

How do local government finances respond to the opioid epidemic? Evidence from Hydrocodone Rescheduling

Felipe Lozano-Rojas¹ Mikhail Ivonchyk²

¹Assistant Professor
School of Public and International Affairs - University of Georgia

²Assistant Professor
Rockefeller College of Public Affairs and Policy - SUNY Albany

22 de mayo de 2023

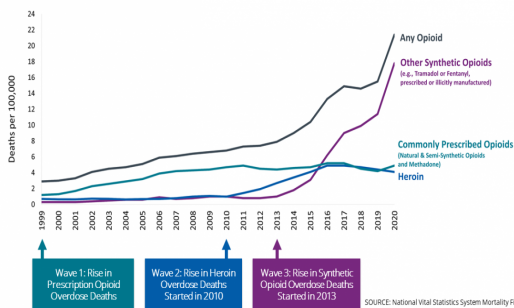


UNIVERSITY OF GEORGIA

The different waves of the Opioid Epidemic

- Opioids continue to be a leading cause of death in the U.S - more than 500,000 people between 1999 and 2020, and 107,000 in 2021 alone.
- Up to 2010, crisis driven by prescription opioids (1st wave).
- From 2010, heroin started to catch up (2nd wave).
- In 2013, synthetic opioids took off exponentially (3rd wave).

Three Waves of Opioid Overdose Deaths



Addressing the Crisis

- **Direct SA Treatment** ⇒ Federal and State Local Governments
 - Strengthening of the Substance Abuse and Mental Health Block Grants
 - In 2021 alone more than \$5 billion (SAMHSA). Map of per capita spending in SAT by State. [◀ Map](#)
 - SSA report funding from states 25 % (non expansion states 40 %)
 - **Funds are fungible** (Andrews, et al.(Forth.)) - **Influenced by Medicaid politics** (Grogan, et al. 2020).
- **Additional reform** to support the effort
 - Since 2016, **\$16 billion approved** for treatment, reduce supply, demand and harm-reduction (CBO,2022)
 - CARA and Cures (2016) / SUPPORT Act (2018) / CARES (2021)



Addressing the Crisis

- **Direct SA Treatment** ⇒ Federal and State Local Governments
 - Strengthening of the Substance Abuse and Mental Health Block Grants
 - In 2021 alone more than \$5 billion (SAMHSA). Map of per capita spending in SAT by State. [◀ Map](#)
 - SSA report funding from states 25 % (non expansion states 40 %)
 - **Funds are fungible** (Andrews, et al.(Forth.)) - **Influenced by Medicaid politics** (Grogan, et al. 2020).
- **Additional reform** to support the effort
 - Since 2016, **\$16 billion approved** for treatment, reduce supply, demand and harm-reduction (CBO,2022)
 - CARA and Cures (2016) / SUPPORT Act (2018) / CARES (2021)
- **Local Governments**
 - Additional health services (i.e. Hospital, ED), First-response, Foregone revenues ⇒ Subject of debate
 - Multi-District Litigation. \$54 billion awarded to states and local governments. States have committed at least 40 % to localities directly (opioidsettlementtracker.com).



Our research question

- What are the expenditure **choices** across county governments affected by the opioid crisis?
 - More **policing**?
 - More **health spending**?
- If there is any, who **bears the burden** of increased expenditures?
 - The county government?
 - Higher levels of government?



Our research question

- What are the expenditure **choices** across county governments affected by the opioid crisis?
 - More **policing**?
 - More **health spending**?
- If there is any, who **bears the burden** of increased expenditures?
 - The county government?
 - Higher levels of government?



Our research question

- What are the expenditure **choices** across county governments affected by the opioid crisis?
 - More **policing**?
 - More **health spending**?
- If there is any, who **bears the burden** of increased expenditures?
 - The county government?
 - Higher levels of government?
- Can we use an exogenous source of variation to address this question?
 - A combination of Difference-in-Difference
 - And matching through a kNN - Regression ($k=10$)



The Hydrocodone Rescheduling

- **Hydrocodone**, the second most common prescription opioid, became **harder to come by**.
 - It was reschedule from Schedule III to the more restrictive Schedule II in October 2014, following recommendation from U.S. Department Health and Human Services. (DEA Schedule [Go](#))
- So far the literature has found (Usmani, et al. 2021; Beheshti, 2022):
 - Prescription of Hydrocodone ↓
 - Prescription of other opioids ↑
 - Illegal opioids ↑ (drug arrests)
 - **Labor supply** ↑
 - Mortality effects are contested - few articles (Hydrocodone ↓) (Other Opioids ↑)
 - **Long-Term Mortality** ↓, **through synthetic modality** ↓ (Behesti, 2022; Lozano-Rojas & Abraham, 2023).
- Do these changes leave any trace in county-governments' accounts?
 - Other studies have not found much of an effect (Bifulco & Shybalkina, 2022).



