (2010). Characteristics and abstinence outcomes among tobacco quitline enrollees using varenicline or nicotine replacement therapy. Nicotine & Tobacco Research, 12(6), 567-573.

Cahill, K., Stevens, S., Perera, R., & Lancaster, T. (2013). Pharmacological interventions for smoking cessation: An overview and network meta-analysis. The Cochrane Library(5).

Cameron, C. A., & Miller, D. L. (2015). A practitioner’s guide to cluster-robust inference. Journal of Human Resources, 50(2), 317-372.

Cawley, J., & Ruhm, C. (2012). The economics of risky health behaviors. In M. V. Pauly, T. G. Mcguire, & P. P. Barros (Eds.), Handbook of Health Economics (Vol. 2, pp. 95-199): North Holland.

Centers for Disease Control and Prevention. (2016). CDC STATE System.

Centers for Disease Control and Prevention. (2010). How tobacco smoke causes disease: The biology and behavioral basis for smoking-attributable disease: A report of the Surgeon General (No. 0160840783). Atlanta, GA: Center for Disease Control and Prevention.

Centers for Disease Control and Prevention. (2017). Smoking & tobacco use: Fast facts and facts sheets. Atlanta, GA: Centers for Disease Control and Prevention.

Chaiton, M., Diemert, L., Cohen, J. E., Bondy, S. J., Selby, P., Philipneri, A., et al. (2016). Estimating the number of quit attempts it takes to quit smoking successfully in a longitudinal cohort of smokers. BMJ Open, 6(6).

Chaloupka, F. J., & Warner, K. E. (2000). The economics of smoking. In A. J. Culyer & J. P. Newhouse (Eds.), Handbook of Health Economics (Vol. 1, pp. 1539-1627).

Courtemanche, C., Marton, J., Ukert, B., Yelowitz, A., & Zapata, D. (2017). Early effects of the Affordable Care Act on healthcare access, risky health behaviors, and self-assessed health (No. 23269). Cambridge, MA.

Cummings, K. M., & Hyland, A. (2005). Impact of nicotine replacement therapy on smoking behavior. Annual Review of Public Health 26, 583-599.

Decicca, P., Kenkel, D., Mathios, A., Shin, Y. J., & Lim, J. Y. (2008). Youth smoking, cigarette prices, and anti-smoking sentiment. Health Economics, 17(6), 733-749.

Decker, S. L. (2012). In 2011 nearly one-third of physicians said they would not accept new Medicaid patients, but rising fees may help. Health Affairs, 31(8), 1673-1679.
DiGiulio, A., Haddix, M., Jump, Z., Babb, S., Schecter, A., Williams, K.-A. S., et al. (2016). State Medicaid expansion tobacco cessation coverage and number of adult smokers enrolled in expansion coverage—United States, 2016. Morbidity and Mortality Weekly Report (MMWR), 65(48), 1364–1369.
Dunn, A., Grosse, S. D., & Zuvekas, S. H. (2016). Adjusting health expenditures for inflation: A review of measures for health services research in the United States. Health Services Research, In press.
Flood, S., King, M., Ruggles, S., & Warren, J. R. (2017). Integrated public use microdata series, Current Population Survey (4 ed.). Minneapolis, MN.
Food and Drug Administration. (2015). FDA 101: Smoking cessation products. Silver Spring, MD: Food and Drug Administration.
Gallet, C. A., & List, J. A. (2003). Cigarette demand: A meta-analysis of elasticities. Health Economics, 12(10), 821-835.
Gates, A., Rudowitz, R., Artiga, S., & Snyder, L. (2016). Two year trends in Medicaid and CHIP enrollment data: Findings from the CMS Performance Indicator Project. Washtington, DC: Kaiser Family Foundation.
Ghosh, A., Simon, K., & Sommers, B. D. (2017). The effect of state Medicaid expansions on prescription drug use: Evidence from the Affordable Care Act (No. 23044). Cambridge, MA: National Bureau of Economic Research.
Greene, J., Sacks, R. M., & McMenamin, S. B. (2014). The impact of tobacco dependence treatment coverage and copayments in Medicaid. American Journal of Preventive Medicine, 46(4), 331-336.
Grossman, M. (1972). On the concept of health capital and the demand for health. Journal of Political Economy, 80(2), 223-255.
Hu, L., Kaestner, R., Mazumder, B., Miller, S., & Wong, A. (2016). The effect of the Patient Protection and Affordable Care Act Medicaid expansions on financial well-being (No. 22170). Cambridge, MA: National Bureau of Economic Research.
Hughes, J. R., Keely, J., & Naud, S. (2004). Shape of the relapse curve and long-term abstinence among untreated smokers. Addiction, 99(1), 29-38.
Jarlenski, M., Bleich, S. N., Bennett, W. L., Stuart, E. A., & Barry, C. L. (2014). Medicaid enrollment policy increased smoking cessation among pregnant women but had no impact on birth outcomes. Health Affairs, 33(6), 997-1005.
Kaiser Commission on Medicaid and the Uninsured. (2012). Coverage of preventive services for adults in Medicaid. Washington, DC: Kaiser Family Foundation.
Kaiser Commission on Medicaid and the Uninsured. (2009). Expanding health coverage for low-income adults: filling the gaps in Medicaid eligibility. Washington, DC: Kaiser Family Foundation.
Kaiser Family Foundation. (2014a). Total Medicaid managed care enrollment: 2014.
Kaiser Family Foundation. (2014b). Understanding how states access the ACA enhanced Medicaid match rates. Washington, DC: Kaiser Family Foundation.
Keeler, T. E., Hu, T. W., Keith, A., Manning, R., Marciniak, M. D., Ong, M., et al. (2002). The benefits of switching smoking cessation drugs to over-the-counter status. Health Economics, 11(5), 389-402.

