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ABSTRACT

This study provides a national analysis of how the 2014 Affordable Care Act (ACA) Medicaid expansions have affected aggregate prescription drug utilization. Given the prominent role of prescription medications in the management of chronic conditions, as well as the high prevalence of unmet health care needs in the population newly eligible for Medicaid, the use of prescription drugs represents an important measure of the ACA's policy impact. Prescription drug utilization also provides insights into whether insurance expansions have increased access to physicians, since obtaining these medications requires interaction with a health care provider. We use 2013-2015 data from a large, nationally representative, all-payer pharmacy transactions database to examine effects on overall prescription medication utilization as well as effects within specific drug classes. Using a differences-in-differences (DD) regression framework, we find that within the first 15 months of expansion, Medicaid-paid prescription utilization increased by 19 percent in expansion states relative to states that did not expand; this works out to approximately seven additional prescriptions per year per newly enrolled beneficiary. The greatest increases in Medicaid prescriptions occurred among diabetes medications, which increased by 24 percent. Other classes of medication that experienced relatively large increases include contraceptives (22 percent) and cardiovascular drugs (21 percent), while several classes more consistent with acute conditions such as allergies and infections experienced significantly smaller increases. As a placebo test, we examine Medicare-paid prescriptions and find no evidence of a post-ACA effect. Both expansion and non-expansion states followed statistically similar trends in Medicaid prescription utilization in the pre-policy era, offering support for our DD approach. We did not observe reductions in uninsured or privately insured prescriptions, suggesting that increased utilization under Medicaid did not substitute for other forms of payment. Within expansion states, increases in prescription drug utilization were larger in geographical areas with higher uninsured rates prior to the ACA. Finally, we find some suggestive evidence that increases in prescription drug utilization were greater in areas with larger Hispanic and black populations.

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1. Introduction

The passage of the Affordable Care Act (ACA) in 2010 and the subsequent implementation of Medicaid expansions have resulted in the largest coverage gain among non-elderly adults since the program's inception in 1965. While the 2012 Supreme Court ruling made Medicaid expansion under the ACA a voluntary decision for states, 31 states plus the District of Columbia have adopted the expansions. With nearly 15 million new enrollees obtaining Medicaid coverage between 2013 and 2016, according to the U.S. Department of Health and Human Services, Medicaid now covers more than 72 million Americans. This represents a 26.5 percent increase in the number of individuals covered by Medicaid relative to 2013 enrollment levels. Not only has this large growth in the Medicaid program led to intense public policy debate, but it also provides researchers with an opportunity to understand the responsiveness of health care use to insurance expansions.

Prescription drugs are one of the most widely used forms of medical care in the U.S., with nearly one out of every two Americans consuming at least one prescription drug in a month (National Center for Health Statistics, 2016). At the same time, health insurance coverage appears to be an important determinant of access to such treatments, partly because the patient must first obtain access to a physician. Non-elderly adults without coverage are four times more likely than their insured counterparts to report foregoing needed prescription drugs due to cost (National Center for Health Statistics, 2016). In recent years, the high prices of life-saving hepatitis C and HIV medications have fueled debate about the role of public policy in providing access to costly but effective pharmacological treatments for vulnerable populations. Moreover, care management through prescription drugs may potentially reduce the use of more resource-intensive medical care such as emergency department visits or other non-drug spending (Goldman, Joyce, & Zheng, 2007; Lavetti & Simon, 2016; Roebuck, Dougherty, Kaestner, & Miller, 2015; Stuart, Doshi, & Terza, 2009). In part reflecting previous research findings, the ACA classifies prescription drugs as one of the ten categories of "essential health benefits" that all commercial private insurance plans must provide.

Expanding insurance coverage was one of the major policy objectives of the ACA. Recent estimates suggest that uninsurance rates have declined substantially since early 2014 (Courtemanche, Marton, Ukert, Yelowitz, & Zapata, 2016; Frean, Gruber, & Sommers, 2016;

Kaestner, Garrett, Gangopadhyaya, & Fleming, 2015; Sommers, Gunja, Finegold, & Musco, 2015), along with improvements in self-reported access to primary care and prescription medications (Sommers, Blendon, Orav, & Epstein, 2016; Sommers et al., 2015). Although changes in insurance coverage resulting from the ACA Medicaid expansions have already received substantial attention from researchers and policy makers, far less is known about its impact on the use of specific types of medical services.

In all 50 states, Medicaid covers most major categories of medical intervention, including pharmacological therapy. Coverage expansions for low-income adults are expected to increase the use of pharmacological treatment through improvements in access and affordability. A large literature using experimental and quasi-experimental research designs establishes that demand for prescription drugs is responsive to cost sharing (Chandra, Gruber, & McKnight, 2010; Newhouse, 1993). Utilization of prescription medications can also provide early evidence of ACA Medicaid expansion effects on access to providers, because prescriptions can only be obtained through consultation with a medical practitioner with prescriptive authority. Thus, studying the effect of insurance on health care utilization is important for understanding how Medicaid expansions affect access and health outcomes.

This paper studies the impact of the ACA's 2014 Medicaid expansions on prescription drug use by comparing outcomes in states that expanded Medicaid eligibility to those in non-expansion states, both before and after the policy change. This difference-in-difference approach is similar to that used in recent studies that assess the impact of ACA Medicaid expansions on uncompensated hospital-care costs (Dranove, Garthwaite, & Ody, 2016; Nikpay, Buchmueller, & Levy, 2015; Nikpay, Buchmueller, & Levy, 2016) and on coverage, access to care, and labor market outcomes (Gooptu, Moriya, Simon, & Sommers, 2016; Kaestner et al., 2015). We assess overall Medicaid prescription utilization rates and utilization within specific drug classes, as well as how changes in utilization varied across different geographic regions based on prior insurance rates and racial composition. In addition to evaluating the impact on use of prescription drugs within the Medicaid program, we also conduct a comprehensive analysis of whether Medicaid expansion simply substituted away from utilization under uninsured or private payment sources. This helps in gauging whether these utilizations are likely to amount to new uses; the issue of Medicaid 'crowd out' of private insurance has been a substantial concern in prior literature (Congressional Budget Office, 2007).

We find that prescription drug utilization in Medicaid increased by 19 percent in Medicaid expansion states in the first 15 months following the 2014 ACA expansion, relative to states that did not adopt Medicaid expansion. Moreover, we isolate heterogeneity in utilization by drug class, with a general pattern of larger increases for chronic conditions and smaller increases for acute conditions. The largest increase of 24% occurred among drugs used for treating diabetes, as well as an estimated 22% increase for contraception and 21% for cardiovascular disease, with significantly smaller increases for respiratory/allergy medications and antibiotics.

We observe no significant effect of Medicaid expansion on Medicare, privately insured prescription utilization or on uninsured prescriptions paid by cash or assistance programs; the magnitudes of these statistically insignificant coefficients are also small, about 1/10th or 1/20th as large as the policy effect for Medicaid prescription utilization. This suggests a lack of substantial crowd out of private prescription drug utilization following Medicaid expansion.

Within expansion states, we find that increases in prescription drug utilization were larger in geographical areas with higher baseline uninsured rates in 2013, where the ACA likely produced the largest coverage changes. Finally, we document suggestive evidence that increases in Medicaid prescriptions were greater in areas with a higher share of minority (Hispanic and black) populations, indicating that Medicaid expansion under the ACA may have reduced ethnic/racial disparities in access to medications. Our findings are robust to various alternative specifications, comparison of pre-policy trends, and placebo testing, suggesting the results can be causally attributed to the Medicaid expansions.