Data

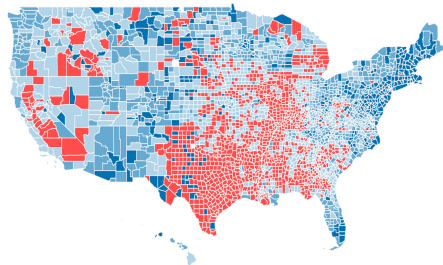
We use the following data sources:

- **Annual Survey of State and Local Government Finances** - Budget Item information at the county level. Expenditures and Revenues.
- **Mortality Data** - Vital Statistics Multiple Cause-of-Death Mortality Data from the National Vital Statistics System **Centers for Disease Control and Prevention**.
- **Hydrocodone Exposure** - Pharmacy level data on MMEs from prescription opioids (i.e. hydrocodone, oxycodone, among others) aggregated at the county level. **DEA ARCOS** from the Multi-District Litigation.
- Time changing **County Characteristics**.
 - Population and demographic characteristics. **Census Bureau**.
 - Economic conditions **Bureau of Economic Analysis**.
 - Additional health and education variables (County Health Rankings).
- Time changing **States' Policies**.
 - Medicaid Expansion. **Kaiser Family Foundation**.
 - Good Samaritan Laws, Naloxone regulation, Presc. Drug Monitoring Programs both, Must Access and Electronic Records. **RAND OPTIC**.
 - Cannabis Laws - (Any) Legalization and (Any) Dispensary Opening (**Steuart, 2022**).

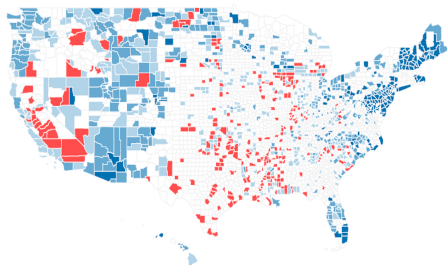


Working Sample of Counties

All Counties



Census of Local Governments Sample



□ No data ■ Q1 ■ Q2 ■ Q3 ■ Q4

Note: The figure on the left presents counties quartiles on the basis of the hydrocodone exposure distribution. Each quartile groups 25% of the population. The figure on the right, shows the counties we have complete information from the Census Survey of State and Local Government Finances. As a note, Connecticut and Rhode Island do not have county governments. The Census sample groups 1,077 counties which account for 83% of the country population.

(k=10) Nearest Neighbor Regression

Event-Study Approximation

$$y_{igt} = \sum_{a=03}^{12} \alpha_a \cdot \mathbf{1}[t = a] \cdot \mathbf{1}[\text{Hydro}_i = 1] + \sum_{b=14}^{19} \beta_b \cdot \mathbf{1}[t = b] \cdot \mathbf{1}[\text{Hydro}_i = 1] \\ + \eta_1 \cdot Z_{it} + \eta_1 \cdot Z_{sit} + \theta_i + \theta_t + \Omega_g + \epsilon_{igt}$$

Pre-Post Summary

$$y_{igt} = \beta \cdot \mathbf{1}[t \geq 2014] \cdot \mathbf{1}[\text{Hydro}_i = 1] + \eta_1 \cdot Z_{it} + \eta_2 \cdot Z_{sit} + \theta_i + \theta_t + \Omega_g + \epsilon_{igt}$$

Where,

- y_{igt} → County i , in neighbor group g , expenditure or Revenue per capita in period t
- $\mathbf{1}[\text{Hydro}_i = 1]$ → Dummy identifying counties in the top of the hydrocodone exposure variable, prior to rescheduling.
- Z_{it} → County-level time-changing characteristics and Z_{sit} → State-level policies.
- Ω_g → Grop of 10 neighbors constructed on the bases of all variables, plus state (time-invariant).

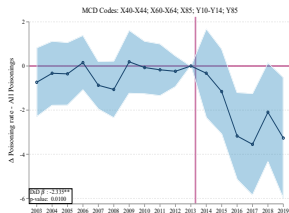
We choose kNN regression because

- Difference in Difference (DiD) results often do not allow for ruling out pre-trends.
- kNN allows to improve counterfactuals' base for comparison.
- Results very similar, although DiD lead to lower estimates in most cases

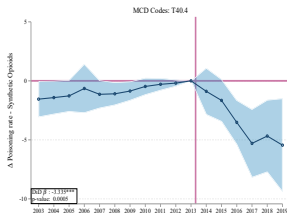


First Stage - Mortality

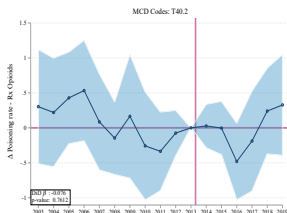
From any Poisoning



Synthetic Opioids



Natural Opioids (Rx)