Kenkel, D. S., Schmeiser, M. D., & Urban, C. (2014). Is smoking inferior? Evidence from variation in the Earned Income Tax Credit. Journal of Human Resources, 49(4), 1094-1120.
Kirby, J. B., & Vistnes, J. P. (2016). Access to care improved for people who gained Medicaid or marketplace coverage in 2014. Health Affairs, 35(10), 1830-1834.
Klick, J., & Stratmann, T. (2006). Subsidizing addiction: Do state health insurance mandates increase alcohol consumption? Journal of Legal Studies, 35(1), 175-198.
Lillard, D. R., Plassmann, V., Kenkel, D., & Mathios, A. (2007). Who kicks the habit and how they do it: Socioeconomic differences across methods of quitting smoking in the USA. Social Science & Medicine, 64(12), 2504-2519.
Liu, F. (2009). Effect of Medicaid coverage of tobacco-dependence treatments on smoking cessation. International Journal of Environmental Research and Public Health, 6(12), 3143-3155.
Liu, F. (2010). Quit attempts and intention to quit cigarette smoking among Medicaid recipients in the USA. Public Health, 124(10), 553-558.
Maclean, J. C., Kessler, A. S., & Kenkel, D. S. (2016). Cigarette taxes and older adult smoking: Evidence from the Health and Retirement Study. Health Economics, 25(4), 424-438.
Maclean, J. C., & Saloner, B. (2017). The effect of public insurance expansions on substance use disorder treatment: Evidence from the Affordable Care Act (No. 23342). Cambridge, MA: National Bureau of Economic Research
Maclean, J. C., Webber, D., & Marti, J. (2014). An application of unconditional quantile regression to cigarette taxes. Journal of Policy Analysis and Management, 33(1), 188-210.
Marti, J. (2012). Assessing preferences for improved smoking cessation medications: A discrete choice experiment. The European Journal of Health Economics, 13(5), 533-548.
McAfee, T., Babb, S., McNabb, S., & Fiore, M. C. (2015). Helping smokers quit—opportunities created by the Affordable Care Act. New England Journal of Medicine, 372(1), 5-7.
McMenamin, S. B., Halpin, H. A., & Bellows, N. M. (2006). Knowledge of Medicaid coverage and effectiveness of smoking treatments. American Journal of Preventive Medicine, 31(5), 369-374.
McMenamin, S. B., Halpin, H. A., Ibrahim, J. K., & Orleans, C. T. (2004). Physician and enrollee knowledge of Medicaid coverage for tobacco dependence treatments. American Journal of Preventive Medicine, 26(2), 99-104.
Miller, S., & Wherry, L. R. (2017). Health and access to care during the first 2 years of the ACA Medicaid expansions. New England Journal of Medicine, 376(10), 947-956.
National Center for Health Statistics. (2017). Age-adjusted percentages (with standard errors) of current cigarette smoking status among adults aged 18 and over, by selected characteristics: United States, 2015 Atlanta, GA: National Center for Health Statistics.
National Center for Health Statistics. (2014). Summary health statistics: National Health Interview Survey, 2013. Atlanta, GA: National Center for Health Statistics,.
Paterson, R. W., Boyle, K. J., Parmeter, C. F., Neumann, J. E., & De Civita, P. (2008). Heterogeneity in preferences for smoking cessation. Health Economics, 17(12), 1363-1377.
Pesko, M. F., Tauras, J. A., Huang, J., & Chaloupka, F. J. (2016). The influence of geography and measurement in estimating cigarette price responsiveness (No. 22296). Cambridge, MA: National Bureau of Economic Research.