2. Background

Medicaid is a means-tested health insurance program for low-income populations; it is jointly administered by the federal and state governments. Since the creation of the Medicaid program in 1965, states have had broad discretion over a range of eligibility rules, program benefits, and provider reimbursement, subject to compliance with federal minimum standards. As a result, there has long been considerable variation in Medicaid eligibility standards and program generosity across states. Even though prescription drug coverage was a state option, all states covered pharmacological treatments prior to the ACA; after the ACA's Medicaid expansion, new enrollees must be offered so-called "benchmark" benefits, including prescription drug coverage. The ACA provides additional federal financing to states for extending Medicaid coverage to non-elderly adults earning less than 138 percent of the federal poverty level (FPL), in hope of standardizing Medicaid coverage across states. The expansion decision was later delegated to states, and as of January 1, 2017 31 states plus Washington DC have implemented the ACA Medicaid expansion, while the remaining 19 states have not.

Provisions of the ACA have reduced uninsurance substantially, with the largest gains in insurance coverage occurring subsequent to the 2014 Medicaid expansions and the creation of health insurance Marketplaces with income-based premium tax credits. Multiple experimental and quasi-experimental studies have demonstrated that health insurance increases the use of medical care, including prescription drug use. The vast quasi-experimental evidence from Medicare Part D implementation suggests that health insurance drug coverage reduced out-of-pocket (OOP) spending and led to higher prescription drug use among the elderly (Kaestner & Khan, 2012; Ketcham & Simon, 2008; Lichtenberg & Sun, 2007) and improved their health status (Afendulis, He, Zaslavsky, & Chernew, 2011; Ayyagari & Shane, 2015; Kaestner, Long, & Alexander, 2014). There is also evidence that prescription medications for chronic conditions such as high cholesterol and diabetes can reduce the use of more expensive forms of health care. Using inpatient discharge data from Florida, Borrescio-Higa (2015) finds that lower prescription medication costs as a result of Walmart's $4 Prescription Drug Program in 2006 led to higher utilization of anti-hypertensive drugs and resulted in fewer hospitalizations among those between the ages of 45 and 64.

Yet, this previous literature on the elderly and the near-elderly does not provide direct evidence from which to draw inferences about the non-elderly adult population gaining Medicaid coverage under the ACA. One concern is that provider acceptance of Medicaid is lower than that of Medicare (Decker, 2012) and access to physicians is needed for obtaining prescriptions. A few prior studies estimate the impact of Medicaid on prescribed medications. The Oregon Health Insurance Experiment finds that in the first year, Medicaid coverage increased the likelihood of using prescription medications by 8.8 percentage points among previously uninsured, low-income adults (Damiano, Bentler, Momany, Park, & Robinson, 2013). Using a difference-in-difference study design, Sommers et al. (2016) estimate a 10-percent reduction in low-income adults reporting skipping prescribed medication in Kentucky and Arkansas following Medicaid expansions under the ACA, relative to non-expansion Texas. In addition, two recent studies have explored the prescription drug utilization implications of the ACA Medicaid expansions in particular. (Mulcahy, Eibner, & Finegold, 2016) use prescription transaction data to longitudinally follow a sample of non-elderly adults who reported any prescription drug use during January 2012. They find that adults who gained Medicaid in 2014 increased their prescription drug use by 79 percent. However, their sample was limited to those already using prescription drugs, nearly two-thirds of whom reported chronic health conditions such as diabetes, asthma, and breast cancer. This indicates that their study focused on a population with much higher prevalence of chronic disease than the overall population of adults potentially gaining coverage through the ACA Medicaid expansions (Decker, Kenney, & Long, 2014). More importantly, their sampling design does not allow them to consider the effects on those who did not use prescription medications prior to the expansions. The second study, by Wen and colleagues (2016), examines aggregate Medicaid medication use as reported in the CMS State Drug Utilization Database (SDUD) through 2014. They find a significant increase in the number of prescriptions per enrollee following expansion, but no significant change in total spending. Notably, their study does not examine heterogeneity in effects by drug class, across payer types other than Medicaid, or by sub-state geographical units.

Our paper builds on prior literature in several important ways. We use a rich national dataset of pharmaceutical claims that allows us to produce a comprehensive estimate of the impact of the ACA Medicaid expansions on aggregate prescription drug utilization through early 2015. More importantly, we are also able to describe the heterogeneous policy impacts of the Medicaid expansion across drug classes and geographic areas that vary by baseline coverage rates and population demographics.

We examine the effect of these state Medicaid coverage changes on prescription drug utilization using a quasi-experimental study design. We exploit variation in adoption of the ACA Medicaid reform across states to compare Medicaid prescriptions drug use in treated states relative to comparison states, both before and after the policy changes. We also explore heterogeneity in response across geographical areas that differ by uninsured rates prior to the policy change. This approach has been used previously in other settings to evaluate, for instance, the effect of Medicare on health care spending (Finkelstein, 2007), the effect of health care reform in Massachusetts on hospitalization (Miller, 2012), and the effect of the ACA on insurance coverage (Courtemanche et al., 2016). In the sections that follow, we discuss our data sources, empirical methods, and results. The estimates from this study, using recently available data, are applicable to the ongoing health policy debates surrounding the effects of the ACA; they are especially relevant, moreover, for understanding the implications of the Medicaid coverage expansions for health care use on the part of low-income Americans.

3. Data

Our main source of data on Medicaid prescription drug utilization is a large, nationally representative database of prescriptions dispensed from January 2013 through March 2015 at both retail and mail-order pharmacies. This proprietary database captures over 80 percent of all transactions in the US; the database also contains weights that are designed to provide estimates of 100 percent of US retail and mail order pharmacy transactions. The database records the date the prescription was filled, the payer, geographical identifiers, and Uniform System of Classification (USC) product codes. We obtained prescription counts aggregated by unit of geography (all states and DC, as well as data from the 917 Core Based Statistical Area (CBSAs) in the US),[1] time (quarterly, from Q1 2013 through Q1 2015), drug class (total, as well as by 9 classes), and payer type.

A key advantage of these data is that they allow us to produce timely estimates of the ongoing Medicaid policy reforms on prescription drug utilization and at the sub-state level. Other rich data sources such as the Medical Expenditure Panel Survey (MEPS) Household Component are only available after a considerable time lag. Meanwhile, CMS totals of state-by-year Medicaid

[1] We use Core Based Statistical Area (CBSA) as our market definition because this is the smallest geographic unit available to us. CBSAs are geographic aggregations produced by the US Office of Management and Budget (OMB); they consist of groupings of geographic areas with at least 10,000 population and associated with an urban core. These areas are clusters of adjacent counties with social and economic integration. Approximately 94 percent of the total US population lives within CBSAs. An example of a CBSA is Mobile, Alabama.

prescription counts in the SDUD lack information on other sources of payment, thus preventing any direct comparison to other payment sources for placebo or crowd-out hypothesis testing; these totals also lack sub-state data for investigating heterogeneity by smaller area characteristics. The administrative database we use also circumvents the small sample problems, as well as the recall and reporting issues associated with household surveys such as the MEPS. Our data include both fee-for-service Medicaid and Medicaid managed-care claims.

An important disadvantage of our dataset is that it does not contain the patient-level information on demographic and socioeconomic characteristics that would allow us to estimate specifications separately by age, gender, or other important subgroupings of individuals. To control for changes in the economic climate that may independently affect state Medicaid rolls, we merge the prescription claims data with state and CBSA-level unemployment rates from the Bureau of Labor Statistics (BLS) Local Area Unemployment Statistics (LAUS).[2] We control for possible changes in population by dividing total counts of prescriptions by Census Bureau state and county annual non-elderly adult population estimates.[3] We also incorporate information on uninsurance rates and racial/ethnic composition of the local markets using estimates produced by the Census Bureau.[4] The resulting dataset is a balanced panel of 51 states (including Washington, DC) observed for a total of 9 quarters (459 =51*9 total cells), and a balanced panel of 781 CBSAs that do not cross state lines (we drop 143 that do) for a total of 7,029 (=781*9) cells.