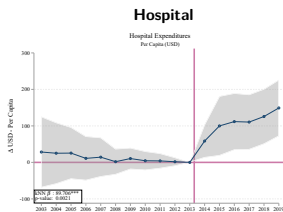
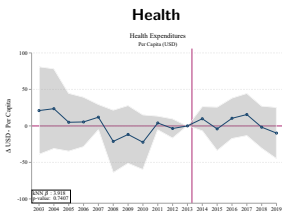
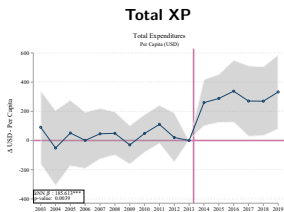
For the sub-sample of counties for which we have financial information:

- Our findings confirm that in the 5-years after the rescheduling, in localities where hydrocodone was more prevalent **poisoning mortality has decreased importantly** ($\beta = -2,3 - p = 0,0100$).
- The decrease stems **from prevented synthetic opioid deaths** ($\beta = -3,3 - p = 0,0005$)
- **Mortality from prescription opioids (Rx), doesn't change** significantly in the long-run. It decreased at first, but recovered its pre-rescheduling level after ($\beta = -0,08 - p = 0,7612$).
- First stage over prescription opioids in 2014 [◀ Go](#)

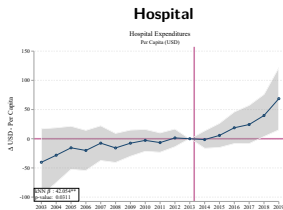
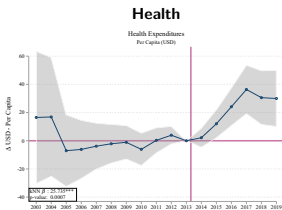
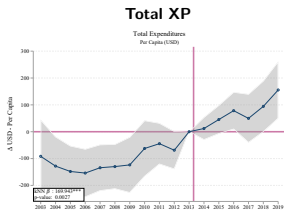


Expenditures

With State Policy Variables

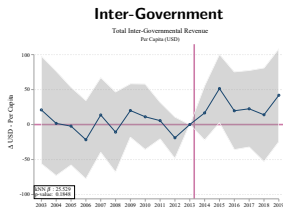
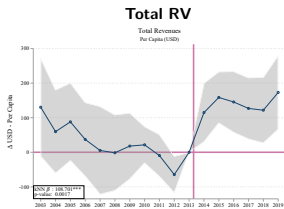


Without including State Policy Variables

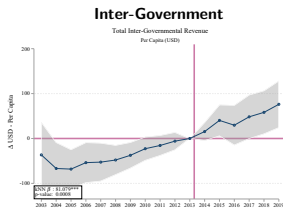
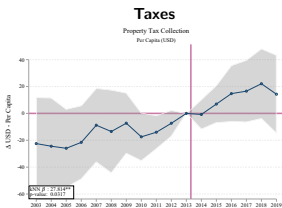
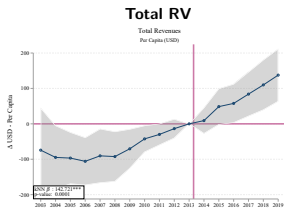


UNIVERSITY OF GEORGIA

With State Policy Variables



Without including State Policy Variables



Coefficient Magnitudes and Summary of Findings

	Expenditures			Revenues		
	(1) Total Exp.	(2) Health	(3) Hospital	(4) Total Rev.	(5) Taxes	(6) IG Rev.
Panel A - with State Policy Variables						
β	185.6*** (63.73)	3.918 (11.82)	89.71*** (28.85)	108.7*** (34.29)	34.28*** (11.91)	25.53 (19.20)
R ²	0.944	0.840	0.945	0.963	0.959	0.947
Panel B - No State Variables						
β	169.9*** (56.18)	25.73*** (7.471)	42.05** (19.41)	142.7*** (36.14)	41.41*** (14.56)	81.08*** (23.91)
R ²	0.947	0.759	0.902	0.947	0.941	0.932
N	48,059	48,059	48,059	48,059	48,059	48,059
Omega Cls.	257	257	257	257	257	257
County Cls.	830	830	830	830	830	830

Standard errors clustered at the county and neighboring group levels in parentheses. Significance levels reported at: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

- Net of considered state policies, **county expenditures increase \$185.6 per capita** (14.5 % of pre-intervention baseline). With an **increase of \$89.7 in Hospital** expenditures.
- State policy drive an increase in health expenditures, and lower levels of hospital expenditures (\$25 add. per capita).
- The **funding** for the increase expenditure stems **from increased tax revenue** (mainly property), but more importantly **from state-federal IG** transfers that start prior to the rescheduling (pre-trend).
- No increases in **policing** or **correction** expenditures.

