Enduring Pain: Effect of the ACA Medicaid Expansion on Over-the-Counter Pain Medication Purchases*

Gue Sung Choi†

Abstract

Over-the-counter (OTC) medications are pharmaceuticals that consumers can access without prescriptions from healthcare providers. Although they serve as a major input for self-treatment by disadvantaged patients, little is known about interactions between insurance coverage and OTC drug use. I study how the expansion in public health insurance eligibility affects local OTC pain medication sales by leveraging the Affordable Care Act (ACA) Medicaid expansion in 2014 with a rich retail scanner dataset. A difference-in-differences framework interacted with a treatment dosage measure showed that 1 percent point increase in share of uninsured population eligible to expanded Medicaids leads to 0.4 percent reduction in sales of OTC oral pain medications. This result, combined with previous literature, suggests that new health insurance benefits could have induced patients to substitute to more professional healthcare from self-medication with OTC drugs.

Keywords: Affordable Care Act, Medicaid expansion, Over-the-counter medication, Self-medication

JEL Codes: I12, I13

*Researcher's own analyses calculated (or derived) based in part on data from Nielsen Consumer LLC and marketing databases provided through the NielsenIQ Datasets at the Kilts Center for Marketing Data Center at The University of Chicago Booth School of Business. The conclusions drawn from the NielsenIQ data are those of the researcher(s) and do not reflect the views of NielsenIQ. NielsenIQ is not responsible for, had no role in, and was not involved in analyzing and preparing the results reported herein.

†Department of Economics, University of Texas at Austin. Email: gschoi@utexas.edu

1 Introduction

Self-medication is a common type of care defined as self-administered use of drugs without consulting professional healthcare providers. While it serves as a valuable source of care– both to patients and the healthcare system itself–with accessible treatment, reduction in costs of care and improved productivity of the population (Noone and Blanchette, 2018), self-medication also has multiple major limitations. First, solely relying on self-medication for a symptomatic relief often provides no fundamental treatment to serious underlying ailments and potentially leads to failure in getting proper medical services on time (Ruiz, 2010). Second, pharmaceutical consumption without professional advice is more likely to cause excessive dosage, prolonged intake, and consequent health problems (Hughes et al., 2001; Lessenger and Feinberg, 2008; Cooper, 2013).

Though it may not be an optimal form of care, sometimes self-medication is all patients have when they have limited access to professional healthcare. This is particularly true in less developed countries with poor healthcare delivery systems (Chang and K. Trivedi, 2003), but a similar problem persists even in a developed country like the United States where around 10 percent of its people are still uninsured[1]. A small portion of the literature makes both qualitative and quantitative analyses of self-medication among racial minorities and the uninsured U.S. population (Vuckovic, 2000; Becker, 2001; Becker et al., 2004; Mainous et al., 2008; Luque et al., 2018). Still, these studies focused on population groups with very specific racial, regional, and clinical backgrounds with limited sample sizes.

In this paper, I examined how a large-scale insurance eligibility expansion for low-income adults, the Affordable Care Act (ACA) Medicaid expansion, affected local sales of Over-the-counter (OTC) pain medications that do not require prescriptions for purchase. Using comprehensive retail sales data and the difference-in-differences framework, I found that implementation of the ACA Medicaid expansion reduced sales of OTC oral pain medications

[1]Health Insurance Coverage: Early Release of Estimates from the National Health Interview Survey, January-June 2021, National Center for Health Statistics, 2021

by $0 \sim 5$ percent depending on prior uninsured rates before the reform. I also provide some evidence that such reduction was not limited to pain relievers. Although there is limited research on the utilization of informal care by disadvantaged households, this study provides insight into how they modify their care arrangements in response to expanded insurance eligibility. Given the extensive literature on the positive impact of insurance benefits on the utilization of formal healthcare, my findings suggest that patients may shift from self-medication with OTC products to professional care and prescription drugs after receiving insurance benefits.