4. Methods

Our main empirical strategy uses a difference-in-difference method to compare prescription drug utilization in all expansion states to non-expansion states (first difference) before

[2] To obtain the unemployment rate in a CBSA, we take the average of the unemployment rates for all the counties within a CBSA. County-level unemployment rates come from BLS LAUS, and the listings of counties within CBSAs come from the Mable Geographic Correspondence Engine (http://mcdc.missouri.edu/websas/geocorr12.html).

[3] We obtain these annual county resident population estimates by year from https://www.census.gov/data/datasets/2015/demo/popest/counties-total.html

[4] We obtain county-level 2013 uninsured rates for non-elderly adults at or below 138 percent FPL from the Census Bureau's Small Area Health Insurance Estimates (SAHIE) program. We obtain 2013 county-level racial/ethnic composition data from the Area Health Resource Files (AHRF).

and after the expansions (second difference). In a specification check, following Wherry and Miller (2016), we drop from our expansion group the five states (DC, DE, MA, NY, and VT) that had the largest expansions of Medicaid to nonelderly adults prior to 2014.

Our main outcome of interest is medication utilization under Medicaid, defined as the total number of Medicaid prescription drugs dispensed (new and refills, all therapeutic classes) where Medicaid (including both FFS and managed care) is recorded as the payer. We also examine total prescriptions dispensed for other payer categories. Our data are aggregated to state and CBSA levels, by quarter. We generate per-100 population utilization rates by dividing the total number of prescriptions by Census Bureau estimates of the non-elderly adult population measured in 100s. The identifying variation in our main analysis comes from cross-state differences in expansion decisions. Our baseline model for the effect of the ACA Medicaid expansions is specified as:

$$Y_{st} = \alpha + \beta PostxExpansion_{st} + \partial UEst + \tau_t + \vartheta_s + \varepsilon_{st} \qquad (1)$$

The dependent variable is the natural logarithm (ln) of prescriptions per 100 non-elderly adult population in the state, with s indexing state and t indexing each quarter in the data, respectively. The DD coefficient, β, measures the change in Medicaid scripts in expansion states net of the change in non-expansion states. While most states implemented the Medicaid eligibility changes beginning January 2014, Indiana, Michigan, New Hampshire, and Pennsylvania expanded later in 2014 or 2015. To account for this staggered timeline, the DD interaction term, $PostxExpansion_{st}$, turns on during the quarter of expansion relevant for that particular state. The model includes state fixed effects to account for time-invariant state-specific differences in prescription drug use and time dummies for each quarter and year in the data to capture national time trends. We use state quarterly unemployment rates (*UE*) to control for changes in economic conditions that may independently influence drug utilization patterns.[5] The model is estimated using ordinary least squares, and throughout we report standard errors clustered at the state level to account for correlated error terms across states over time (Bertrand, Duflo, & Mullainathan, 2004).

[5] We also estimate our models without including the unemployment rate as a covariate and find they do not materially alter our results.

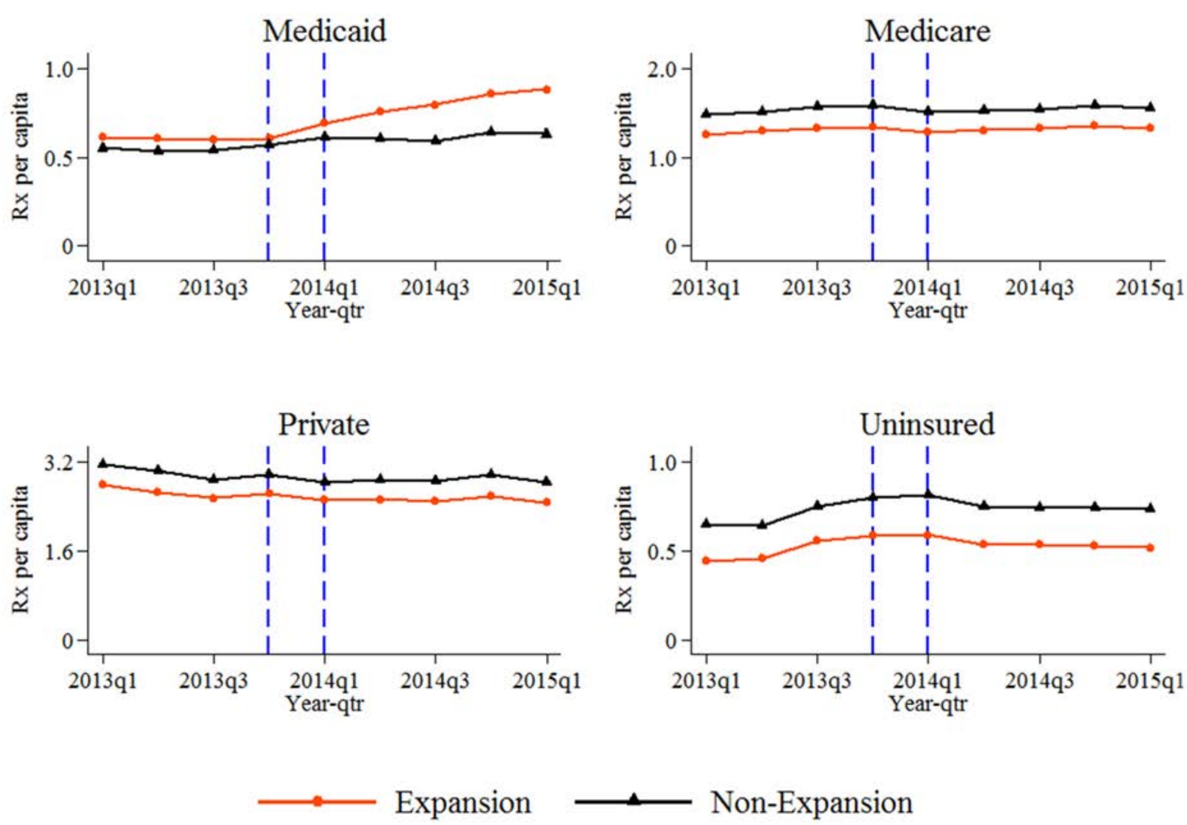
Identification in the difference-in-differences model is based on the assumption of parallel trends – that absent the 2014 Medicaid expansion, trends in outcomes would not have differed significantly across the expansion and non-expansion states. While this assumption is not directly testable, we compare trends in Medicaid prescriptions across the treatment and comparison states prior to the policy change; this comparison offers support for our identifying approach. Because we have a limited number of quarters of data prior to the policy change, we also examine Medicare prescription counts as a placebo test; if we were to find similar effects in Medicare as in Medicaid, we would have cause to suspect that our assumptions are not valid.

5. Results

In Figure 1, we plot unadjusted time trends for total per-capita (we normalize by the number of non-elderly adults in the state) prescriptions paid at the state level by Medicaid, Medicare, private insurance plans, or through cash and assistance programs available to the uninsured during the study period; we plot these trends separately for the expansion and non-expansion states. The red and black lines represent ACA Medicaid-expansion states and non-expansion states, respectively.[6] The first vertical line in blue denotes the beginning of the ACA's first open enrollment period in the fourth quarter of 2013; the second denotes the implementation of the ACA Medicaid expansions in the first quarter of 2014.

[6] Four states (i.e., IN, MI, NH and PA) are omitted from the graphs because they expanded after January 2014. They are, however, included in the regressions that allow for more flexibility in specifying the Medicaid expansion date. The graphs do not change in any meaningful manner when these states are included in the expansion category.