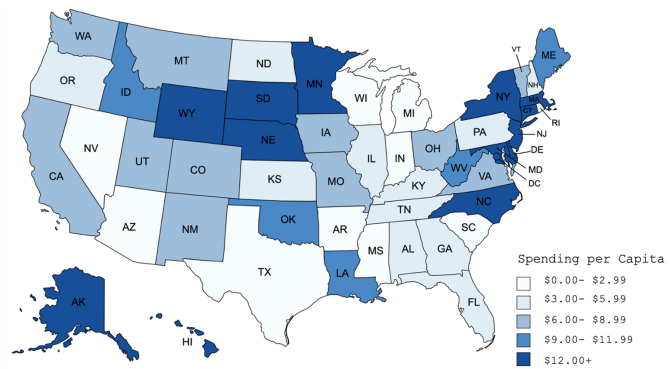


Conclusions

- Following rescheduling of hydrocodone, **improvements in mortality** in the localities where the medication was more prevalent, **have been accompanied by**:
 - Increase the counties' **health and hospital** expenditures.
 - Increase in revenues from property **taxes** and from **IG transfers**.
 - **State policies** drive the increases in health services and the increase in IG revenue. The latter starts prior to the rescheduling.
 - No significant change in **policing** or correction expenditures.
- The **burden** of the increase in expenditures has been on **State and Federal budgets** as the increase in transfers would indicate
- **Magnitudes are important** in contrast to the other available study. More in line with what the MDL suggest.
- **Caveats / Limitations**
 - We do not observe project-specific expenditure, nor can connect the increased revenues to specific sources beyond the classification from the Census Survey.
 - It is hard to argue that improved mortality conditions “cause” more expenditures. We argue that the improvements “have been accompanied” by changes in county level expenditures in average.



Mean State Per Capita Funding for Substance Use Disorder Treatment and Prevention, by State, 2019



Andrews, et al (Forth.).

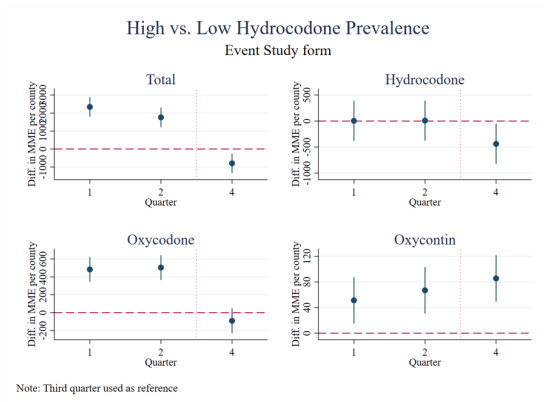
Note: Andrews, et al. (Forth.) analysis of Substance Abuse and Mental Health Services Administration Web-Based Block Grant Application System (WebBGAS), State Agency Reported Expenditures by Source of Funds, 2019

Substance Regulation in the United States

- **Schedule I** substances, or chemicals are defined as drugs with no currently accepted medical use and a high potential for abuse.
 - heroin, LSD, THC cannabis, 3,4-methylenedioxymethamphetamine (ecstasy), methaqualone, and peyote.
- **Schedule II** substances, or chemicals are defined as drugs with a high potential for abuse, with use potentially leading to severe psychological or physical dependence. These drugs are also considered dangerous.
 - combination products with less than 15 milligrams of hydrocodone (Vicodin), cocaine, methamphetamine, methadone, hydromorphone (Dilaudid), meperidine (Demerol), oxycodone (Oxycontin), fentanyl, Dexedrine, Adderall, and Ritalin
- **Schedule III** drugs, substances, or chemicals are defined as drugs with a moderate to low potential for physical and psychological dependence. Schedule III drugs abuse potential is less than Schedule I and Schedule II drugs but more than Schedule IV.
 - products containing less than 90 milligrams of codeine per dosage unit (Tylenol with codeine), ketamine, anabolic steroids, testosterone
- **Schedule IV** drugs, substances, or chemicals are defined as drugs with a low potential for abuse and low risk of dependence.
 - Xanax, Soma, Darvon, Darvocet, Valium, Ativan, Talwin, Ambien, Tramadol
- **Schedule V** drugs, substances, or chemicals are defined as drugs with lower potential for abuse than Schedule IV and consist of preparations containing limited quantities of certain narcotics. Schedule V drugs are generally used for antidiarrheal, antitussive, and analgesic purposes.



Opioid prescriptions and Hydrocodone rescheduling



Note: The figure presents the event studies for the series of prescription opioids in Morphine Milligram Equivalents (MME). While the total decrease in opioids exhibits pre-trends in 2014, the drop in hydrocodone is causally linked to the introduction of the rescheduling change.