This is the first study to explore the effect of the ACA Medicaid expansion on patients' reliance on OTC pain relievers, contributing to the existing large literature on the impact of this reform. A wide range of papers have demonstrated how the ACA Medicaid expansion led to a significant increase in Medicaid enrollment (Ghosh et al., 2019) and reduction in uninsured rates (Courtemanche et al., 2017; Kaestner et al., 2017). Other studies have reported better access to medical care, including ED and prescription drug utilization (Wherry and Miller, 2016; Garthwaite et al., 2017; Ghosh et al., 2019). Subsequent improvement in health outcomes have also been reported (Borgschulte and Vogler, 2020; Miller et al., 2021). As noted earlier, my study contributes to this literature by presenting concrete evidence that health insurance benefits result in a decrease in consumers' dependence on self-treatment with OTC drugs.

This paper adds to the relatively smaller but expanding body of literature on the relationship between OTC drugs and professional healthcare utilization as well. A couple of studies have examined whether OTC and prescription drugs are economic substitutes or complements, but with inconsistent results (Leibowitz, 1989; Stuart and Grana, 1995). Soni (2019) and Musse (2020) reveal substitution between the two by exploiting exogenous out-of-pocket price shocks of Medicare and reductions in prescription opioid supply respectively. I provide supporting evidence of such substitution, while also identifying further heterogeneity across drug types.

2 Background

2.1 ACA Medicaid Expansion

One of the biggest changes introduced by the 2010 ACA was the sharp expansion of Medicaid eligibility. Starting in 2014, all nonelderly adults and children with income below 138 percent of the federal poverty line (FPL) became eligible for Medicaid benefits. While the original intention was to implement this nationwide, the 2012 Supreme Court decision allowed state governments to opt out of the reform. Consequently, only 27 states, including the District of Columbia expanded Medicaid eligibility in 2014 and 12 states expanded later by 2022.[2] However, there was substantial variation in the degrees of expansion: some states that adopted the expansion already had significant prior expansion in eligibility before passage of the ACA (NY, MA, ME, DE, DC), therefore expanding only marginally under the ACA. In contrast, Wisconsin technically did not adopt the Medicaid expansion, but it greatly expanded the Medicaid eligibility on its own. I assign states to the treatment group considering such heterogeneity in the degree of actual eligibility expansion, which I discuss in a later section.

2.2 Health Insurance and OTC Drug Use

There are multiple possible channels through which insurance availability may affect patients' OTC medication use. First, lower out-of-pocket costs of professional healthcare options can induce more utilization of professional healthcare, hence reducing OTC consumption[3] (Leibowitz, 1989; Soni, 2019). Second, if certain OTC products are used in conjunction with care covered by insurance, the sales of such products could increase after insurance is gained (Baicker et al., 2017). Third, unlike previous substitution and complementary effects,

[2]Kaiser Family Foundation, Status of State Medicaid Expansion Decisions (2022)

[3]Even though most state Medicaid programs do cover OTC products, their coverage is highly limited. Most of them require prescriptions for reimbursement and cover only narrow lists of products (Medicaid Benefits: Over-the-Counter Products, KFF, 2018). It should be noted that even state Medicaids tagged "no limits on service" actually often have strict restrictions over OTC coverage.

an insurance benefit itself could have a significant income effect (Marie and Castello, 2012), which could also increase or decrease OTC consumption, depending on whether products are considered normal or inferior goods. These offsetting effects make the direction of response an empirical question.

3 Data

This study uses a large retail sales dataset, the Nielsen Retail Scanner dataset (NRS) provided by the Kilts Center for Marketing of the University of Chicago. It contains information on the weekly sales of each product, along with detailed product and store characteristics[4]. More than 30,000 retailers across all of the continental United States are covered. For this study, I use sales aggregated at the store-year level from 2010 to 2018, four years before and four years after the 2014 Medicaid expansion. To address potential compositional effects from the addition and attrition of sample stores in the data, the sample is restricted to stores that reported sales every year from 2010 to 2018. I focus on the sales of OTC oral pain medications and two other minor types of pain relievers. Summary statistics regarding their sales volume and store types are presented in Table 1, along with those of five other widely consumed OTC drugs. Following the approach of Simon et al. (2017), Cotti et al. (2019) and He et al. (2020), I identify treatment states by states' Medicaid expansion decisions throughout 2018, excluding the five states[5] that had large expansions prior to 2014. Table 2 illustrates the subsequent identification of treatment and control states.