Figure 1: Unadjusted Trends in Per Capita Prescriptions Filled by Payer, 2013Q1-2015Q1



Notes:

1. January 2014 expansion states include: AR, AZ, CA, CO, CT, DC, DE, HI, IL, IA, IL, KY, MA, MD, MN, NV, NY, NJ, NM, ND, OH, OR, RI, VT, WA, WV. IN, MI, NH, PA are excluded from this list and from this analysis as they expanded after January 2014 (but are included in the regressions with time-varying expansion definitions).
2. Non-expansion states include: AL, AK, FL, GA, ID, KS, LA, ME, MI, MO, MT, NE, NC, OK, SC, SD, TN, TX, UT, VA, WI, WY.
3. The first vertical line is drawn at 4th quarter of 2013, and the second vertical line is drawn at the 1st quarter of 2014, thus the area in between the two lines indicates the transition into the 2014 ACA Medicaid expansion.

Figure 1 reveals that prior to the expansions in early 2014, Medicaid prescriptions followed similar trends across the two groups of states. There is a slight upward trend in Medicaid prescriptions coinciding with the start of the ACA open enrollment period in 2013Q4, but this trend is visible in both expansion and non-expansion states. This is consistent with increases in Medicaid coverage during the open enrollment period found in prior research (Carman, Eibner, & Paddock, 2015; Sommers et al., 2015; Sommers et al., 2014). There is a clear divergence in trends after the first quarter of 2014, when the expansion states experience a very noticeable increase in Medicaid within 6 months of the policy change, relative to the non-expansion states. The remaining panels in Figure 1 display trends in prescriptions that were paid by Medicare, private insurance, and were uninsured (cash and assistance programs). These panels demonstrate that trends in aggregate prescriptions did not differ appreciably across the two groups of states for the non-Medicaid payment categories.

Table 1 displays results from our main difference-in-differences analysis of equation (1) and unadjusted sample means of the dependent variable. The dependent variable is the natural logarithm of Medicaid prescriptions per 100 population. The pattern in the first panel of figure 1 is reflected in the DD estimate for Medicaid prescriptions in column (1) of Table 1. The estimate demonstrates that Medicaid expansions in 2014 led to sizable and statistically significant increases in Medicaid prescription drug use. The coefficient represents a 19-percent increase in Medicaid prescription utilization relative to non-expansion states for all drug classes. Column (2) demonstrates that the estimate increases to 23 percent when we drop the five states that provided publicly subsidized coverage to adults at or below 100 percent of the FPL prior to 2014 (the District of Columbia, Delaware, Massachusetts, New York, and Vermont).

Table 1: Effect of ACA Medicaid Expansions on Medicaid Prescription Utilization

Dependent variable: Ln (Medicaid prescriptions per 100 population)		
	(1)	(2)
	All States	Excl. DC, DE, MA, NY, VT
Post x Expansion	0.19***	0.23***
	(0.06)	(0.06)
Year and quarter fixed effects	Y	Y
State fixed effects	Y	Y
Observations	459	414
Dependent variable means		
Expansion, Before	4.08	3.97
Non-expansion, Before	3.94	3.94
Expansion, After	4.35	4.29
Non-expansion, After	4.04	4.04

Note:

1. Difference-in-differences (DD) estimates are based on aggregated state-quarter data covering 2013Q1 to 2015Q1. The pre-expansion period includes 2013Q1-2013Q4, while 2014Q1-2015Q1 represents the post-expansion period. All models include state fixed effects, fixed effects for each quarter in the data, and state quarterly unemployment rate. Robust standard errors clustered by state reported in parentheses. * Significant at the 10-percent level. ** Significant at the 5-percent level. *** Significant at the 1-percent level.
2. In column (1), specification includes all states being categorized into expansion vs non expansion states.
Expansion states: AR, AZ, CA, CO, CT, DE, DC, HI, IL, IN, IA, IL, KY, MD, MA, MI, MN, NV, NH, NJ, NM, NY, ND, OH, OR, PA, RI, VT, WA, WV.
Non-expansion states: AL, AK, FL, GA, ID, KS, LA, ME, MI, MO, MT, NE, NC, OK, SC, SD, TN, TX, UT, VA, WI, WY.
3. For the analysis corresponding to column (2), DC, DE, MA, NY, and VT were dropped from the sample; the analysis is otherwise the same as in the first column.

We next study whether specific drug classes were differentially affected by the expansion. Prescription medications that treat acute medical conditions may respond differently to coverage expansion than drugs used for chronic illnesses. One possible reason is that unlike medications for chronic illnesses (e.g. anti-hyperlipidemic agents), acute medications that treat conditions requiring immediate treatment are likely less price sensitive, and therefore may not respond sharply to changes in coverage. Another reason for differences across drug classes is that the newly eligible population's health care needs may differ from those of the nation as a whole – in particular, chronic conditions may be more common among low-income individuals qualifying for Medicaid than among those with private insurance.

Table 2 describes the impact on utilization of a range of medication classes. Our results indicate that there were statistically significant increases in utilization across all drug classes, but relatively larger effects for certain classes, particularly those relevant to common chronic medical conditions. Medications used for treating diabetes accounted for the largest growth among all the classes, with an increase of 24 percent; this effect was statistically different from the mean effect on all the remaining classes combined. The use of cardiovascular medications (those for high blood pressure, high cholesterol, and heart disease) increased by 21 percent, while the use of contraceptives increased by 22 percent. Meanwhile, the use of respiratory/allergy medications, antibiotics, and gastrointestinal medications, which are more commonly taken for shorter-term acute conditions than the other drug classes, increased less than overall drug spending, with growth rates ranging from 16 to 17 percent.

The larger increases in use of medications for chronic conditions such as diabetes detected in our data are consistent with recent research that finds that diagnoses of chronic health conditions have increased among low-income adults in states that have expanded Medicaid eligibility under the ACA (Kaufman et al. 2015, Wherry and Miller 2016). Overall, this pattern of results suggests that Medicaid expansion was particularly effective at increasing prescription drug utilization for common and potentially costly chronic medical conditions, and that there may have been a meaningful effect on access to contraceptive treatments, even though Medicaid family planning waivers had existed prior to the ACA expansions.

Table 2: Heterogeneity by Drug Class

Dependent variable: Ln (Medicaid prescriptions per 100 population)			
	(1)	(2)	(3)
Drug Class	DD coefficient	Is the effect statistically different from the effect on the remaining classes?	Share among all Medicaid prescriptions
All classes	0.19*** (0.06)		
Antibiotics	0.17*** (0.06)	§	0.101
Birth Control	0.22*** (0.06)		0.019
Cardiovascular medications	0.21*** (0.07)		0.140
Diabetes medications	0.24*** (0.06)	#	0.037
GI medications	0.17*** (0.05)	#	0.066
HIV/ Hepatitis	0.16** (0.07)		0.011
Mental health medications	0.19*** (0.07)		0.149
Respiratory and Allergy medications	0.16*** (0.05)	#	0.118
Other	0.19*** (0.05)		0.359

Note: Each coefficient is from a separate difference-in-difference regression. Regressions are based on aggregated state-quarter Medicaid prescription data covering 2013Q1 to 2015Q1 by drug class. The pre-expansion period includes 2013Q1-2013Q4, while 2014Q1-2015Q1 represents the post-expansion period. All models include state fixed effects, fixed effects for each quarter in the data, and unemployment rate. Robust standard errors clustered by state are reported in parentheses. This analysis includes all states.
* Significant at the 10-percent level. ** Significant at the 5-percent level. *** Significant at the 1-percent level.
# Significant at the 5-percent level. § Significant at the 10 percent level.

Our lack of finding a strong effect for HIV and Hepatitis C medications is likely due to two factors. First, the existence of federally funded programs such as the Ryan White HIV/AIDS Program (RWP) and the AIDS Drug Assistance Program (ADAP) already facilitated the use of these medications for many patients prior to the expansion of Medicaid in 2014. Second, growth in use of Hepatitis C medications may have been attenuated by limited access in several state Medicaid programs (such as Indiana and Washington) due to cost concerns (*New York Times*, 2015; Pear, 2015).