Polsky, D., Candon, M., Saloner, B., & et al. (2017). Changes in primary care access between 2012 and 2016 for new patients with Medicaid and private coverage. JAMA Internal Medicine, 177(4), 588-590.
Richard, P., West, K., & Ku, L. (2012). The return on investment of a Medicaid tobacco cessation program in Massachusetts. PLoS One, 7(1), e29665.
Richards, M., Marti, J., Maclean, J. C., Fletcher, J., & Kenkel, D. (2014). In Tobacco control and smoking outcomes: New evidence from pharmaceuticals. Paper presented at the 2014 Association for Public Policy and Management Fall Research Conference, Albuquerque, NM.
RTI International. (2016). Independent assessment report: Medicaid incentives for prevention of chronic diseases evaluation. Research Triangle Park, NC: RTI International.
Ruger, J. P., & Lazar, C. M. (2012). Economic evaluation of pharmaco-and behavioral therapies for smoking cessation: A critical and systematic review of empirical research. Annual Review of Public Health, 33, 279-305.
Simon, K., Soni, A., & Cawley, J. (2017). The impact of health insurance on preventive care and health behaviors: Evidence from the first two years of the ACA Medicaid expansions. Journal of Policy Analysis and Management, 36(2), 390-417.
Singleterry, J., Jump, Z., Lancet, E., Babb, S., MacNeil, A., Zhang, L., et al. (2014). State Medicaid coverage for tobacco cessation treatments and barriers to coverage—United States, 2008–2014. Morbidity and Mortality Weekly Report (MMWR), 63(12), 264-269.
Solon, G., Haider, S. J., & Wooldridge, J. M. (2015). What are we weighting for? Journal of Human Resources, 50(2), 301-316.
Sommers, B. D., Blendon, R. J., Orav, E., & Epstein, A. M. (2016). Changes in utilization and health among low-income adults after Medicaid expansion or expanded private insurance. JAMA Internal Medicine, 176(10), 1501-1509.
Sonier, J., Boudreaux, M. H., & Blewett, L. A. (2013). Medicaid 'welcome-mat' effect of Affordable Care Act implementation could be substantial. Health Affairs, 32(7), 1319-1325.
Stead, L. F., Perera, R., Bullen, C., Mant, D., Hartmann-Boyce, J., Cahill, K., et al. (2012). Nicotine replacement therapy for smoking cessation. The Cochrane Library, 11.
Tauras, J. A., & Chaloupka, F. J. (2003). The demand for nicotine replacement therapies. Nicotine & Tobacco Research, 5(2), 237-243.
Tauras, J. A., Pesko, M. F., Huang, J., Chaloupka, F. J., & Farrelly, M. C. (2016). The effect of cigarette prices on cigarette sales: Exploring heterogeneity in price elasticities at high and low prices (No. 22251). Cambridge, MA: National Bureau of Economic Research.
U.S. Department of Health and Human Services. (2012). States' collection of rebates for drugs paid through Medicaid managed care organizations (No. OEI-03-11-00480). Washington, DC: U.S. Department of Health and Human Services, Office of Inspector General.
University of Kentucky Center for Poverty Research Center. (2016). State level data of economic, political, and transfer program information for 1980-2015. Lexington, KY.
Warren, G. W., Alberg, A. J., Kraft, A. S., & Cummings, K. M. (2014). The 2014 Surgeon General's report:"The health consequences of smoking–50 Years of progress": A paradigm shift in cancer care. Cancer, 120(13), 1914-1916.
Wen, H., Hockenberry, J. M., Borders, T. F., & Druss, B. G. (2017). Impact of Medicaid expansion on Medicaid-covered utilization of Buprenorphine for opioid use disorder treatment. Medical Care, 55(4), 336-341.

Wherry, L. R., & Miller, S. (2016). Early coverage, access, utilization, and health effects associated with the affordable care act medicaid expansions: A quasi-experimental study. Annals of Internal Medicine, 164(12), 795-803.
Witman, A. (2013). Medicaid coverage of smoking cessation treatment and smoking behavior.Unpublished manuscript.
Wolfers, J. (2006). Did unilateral divorce laws raise divorce rates? A reconciliation and new results. American Economic Review, 96(5), 1802-1820.
Xu, X., Bishop, E. E., Kennedy, S. M., Simpson, S. A., & Pechacek, T. F. (2015). Annual healthcare spending attributable to cigarette smoking: An update. American Journal of Preventive Medicine, 48(3), 326-333.
Young-Wolff, K. C., Klebaner, D., Campbell, C. I., Weisner, C., Satre, D. D., & Adams, A. S. (2017). Association of the Affordable Care Act with smoking and tobacco treatment utilization among adults newly enrolled in health care. Medical Care, 55(5), 535-541.
Zhu, S. H., Melcer, T., Sun, J., Rosbrook, B., & Pierce, J. P. (2000). Smoking cessation with and without assistance: A population-based analysis. American Journal of Preventive Medicine, 18(4), 305-311.