For the information on the uninsured rates that I used in this study, I relied on data provided by the Small Area Health Insurance Estimates (SAHIE) program. This dataset offers county-year level uninsured rate estimates based on various survey data, including the American Community Survey, federal tax returns and census data. I used pre-expansion shares of uninsured nonelderly adults earning less than 138 percent of the FPL out of the

[4]Product characteristics include product name, size and price. Store characteristics include location, parent company identifier, and store type.

[5]New York, Delaware, District of Columbia, Vermont and Massachusetts

	Pain Medications			Other OTC Drugs				
	Oral Pain Med	Tooth & Gum	Chest Rub	Cold Med	Antacid	Laxative	Eye Drop	Sleeping Aid
Revenue ($)	41523	3930	8891	38219	25194	17919	13192	5788
Products sold (#)	6615	553	1346	6180	3042	2310	1543	710
Convenience(%)	3	0	0	3	3	0	2	0
Drug(%)	45	63	47	45	45	46	47	55
Grocery(%)	20	20	20	20	20	21	21	22
Mass Merchandiser(%)	32	17	33	32	32	33	30	23
Number of Stores	19999	14064	18861	19999	19990	19288	18760	15832

Note: Sales revenue and number of products sold are store-year level average values.

Table 1: Summary Statistics

entire nonelderly adult population as my treatment dosage variable, to identify potential degrees of treatment by the Medicaid expansion to local consumer bases. For convenience, these are called "uninsured rates" in this study. Figure 1 illustrates the distribution of the measure. It could be noted that people in non-expansion states were more likely to be uninsured compared to those in expansion states.

4 Empirical Framework

To estimate the causal relationship between Medicaid expansion and sales of OTC pain medications, I used a difference-in-differences (DD) model with continuous treatment dosages frequently used in the literature (e.g, Courtemanche et al., 2017, 2019; Ghosh et al., 2019). I also exploited staggered implementation of states after 2014 following the approach specified by Black et al. (2019):

$$y_{icst} = \beta PriorUninsured_{cs} \times Expansion_{st} + \gamma Expansion_{st} + \delta X_{cst} + \theta_i + \tau_t + \epsilon_{icst} \quad (1)$$

where i, c, s and t denote store, county, state, and year respectively; y_{icst} is the log sales in a store i located in county c of a state s in year t; $Expansion_{st}$ equals 1 if state s had its

Treatment		Control	
State	Expansion date	State	Expansion date
Alaska	9/1/2015	Alabama	
Arkansas	1/1/2014	Florida	
Arizona	1/1/2014	Georgia	
California	1/1/2014	Idaho	1/1/2020
Colorado	1/1/2014	Kansas	
Connecticut	1/1/2014	Maine	1/10/2019
Hawaii	1/1/2014	Missouri	
Iowa	1/1/2014	North Carolina	
Illinois	1/1/2014	Nebraska	10/1/2020
Indiana	2/1/2015	Oklahoma	7/1/2021
Kentucky	1/1/2014	South Carolina	
Louisiana	7/1/2016	South Dakota	
Maryland	1/1/2014	Tennessee	
Michigan	4/1/2014	Texas	
Minnesota	1/1/2014	Utah	1/1/2020
Montana	1/1/2016	Virginia	1/1/2019
North Dakota	1/1/2014		
New Hampshire	8/15/2014		
New Jersey	1/1/2014		
New Mexico	1/1/2014		
Nevada	1/1/2014		
Ohio	1/1/2014		
Oregon	1/1/2014		
Pennsylvania	1/1/2015		
Rhode Island	1/1/2014		
Washington	1/1/2014		
Wisconsin	1/1/2014		
West Virginia	1/1/2014		

Source : Kaiser Family Foundation, Status of State Medicaid Expansion Decisions (2022)

Note : Missouri began processing applications for the expanded Medicaid in 10/1/2021.