5.1. Robustness Checks

To investigate the basis of support for the quasi-experimental study design, we examine whether there were differential pre-trends in Medicaid prescription drug utilization across states based on treatment status. We do this by using data from 2013Q1-2013Q4 and the following empirical specification:

$$Y_{st} = \alpha + \gamma Trend_t + \delta Expansion_s xTrend_t + \beta UnemploymentRate_{st} + \tau_t + \vartheta_s + \varepsilon_{st} \quad (2)$$

In the above equation, $Trend$ stands for a quarterly linear time trend, $Expansion$ indicates the states that expanded after the last time period in this regression (2013 Q4), and the interaction term $ExpansionxTrend$ identifies differential trends between expansion and non-expansion states during the pre-expansion period. Also included in the regression are the trend main term, the unemployment rate, and state and month-by-year fixed effects.

In addition, to evaluate the parallel trends assumption, we use an event study approach by interacting the expansion dummy with each year-quarter in the data from 2013-2015. For the parallel trends assumption to be valid, we would expect the interaction terms in 2013 to be statistically indistinguishable from 0. The point estimates in column 1 of Table 3 are indeed quite small in magnitude (and not statistically significant) relative to the DD estimate in Table 2, indicating that no significant differential trends appear in the pre-expansion period that would otherwise threaten our identification strategy. Column 2 displays the event study estimates; there is no evidence of differential trends across the states that expanded and those that did not, prior to the policy change. Starting with 2014 Q2, the estimates are positive, statistically significant, and higher in magnitude every consecutive quarter, which implies that the impact of coverage has amplified over time, consistent with other recent evidence on the ACA’s Medicaid expansion (Sommers, Blendon, & Orav, 2016). This pattern in the data also mirrors the staggered timeline of state expansion decisions. In every successive quarter after the first six months of the policy change, the effect on aggregate Medicaid prescriptions exceeds the mean effect of 19 percent shown in Table 2. These changes over the 15-month period following the onset of the Medicaid expansions may also reflect longer-term effects on access and utilization. The evolution of the ACA’s impact on Medicaid prescriptions during this 15-month period likely reflects higher use of medications due to pent-up demand for health care; it also suggests longer-term effects on coverage, access, and utilization that occur through diffusion of information about the policy changes.

We test the sensitivity of our results to the addition of group-specific linear time trends. These results are presented in column (3) of Table 3. This specification addresses the possibility that expansion and non-expansion states may follow different, unobserved time trends correlated with Medicaid expansion decisions. We detect no difference in the estimates in column (3) compared to the baseline model, emphasizing that underlying group-specific trends are not responsible for the observed effect on Medicaid prescriptions.

Table 3: Testing for Differential Pre-Policy Trends in Medicaid Prescription Drug Utilization

Dependent variable: Ln (Medicaid prescriptions per 100 population)			
	(1)	(2)	(3)
	Pre-treatment trend test	Event study	Event study
Expansion x Trend (2014 Q1-Q4)	-0.002 (0.02)		
Expansion x 2013Q2		0.030 (0.033)	0.030 (0.033)
Expansion x 2013Q3		0.022 (0.055)	0.022 (0.055)
Expansion x 2013Q4		-0.005 (0.060)	-0.005 (0.060)
Expansion x 2014Q1		0.090 (0.072)	0.090 (0.072)
Expansion x 2014Q2		0.176** (0.078)	0.176** (0.078)
Expansion x 2014Q3		0.231*** (0.085)	0.231*** (0.085)
Expansion x 2014Q4		0.245*** (0.088)	0.245*** (0.088)
Expansion x 2015Q1		0.265*** (0.087)	0.265*** (0.087)
Includes *Expansion x linear time trend*	Y	N	Y
Observations	204	459	459

Note: Analysis is based on aggregated state-quarter Medicaid prescription data. Estimate in column (1) uses data covering 2013Q1-2013Q4 and only includes separate time trends for expansion vs non-expansion states, while those in columns (2) and (3) use data from 2013Q1 to 2015Q1 and an event study approach. All models include state fixed effects, fixed effects for each quarter in the data, and unemployment rate. Robust standard errors clustered by state are reported in parentheses. * Significant at the 10-percent level. ** Significant at the 5-percent level. *** Significant at the 1-percent level.

One mechanism through which Medicaid prescriptions may increase following expansions is private insurance crowd-out. To explore this mechanism, we investigate the impact of the expansions on prescriptions from private insurance, cash and other assistance programs available to the uninsured. This analysis allows us to consider whether Medicaid prescriptions increased simply through a substitution of payment source from private or uninsured to Medicaid, or due to a net increase in utilization. Table 4 below contains these results. The statistically insignificant point estimate of -0.01 in column (1) corresponds to a 1-percent decrease in prescriptions from cash and assistance programs; this magnitude is nearly one-twentieth of the statistically significant effect on Medicaid prescriptions. Similarly, in the case of private insurance, the statistically insignificant estimated coefficient in column (2) implies a reduction of 1 percent, which is almost one twentieth smaller in magnitude than the Medicaid effect. The point estimates for privately insured and uninsured prescriptions are negative but statistically indistinguishable from zero. The magnitudes of these coefficients suggest at most an effect 1.5-5 percent as large as the Medicaid effect, indicating little to no crowd-out of prescription drug use from other sources to Medicaid.

As a falsification test, we next consider changes in Medicare prescription utilization. We hypothesize that the Medicaid eligibility changes for the non-elderly adult population under the ACA are unlikely to affect prescription drug use in the Medicare program. Consistent with our hypothesis, the result from this analysis, which we report in column (3) of Table 4, suggests that there was no effect on Medicare prescriptions. In Appendix Table 2, we present event study estimates for aggregate prescriptions paid by non-Medicaid sources; taken together, these results provide support for the validity of the difference-in-difference specification. The dependent variable is the natural logarithm of uninsured, privately insured or Medicare prescriptions per 100 population. These results confirm our findings that prescriptions from non-Medicaid payment sources did not respond significantly to the ACA Medicaid expansions, and taken together, these results provide support for the validity of the main difference-in-difference specification.

Table 4: Effect on Aggregate Prescription Drug Use by Payer

Dependent variable: Ln (prescriptions per 100 population)				
	(1)	(2)	(3)	(4)
	Uninsured (Cash and assistance programs)	Commercial	Medicare	Medicaid
Post x Expansion	-0.01	-0.01	0.003	0.19***
	(0.02)	(0.01)	(0.01)	(0.06)
Year and quarter fixed effects	Y	Y	Y	Y
State fixed effects	Y	Y	Y	Y
Observations	459	459	459	459
Dependent variable means				
Expansion, Before	3.96	5.66	4.92	4.08
Non-expansion, Before	4.22	5.70	4.96	3.94
Expansion, After	4.02	5.60	4.94	4.35
Non-expansion, After	4.31	5.65	4.98	4.04

Note: Each coefficient comes from a separate difference-in-difference regression. Analyses are based on aggregated state-quarter prescription data by payer type, and include all states. Data covers the period 2013Q1 to 2015Q1. All models include state fixed effects, fixed effects for each quarter in the data, and unemployment rate. Robust standard errors clustered by state are reported in parentheses. * Significant at the 10-percent level. ** Significant at the 5-percent level. *** Significant at the 1-percent level.

5.2. Heterogeneous Effects at the Market Level

The analysis with aggregated state data presented so far indicates that Medicaid prescription drug utilization increased significantly in response to the ACA Medicaid expansions. We next expand on this reduced form analysis to examine whether these results are isolated in geographical areas with higher treatment intensity. Here we consider the response of prescriptions paid by Medicaid to reductions in uninsurance that occurred after 2014. Using data aggregated to the CBSA level, we explore whether the effects of Medicaid expansion on prescription drugs is larger in CBSAs with higher pre-reform uninsurance levels (where we expect larger gains in coverage), relative both to CBSAs with lower baseline (2013) uninsurance in expansion states and to CBSAs with higher baseline uninsurance rates in non-expansion states. Courtemanche et al. (2016), who examined the effects of the ACA Medicaid expansions on insurance status, conducted a similar analysis using CBSAs as geographic units. The estimating equation is specified below:

$$Y_{cst} = \alpha_1 Post_t x Pct\ Uninsured\ 2013_c x Expansion_s + \alpha_2 Post_t x\ Pct\ Uninsured\ 2013_c + \alpha_3 Post_t x Expansion_s + \alpha_4 Expansion_s x\ Pct\ Uninsured\ 2013_c + \tau_t + \vartheta_s + \alpha_5 X_{cst} + CBSA\ FE + \varepsilon_{st} \qquad (3)$$

The main coefficient of interest in the above equation is α_1, which represents the differential change in Medicaid prescription use in CBSAs with high 2013 uninsurance rates compared to those with low rates in expansion states, with non-expansion states as the DD control group. We expect that there would be a greater increase in Medicaid prescription drugs in CBSAs where the baseline fraction of uninsured population was larger, more so than in baseline-highly-uninsured CBSAs in non-expansion states (i.e., α_1>0). The coefficient of interest in this regression appears in panel A of Table 5, along with summary statistics of 2013 uninsurance rates. The estimate for α_1 in column (1) is consistent with our expectations and indicates that in the CBSA where the uninsurance rate at baseline was one percentage point higher, the Medicaid expansion increased Medicaid prescription utilization by 1 percent, relative to similar CBSAs in non-expansion states. In other words, CBSAs with 2013 uninsurance rates that were one standard deviation (9.33) below the median uninsurance rate experienced a 9.3-percent increase (1 percent * 9.33) in aggregate Medicaid prescriptions post-ACA.[7]

The ACA Medicaid expansions are also expected to reduce absolute differences in insurance coverage related to race and ethnicity. Using the American Community Survey,

[7] One concern in examining this specification is whether the remaining CBSAs in the sample differ in ways that introduce bias in our estimates. We re-estimate our baseline difference-in-difference model (equation 1) using this sample, comparing CBSAs in expansion states to a group of comparison CBSAs in non-expansion states. The results from this analysis are displayed in Appendix Table 5. While these estimates are smaller in magnitude, they are similar in direction and precision, confirming our findings from the main specification. [8] This estimate is expected to be smaller than the total realized increase in prescriptions under Medicaid from 2013 to 2014, as this estimate does not capture the "welcome mat" effect and changes in prescription use among other Medicaid populations that may be co-occurring.

Buchmueller and colleagues (2016) document that in 2014, the largest declines in uninsurance occurred among Hispanics (7.1 percentage points) and blacks (5.1 percentage points), relative to whites (3 percentage points). We exploit geographic variation in racial composition to examine whether the impact on Medicaid prescriptions was comparatively larger in areas with greater Hispanic and black populations. The estimating equation is:

$$Y_{cst} = \alpha_1 Post_t x Pct\ Minority\ 2013_c x Expansion_s + \alpha_2 Post_t x\ Pct\ Minority\ 2013_c + \alpha_3 Post_t x Expansion_s + \alpha_4 Expansion_s x\ Pct\ Minority\ 2013_c + \tau_t + \vartheta_s + \alpha_5 X_{cst} + CBSA\ FE + \varepsilon_{st} \quad (4)$$

We report this result in panel B of Table 5. The coefficient on the interaction term $Post_t x Pct\ Minority\ 2013_c x Expansion_s$ of 0.003 indicates that the effect of the Medicaid expansion on Medicaid prescription drug utilization was statistically significantly higher in areas of expansion states with a greater share of Hispanic and black populations. More specifically, Medicaid prescription volume increased by 0.3 percent more in expansion states compared to states that did not expand, for every one-percentage-point increase in the minority population share of a CBSA. A CBSA that is one standard deviation higher in percent minority thus experienced a 5.7 percent larger increase in Medicaid prescription utilization. This suggests that the Medicaid expansions reduced racial disparities in access to medications.

Appendix Tables 3 & 4 present results from a specification where we replace the post-2014 indicator with a dummy for each quarter to investigate pre-policy trends for these two heterogeneity analyses through an event study. Appendix Table 3 shows small and statistically insignificant coefficients for the time periods before Medicaid expansion, which is reassuring. The results also indicate that the post expansion effects appear strongest in the 3rd quarter of 2014, although statistically significant and positive effects also appear later in column 2. The results of Appendix Table 4 are less convincing; although most coefficients are statistically insignificant in this table, they are all negative before the expansion and positive after the expansion.

Table 5: Effect of the ACA Medicaid Expansions on Medicaid Prescriptions, Triple Difference (CBSA-level Analysis)

Dependent variable: Ln (Medicaid prescriptions per 100 population)		
	(1)	(2)
	All States	Excl. DC, DE, MA, NY, VT
Panel A		
Post x Expansion x Pct Uninsured 2013	0.010***	0.011***
	(0.0021)	(0.002)
Post x Expansion	-0.092	-0.133*
	(0.0714)	(0.081)
Post x Pct Uninsured 2013	0.002*	0.002**
	(0.0011)	(0.001)
Median 2013 pct uninsured	36.9	37.4
Standard deviation of 2013 pct uninsured	9.33	8.80
Panel B		
Post x Expansion x Pct Minority 2013	0.003**	0.003**
	(0.0013)	(0.001)
Post x Expansion	0.191***	0.201***
	(0.0226)	(0.023)
Post x Pct Minority 2013	0.002***	0.002***
	(0.0005)	(0.0005)
Median 2013 pct minority	12.36	12.87
Standard deviation of 2013 pct minority	19.06	19.28
Observations	7,029	6,715

Notes:

1. Analysis is based on aggregated CBSA-quarter Medicaid prescription data from 2013Q1 to 2015Q1. All models include CBSA fixed effects, fixed effects for each quarter in the data, and unemployment rate. Robust standard errors clustered by CBSA are reported in parentheses. * Significant at the 10-percent level. ** Significant at the 5-percent level. *** Significant at the 1-percent level.
2. In column (1), estimates are based on all states being categorized into expansion vs non expansion states.
   Expansion states: AR, AZ, CA, CO, CT, DE, DC, HI, IL, IN, IA, IL, KY, MD, MA, MI, MN, NV, NH, NJ, NM, NY, ND, OH, OR, PA, RI, VT, WA, WV.
   Non-expansion states: AL, AK, FL, GA, ID, KS, LA, ME, MI, MO, MT, NE, NC, OK, SC, SD, TN, TX, UT, VA, WI, WY.
3. For the analysis corresponding to column (2), the early expansion states of DC, DE, MA, NY, and VT were dropped from the sample.

Taking the results from Tables 5 and Appendix Tables 3 and 4 together suggest that the growth in utilization of Medicaid prescription medications was more pronounced in geographical areas where the "bite" of the Medicaid expansions was larger because baseline uninsurance was higher, and in areas where minority populations were more concentrated. While the results from the event study method in Appendix Table 4 are broadly consistent with the results from the DDD approach in Table 5 for the baseline uninsurance study, the corresponding story is not as strong for the percent minority study.