Following states with substantial prior expansions are excluded: Delaware, District of Columbia, Massachusetts, New York, Vermont

Table 2: State Medicaid Expansion Status and Implementation Dates

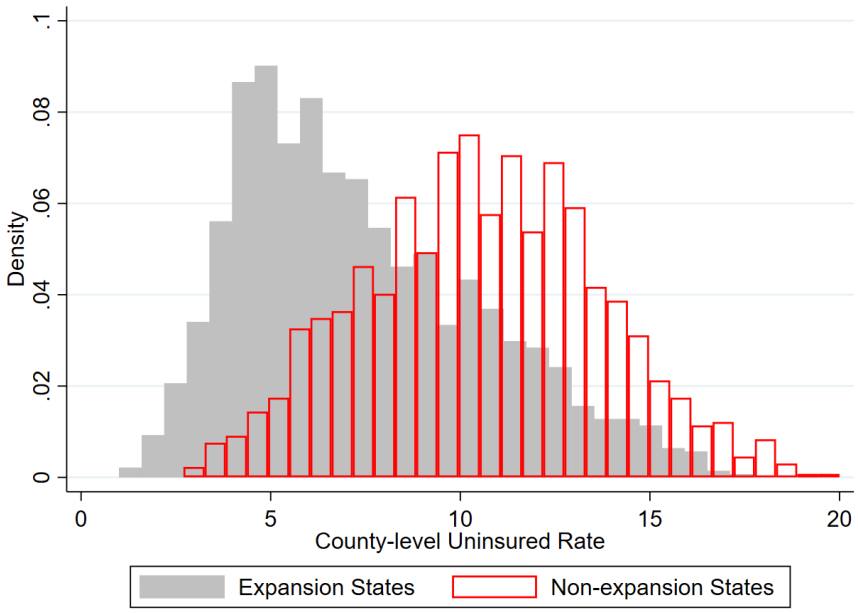


Figure 1: Distribution of County-level Prior Uninsured Rates

Medicaid expanded in year t; $PriorUninsured_{cs}$ represents shares of uninsured low-income adults among all non-elderly adults of a county c measured one year prior to the expansions[6]. X_{cst} denotes various time-varying county level controls including log number of population, proportion of population under the poverty line and unemployment rate. Store and year fixed effects, θ_i and τ_t, are added to control for all store and year-invariant characteristics.[7] The main coefficient of interest here is β, which estimates the effect of the Medicaid expansion per 1 percent point of prior county uninsured rates. All standard errors are clustered at the county level.

The validity of Eq.(1) relies on the parallel trends assumption, which cannot be tested directly. To provide graphical evidence to support the assumption, I estimated following

[6]As previously mentioned, I call this measure "uninsured rate" for pure convenience.

[7]Since all stores do not move across counties and states, the store fixed effect absorbs other geographical fixed effects.

	(1) Oral Pain Med	(2) Tooth & Gum Analgesics	(3) Chest rub
Expansion	0.0109	0.0760***	0.0222**
	(0.00793)	(0.0109)	(0.0109)
PriorUninsured × Expansion	-0.00413***	-0.00680***	-0.00334***
	(0.00103)	(0.00143)	(0.00121)
Store FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
States with Prior Expansion	Excl.	Excl.	Excl.
R^2	0.987	0.965	0.979
Observations	179991	126576	169749

Standard errors in parentheses
Standard errors are clusered at the county level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$

Table 3: Effects of the Medicaid Expansions on OTC Pain Reliever Sales

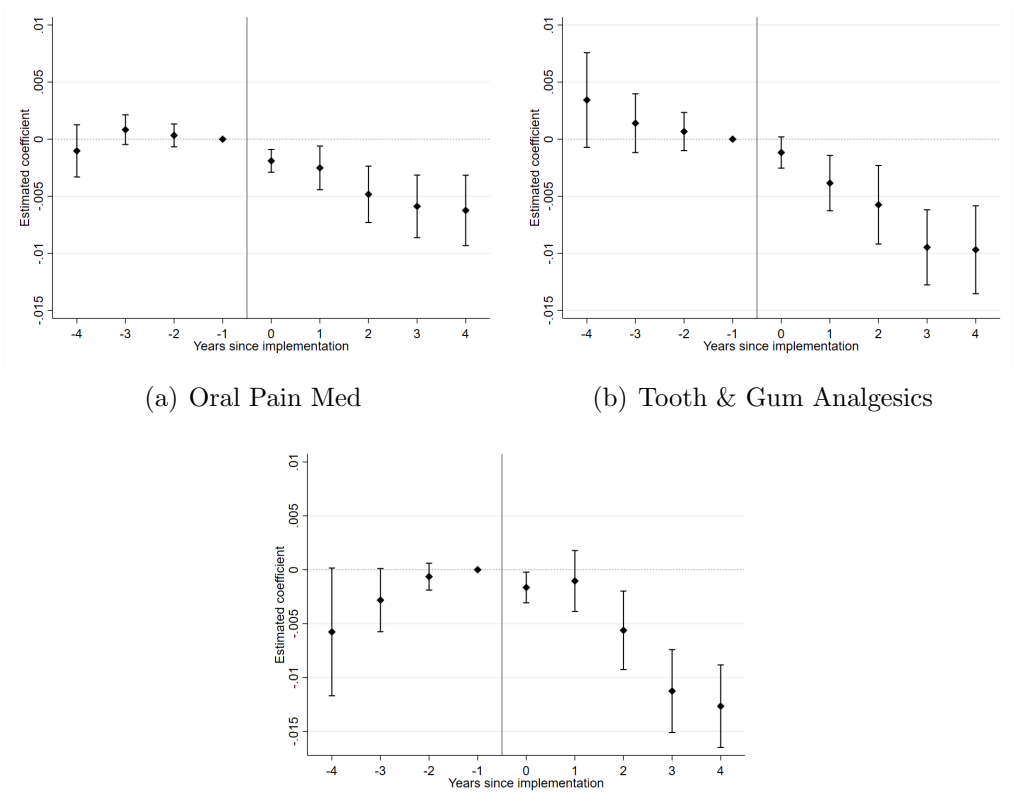
event study specification:

$$y_{icst} = \sum_{\substack{k=-4 \\ k\neq -1}}^{4} \beta_k PriorUninsured_{cs} \times E_{st}(k = t - t_s^*) + \sum_{\substack{k=-4 \\ k\neq -1}}^{4} \gamma_k E_{st}(k = t - t_s^*) + \delta X_{cst} + \theta_i + \tau_t + \epsilon_{icst} \quad (2)$$

I estimated up to four years prior to and five years following the Medicaid expansion to examine the response specific to the relative timing around implementation. Statistically significant β_ks for $k < 0$ could imply the existence of nonparallel trends between treatment and control states. In addition, estimates for $k \geq 0$ may show whether the impacts of the Medicaid expansions increased or decreased over time.

5 Results

Table 3 and Figure 2 present the point estimates and dynamic event study estimates, respectively for Eq.(1) and Eq.(2). The overall effect coefficients are all statistically significant, suggesting that a 1 percent point increase in the proportion of uninsured low-income population led to $0.36 \sim 0.79$ percent reduction in sales. Oral pain medications and chest rub



(a) Oral Pain Med

(b) Tooth & Gum Analgesics

(c) Chest Rub

Figure 2: Event study : Effects of the Medicaid Expansions on OTC Pain Reliever Sales

Notes: Above plots illustrate β_ks and corresponding 95 percent confidence intervals estimated by the event study regression of Eq.(2). Standard errors are clustered at the county level. The red vertical lines indicate the implementation of Medicaid expansions, where $k = -1$ serves as the reference year.