6. Discussion

Using a national administrative dataset of prescription drug utilization, we find that in the 15 months following the ACA Medicaid expansions, non-elderly adult Medicaid prescriptions per 100 population increased by 19 percent. We consider next what these results suggest is the increase in use of prescription medications among the newly enrolled population. Multiplying the quarterly average of 59.15 Medicaid prescriptions per 100 non-elderly adult population in our data (from taking the inverse natural log of 4.08 in Table 1) by the total pre-ACA non-elderly adult population in the expansion states (114 million, based on the 2013 American Community Survey) translates the 19 percent increase to 12.8 million additional prescriptions (0.19 *59.15* 114 million/100). This is an estimate of the ACA Medicaid expansion induced increase in prescriptions per quarter, assuming no population growth.[8] In order to back out how many new prescriptions this represents per newly eligible beneficiary, we divide this 12.8 million by an estimate of the number of individuals who gained Medicaid coverage through ACA, which comes from a DD research design that compares expansion to non-expansion states. Centers for Medicare and Medicaid Services (CMS) official enrollment reports through the end of March 2015 indicate that the net enrollment in Medicaid/CHIP in expansion states was 10.5 million more compared to 2013 (CMS 2015), while the similar figure for non-expansion states was 1.8 million, yielding an unadjusted

[8] This estimate is expected to be smaller than the total realized increase in prescriptions under Medicaid from 2013 to 2014, as this estimate does not capture the "welcome mat" effect and changes in prescription use among other Medicaid populations that may be co-occurring.

difference-in-differences estimate of 8.7 million newly-enrolled individuals by the end of our study period, though this number may include as many as 1 million children (Frean, Gruber, and Sommers 2016). Subtracting out children yields 7.7 million newly-enrolled adults. Therefore, the "treatment on the treated" estimate of the effect of Medicaid expansion on prescription drug use equates to 1.7 (12.8 million /7.7 million) prescriptions per enrollee per quarter or 6.6 prescriptions per enrollee per year. As a comparison, Mulcahy et al. (2016) find that previously uninsured adults who gained Medicaid had 13.3 more prescription fills in 2014 compared to 2013. This was higher (17.8 more prescriptions) for those with chronic conditions, and lower (10.9 additional fills) among the healthier Medicaid enrollees in their sample (aged 20-61). Our results imply a somewhat smaller effect but a similar order of magnitude as their less-healthier-population estimate.

Our sub-group analysis by drug-class suggests that the increase in utilization was higher for medications used in treating chronic conditions such as diabetes and cardiovascular disease, and for psychotherapeutic medications. Given that lack of appropriate management of chronic diseases through medications is one of the plausible mechanisms for coverage affecting long-term health (Tamblyn et al., 2001), and that survey-based analyses of the Medicaid expansion have shown increased rates of care for chronic conditions (Sommers, Blendon, Orav, et al., 2016), these findings are encouraging in terms of potential health outcomes.

One of the limitations of this study is that our data does not observe individuals longitudinally, so it cannot capture the effect of the expansions on those who were previously uninsured. However, in additional analysis using pre-expansion uninsurance rates at the sub-state level, we examine the effect of change in insurance coverage on utilization. The lack of individual-level data also precludes us from estimating directly the per-person changes in utilization, though our back-of-the-envelope calculations indicate that our estimates correspond to a little more than one monthly prescription increase per newly enrolled Medicaid beneficiary.

Using recently available prescription drug data at the national level, this study provides an important set of results in the context of the ACA. Our findings suggest a significant and positive impact of the ACA Medicaid expansions on the use of prescription drugs in expansion states, which is consistent with the impact of insurance coverage expansions on improving access to care. This study contributes to the growing literature on the impact of the health reform under the ACA.

Our findings provide important new evidence on the role of Medicaid in the health care safety net, and the first order impact of the ACA Medicaid expansions for improvements in access to and utilization of medical care in states that expanded Medicaid. Future research should consider whether this policy-induced boost in prescription drug utilization is reflected in subsequent health impacts and downstream effects on use of other types of medical care.

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Appendix Table 1: Categorization of State Expansion Status:

2014 Expansion States without substantial prior Medicaid expansion	Expansion States with Substantial prior Medicaid expansion	Non-Expansion States (Control group)
Arkansas[1]	Delaware[11]	Alabama
Arizona[2]	District of Columbia[7]	Alaska
Arkansas[3]	Massachusetts[12]	Florida
California[4,7]	New York[13]	Georgia
Colorado[5]	Vermont[14]	Idaho
Connecticut		Kansas
Hawaii[9]		Louisiana[1]
Illinois		Maine
Indiana[1]		Mississippi
Iowa[6]		Missouri
Kentucky		Montana[1]
Maryland		Nebraska
Michigan[1]		North Carolina
Minnesota[7]		Oklahoma
Nevada		South Carolina
New Hampshire[1]		South Dakota
New Jersey[7]		Tennessee
New Mexico		Texas
North Dakota		Utah
Ohio		Virginia
Oregon[8]		Wisconsin[10]
Pennsylvania[1]		Wyoming
Rhode Island		
Washington[7]		
West Virginia		

Notes: This table shows the state classification for Medicaid eligibility used in this paper. These are mutually exclusive lists of states. We first examine states in the first two columns together, as expansion states. Later specifications separate expansion states into those with and without substantial pre-2014 Medicaid expansions. Source: Reproduced from Table A1 of Simon, Soni and Cawley (forthcoming).

1 The Medicaid expansion became effective in January 2014 for all expansion states as of this writing, except for the following: Alaska (September 2015), Indiana (February 2015), Louisiana (July 2016), Michigan (April 2014), Montana (January 2016), New Hampshire (August 2014), and Pennsylvania (January 2015). Since this table records only expansion status as of January 2014, some of the states that later expanded Medicaid appear in the control group column. However, our regressions categorize those states that expanded after January 2014 but before March 2015 as expansion states only in the quarters after the expansion was implemented. The remaining notes to this Table explain the categorization of expansion states into columns 1 or 2.

2 Since 2000, Arizona offered Medicaid-equivalent benefits to childless adults with income below 100 percent FPL through a Section 1115 waiver program. However, the state closed the program to new enrollees in July 2011 (Kaiser Family Foundation, 2016) and consequently experienced a significant expansion for childless adults in 2014.

3 Arkansas operated a limited-benefit premium-assistance program for childless adults who worked for small, uninsured employers (ARHealthNetworks waiver) (Kaiser Family Foundation, 2016) prior to the ACA.

4 Although California expanded Medicaid for childless adults to some degree as part of the state's 1115 "Bridge to Reform" waiver, this was not available in all counties and was not full Medi-Cal benefits (http://kff.org/health-reform/fact-sheet/the-california-health-care-landscape/).

5 Colorado had only very limited eligibility before 2014. Adults with income up to 10 percent FPL were eligible for Medicaid as of May 2012, and enrollment was capped to 10,000 adults (Kaiser Family Foundation, 2016).

6 Under the IowaCare program, childless adults with income below 200 percent FPL were eligible for public health insurance since 2005. However, IowaCare provided limited services in a limited network, and so low-income adults in Iowa effectively underwent substantial expansion in coverage in 2014 (Damiano et al., 2013).

7 California, Connecticut, District of Columbia, Minnesota, New Jersey, and Washington elected to enact the ACA Medicaid expansion in 2010 to 2011. However, New Jersey's early expansion only extended to 23 percent FPL while the other five states extended at least until 50 percent FPL (Sommers, Buchmueller, Decker, Carey, & Kronick, 2013). Also, Washington's early expansion was limited to prior state plan enrollees (Sommers et al., 2013). Hence we treat New Jersey and Washington as full 2014 expansion states.

8 In 2008, Oregon enacted a small Medicaid expansion for low-income adults through lottery drawings from a waitlist. However, less than one-third of the 90,000 people on the waitlist were selected to apply for Medicaid in 2008 (Baicker et al., 2013) and so the 2014 expansion represented a significant increase in eligibility for low-income adults.