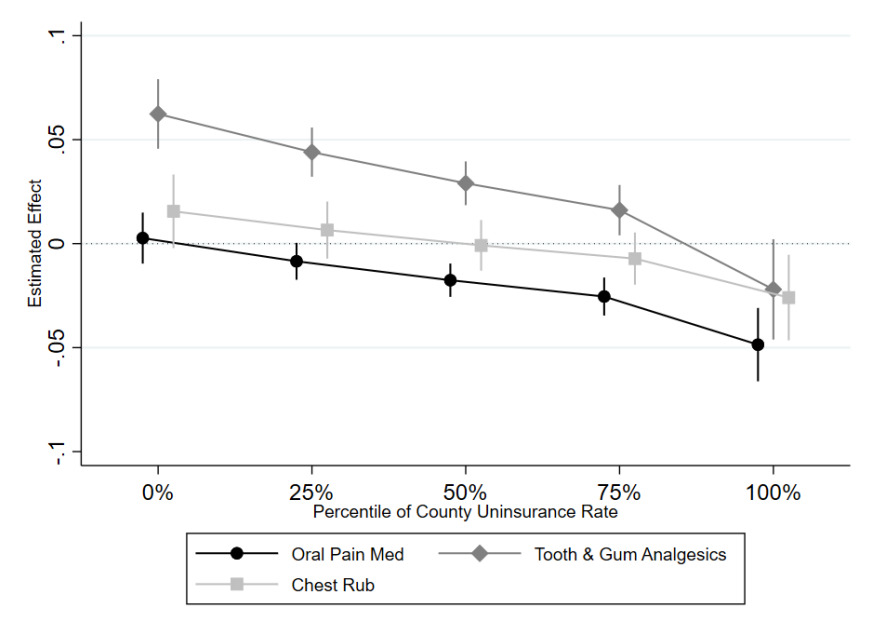


Figure 3: Estimated Effects Across Prior Uninsured Rates

products showed little base effect ($Expansion$), but a highly significant effect from treatment dosage ($PriorUninsured \times Expansion$). In contrast, tooth & gum analgesics exhibited a large base effect that was opposite to the dosage effect. It may be due to smaller sales and sample size of this drug type compared to the other two, which are more widely marketed and consumed.

The event study plots of Figure 2 confirm the point coefficients introduced earlier. The largest category, oral pain medications Figure 2-(a) did not show a pre-trend before the expansion, but a strong treatment effect afterward. The other two minor drug categories, Figure 2-(b) and (c) did show some signs of pre-trends, although they were marginally not significant. It should be noted that the estimates of Table 3 for these two categories could be biased given such results. Nonetheless, the magnitudes of pre-trends were small compared to the estimated post-period effects.

It could be difficult to understand the effects of Medicaid expansion on actual sales from the coefficients presented in Table 3. Therefore, Figure 3 illustrates how the treatment effects varied across counties with different prior uninsured rates. For example, sales of oral pain

medication decreased in almost all counties: by 0 percent in the least uninsured county with prior uninsured rate of 2 percent but by 4.9 percent in the most uninsured county, where 14.4 percent of adult population was uninsured and low-income before the expansion. Table 4 and Figure 5 of Appendix B show results for other OTC drug types. Similar patterns of reduction in sales were observed for sales of cold medicine, laxatives and eye drop.

6 Conclusion

This study investigated how the ACA Medicaid expansion affected the sales of OTC pain medications. I used a standard DD model interacted with a continuous treatment variable to examine the heterogeneous effects across counties with different prior uninsured rates. The estimates found that the Medicaid expansion effectively decreased retail sales of OTC oral pain medications by about 0.4 percent for every 1 percent point increase in the proportion of uninsured low-income adult population, with similar results for other minor pain relievers. This decrease in OTC sales, combined with increased utilization of professional care reported by previous literature, suggests that improved access to healthcare through the Medicaid expansion helped people move toward more professional healthcare and prescription drugs from self-medication with OTC products.

7 Acknowledgement

Researcher's own analyses calculated (or derived) based in part on data from Nielsen Consumer LLC and marketing databases provided through the NielsenIQ Datasets at the Kilts Center for Marketing Data Center at The University of Chicago Booth School of Business. The conclusions drawn from the NielsenIQ data are those of the researcher(s) and do not reflect the views of NielsenIQ. NielsenIQ is not responsible for, had no role in, and was not involved in analyzing and preparing the results reported herein.

8 Data Availability Statement

The data that support the findings of this study are available from the U.S. Census Bureau and the Kilts Center at the University of Chicago. Restrictions apply to the availability of these data.

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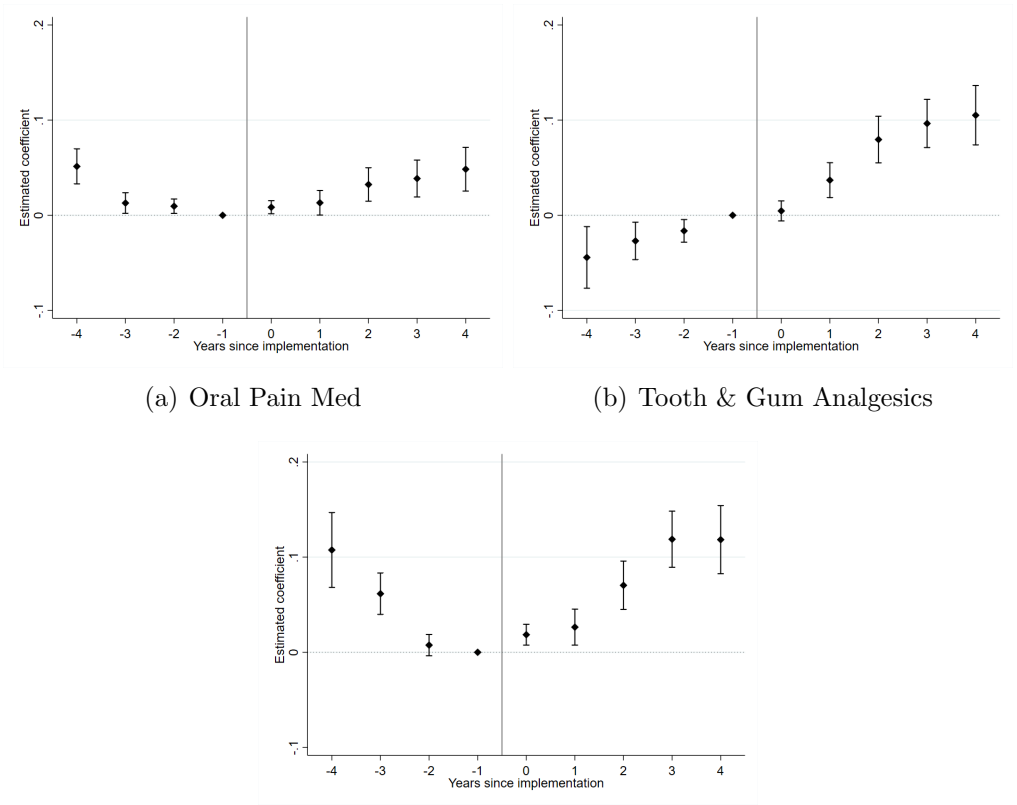
Appendix A. DD coefficients



(a) Oral Pain Med

(b) Tooth & Gum Analgesics

(c) Chest Rub

Figure 4: Event study : Effects of the Medicaid Expansions on OTC Pain Reliever Sales