9 In Hawaii, childless adults with incomes up to 100 percent FPL were eligible for the state's QUEST Medicaid managed care waiver program (Kaiser Family Foundation, 2016).

10 Although Wisconsin was not an ACA expansion state, the state received federal approval to offer Medicaid to childless adults below 100 percent FPL through the BadgerCare program as of 2009 (Gates & Rudowitz, 2014).

11 In Delaware, childless adults with incomes up to 100 percent FPL were eligible for Medicaid benefits through the Diamond State Health Plan waiver (Kaiser Family Foundation, 2016).

12 Massachusetts implemented reforms to expand insurance coverage to low-income adults in 2006 (Kaiser Family Foundation, 2016).

13 In New York, childless adults up to 78 percent FPL were eligible for the Medicaid (Home Relief) waiver program and childless adults up to 100 percent FPL were eligible for the Family Health Plus waiver program (Heberlein, Brooks, Guyer, Artiga, & Stephens, 2011).

14 In Vermont, childless adults up to 150 percent FPL were eligible for Medicaid-equivalent coverage through the Vermont Health Access Plan waiver program (Heberlein et al., 2011).

Appendix Table 2: Event Study Estimates by Payer

Dependent variable: Ln (prescriptions per 100 population)			
	(1)	(2)	(3)
	Uninsured (Cash and assistance programs)	Commercial	Medicare
Expansion x 2013Q2	0.03*	-0.01	0.01*
	(0.02)	(0.01)	(0.005)
Expansion x 2013Q3	0.03	-0.004	0.01*
	(0.03)	(0.01)	(0.01)
Expansion x 2013Q4	0.03	-0.005	0.01
	(0.03)	(0.02)	(0.01)
Expansion x 2014Q1	0.01	-0.01	0.001
	(0.03)	(0.02)	(0.01)
Expansion x 2014Q2	0.003	-0.01	0.003
	(0.03)	(0.02)	(0.01)
Expansion x 2014Q3	0.005	-0.02	0.01
	(0.03)	(0.02)	(0.02)
Expansion x 2014Q4	0.002	-0.02	0.01
	(0.03)	(0.02)	(0.02)
Expansion x 2015Q1	-0.01	-0.03	0.004
	(0.03)	(0.02)	(0.02)
Observations	459	459	459

Note: Analysis is based on aggregated state-quarter Medicaid prescription data from 2013Q1 to 2015Q1. All models include state fixed effects, fixed effects for each quarter in the data, and unemployment rate. Robust standard errors clustered by state reported in parentheses. * Significant at the 10 percent level. ** Significant at the 5 percent level. *** Significant at the 1 percent level.

Appendix Table 3: Event Study Estimates of Prescription Drug Utilization Based on 2013 CBSA Uninsurance Rates

Dependent variable: Ln (Medicaid prescriptions per 100 population)		
	(1)	(2)
	All States	Excl. DC, DE, MA, NY, VT
Pct Uninsured 2013 x Expansion x 2013Q2	-0.00002	0.001
	(0.001)	(0.002)
Pct Uninsured 2013 x Expansion x 2013Q3	-0.001	0.002
	(0.002)	(0.003)
Pct Uninsured 2013 x Expansion x 2013Q4	-0.003	0.0004
	(0.003)	(0.003)
Pct Uninsured 2013 x Expansion x 2014Q1	0.002	0.005*
	(0.003)	(0.003)
Pct Uninsured 2013 x Expansion x 2014Q2	0.004	0.006*
	(0.003)	(0.003)
Pct Uninsured 2013 x Expansion x 2014Q3	0.006**	0.009***
	(0.003)	(0.003)
Pct Uninsured 2013 x Expansion x 2014Q4	0.004	0.006*
	(0.003)	(0.003)
Pct Uninsured 2013 x Expansion x 2015Q1	0.004	0.006*
	(0.003)	(0.004)
Observations	7,029	6,714

Notes:

1. Analysis is based on aggregated CBSA-quarter Medicaid prescription data from 2013Q1 to 2015Q1. All models include CBSA fixed effects, year by quarter fixed effects, and CBSA unemployment rate. Robust standard errors clustered by CBSA reported in parentheses. * Significant at the 10 percent level. ** Significant at the 5 percent level. *** Significant at the 1 percent level.
2. In column (1), estimates are based on all states being categorized into expansion vs non expansion states.
3. For the analysis corresponding to column (2), the early expansion states of DC, DE, MA, NY, and VT were dropped from the sample.

Appendix Table 4: Event Study Estimates of Prescription Drug Utilization Based on 2013 CBSA Minority Proportions

Dependent variable: Ln (Medicaid prescriptions per 100 population)		
	(1)	(2)
	All States	Excl. DC, DE, MA, NY, VT
Pct Minority 2013 x Expansion x 2013Q2	-0.001	-0.0004
	(0.001)	(0.001)
Pct Minority 2013 x Expansion x 2013Q3	-0.002*	-0.002
	(0.001)	(0.001)
Pct Minority 2013 x Expansion x 2013Q4	-0.003*	-0.002
	(0.001)	(0.001)
Pct Minority 2013 x Expansion x 2014Q1	0.001	0.002
	(0.002)	(0.002)
Pct Minority 2013 x Expansion x 2014Q2	0.001	0.001
	(0.002)	(0.002)
Pct Minority 2013 x Expansion x 2014Q3	0.002	0.002
	(0.002)	(0.002)
Pct Minority 2013x Expansion x 2014Q4	0.001	0.001
	(0.002)	(0.002)
Pct Minority 2013 x Expansion x 2015Q1	0.002	0.002
	(0.002)	(0.002)
Observations	7,029	6,714

Notes:

1. Analysis is based on aggregated CBSA-quarter Medicaid prescription data from 2013Q1 to 2015Q1. All models include CBSA fixed effects, fixed effects for each quarter in the data, and unemployment rate. Robust standard errors clustered by CBSA reported in parentheses. * Significant at the 10 percent level. ** Significant at the 5 percent level. *** Significant at the 1 percent level.
2. In column (1), estimates are based on all states being categorized into expansion vs non expansion states.
3. For the analysis corresponding to column (2), the early expansion states of DC, DE, MA, NY, and VT were dropped from the sample.

Appendix Table 5: Effect of the ACA Medicaid Expansions on Medicaid Prescription Drugs, State Specification, Restricted to data from CBSAs

Dependent variable: Ln (Medicaid prescriptions per 100 population)		
	(1)	(2)
	All States	Excl. DC, DE, MA, NY, VT
Post x Expansion	0.103***	0.110***
	(0.029)	(0.029)
Year and quarter fixed effects	Y	Y
CBSA fixed effects	Y	Y
Observations	7029	6715
Dependent variable means		
Expansion, Before	4.3	4.26
Non-expansion, Before	4.64	4.63
Expansion, After	4.63	4.59
Non-expansion, After	4.76	4.76

Notes:

1. Analysis is based on aggregated CBSA-quarter Medicaid prescription data from 2013Q1 to 2015Q1. All models include unemployment rate. Robust standard errors clustered by state reported in parentheses. * Significant at the 10 percent level. ** Significant at the 5 percent level. *** Significant at the 1 percent level.
2. In column (1), estimates are based on all states being categorized into expansion vs non expansion states.
   Expansion states: AR, AZ, CA, CO, CT, DE, DC, HI, IL, IN, IA, IL, KY, MD, MA, MI, MN, NV, NH, NJ, NM, NY, ND, OH, OR, PA, RI, VT, WA, WV.
   Non-expansion states: AL, AK, FL, GA, ID, KS, LA, ME, MI, MO, MT, NE, NC, OK, SC, SD, TN, TX, UT, VA, WI, WY.
3. For the analysis corresponding to column (2), the early expansion states of DC, DE, MA, NY, and VT were dropped from the sample.