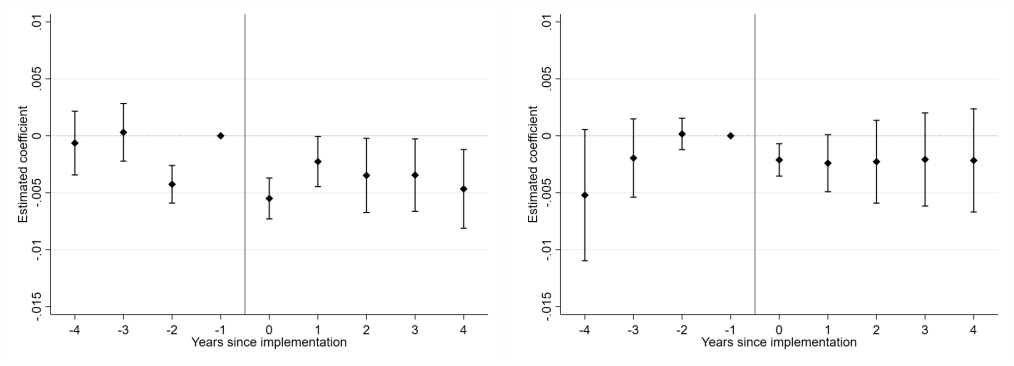
Notes: Above plots illustrate γ_ks and corresponding 95% confidence intervals estimated by the event study regression of Eq.(2). Standard errors are clustered at the county level. The red vertical lines indicate the implementation of Medicaid expansions, where $k = -1$ serves as the reference year.

Appendix B. Other OTC Medications

	(1) Cold Med	(2) Antacid	(3) Laxative	(4) Sleeping Aid	(5) Eye Drop
Expansion	-0.0042	-0.0349***	0.0279***	-0.0381***	0.0114
	(0.0092)	(0.00853)	(0.00964)	(0.0124)	(0.00845)
PriorUninsured × Expansion	-0.0021*	-0.000866	-0.00322***	0.000268	-0.00183*
	(0.0012)	(0.00101)	(0.00111)	(0.00171)	(0.000972)
Store FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
States with Prior Expansion	Excl.	Excl.	Excl.	Excl.	Excl.
R^2	0.989	0.981	0.985	0.958	0.990
Observations	170676	179910	173592	142488	168840

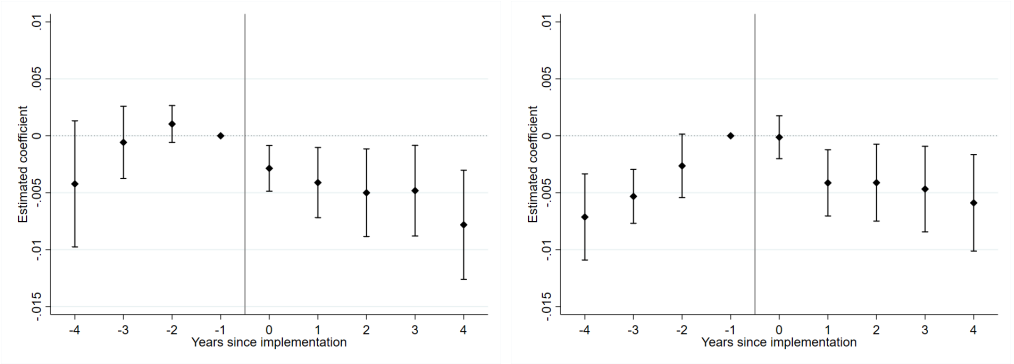
Standard errors in parentheses
Standard errors are clusered at the county level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$

Table 4: Effects on Other OTC Drug Sales



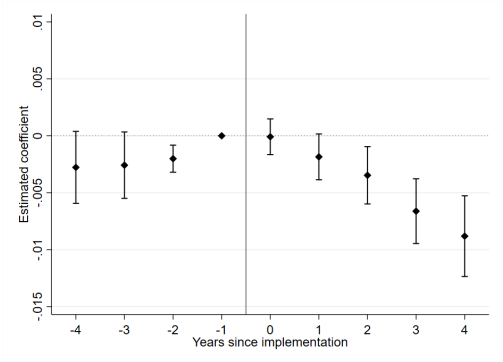
(a) Cold Med

(b) Antacid



(c) Laxative

(d) Sleeping Aid



(e) Eye Drop

Figure 5: Event study : Effect of Medicaid expansions on Other OTC Drug Sales

Notes: Above plots illustrate β_ks and corresponding 95% confidence intervals estimated by the event study regression of Eq.(2). Standard errors are clustered at the county level. The red vertical lines indicate the implementation of Medicaid expansions, where $k = -1$ serves as the reference year.