

The Impacts of Naloxone Access Laws on Opioid Overdose Deaths in the U.S.

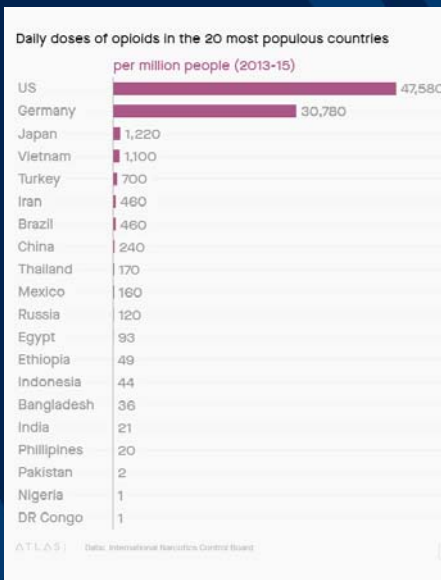
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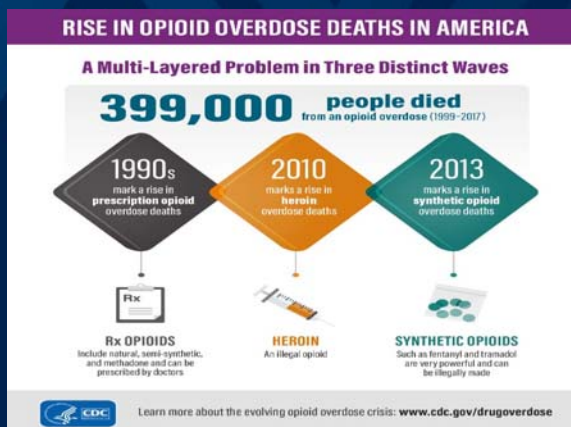


Opioid Epidemic

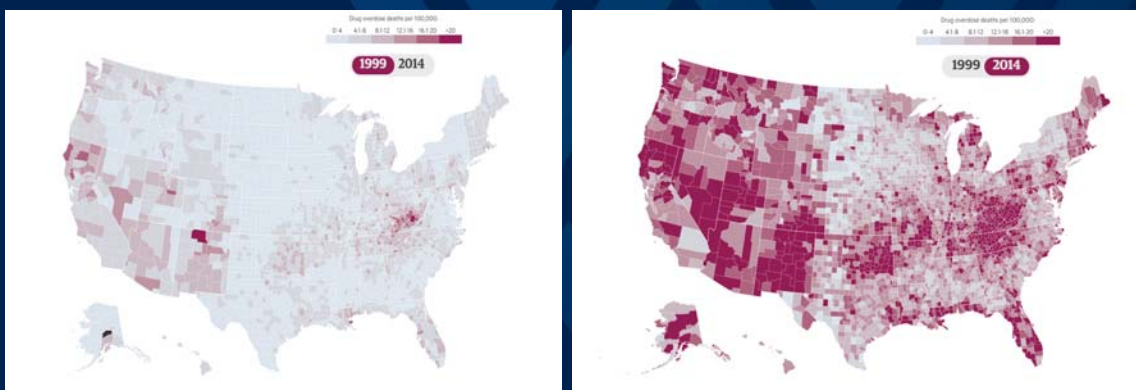


#1

- The leading cause of unintentional death in the U.S.
- On average 130 deaths per day
- Caused about half a million deaths in the U.S. (2000-2017)



Introduction- Map of Drug Overdose Deaths per 100,000 in 1999- 2014



1999

Source: The Guardian

2014

Introduction

- Opioid overdose is reversible through the timely administration of the medication naloxone
- “Law is at least partially responsible for inability to access appropriate medical care.” Corey Davis (2016)

Introduction

Addressing the opioid crisis attempts to

1. limit the supply of opioids through prescription drug monitoring programs.
2. reduce the number of overdose deaths by authorizing the more widespread provision of overdose reversal drugs, such as naloxone.

Introduction- From Policy Standpoint

- Since 1996, an increasing number of programs have provided naloxone to opioid users.
- Naloxone is a prescription medicine that can reverse an overdose and block the effects of opioids (Heroin, Morphine, Methadone) with no life threatening effects on the opioid users.

Introduction- Naloxone

Currently available devices for naloxone administration are

1. Nasal spray
2. Narcan Nasal Spray
3. Evzio auto-injector
4. Syringe



1.



2.



3.



4.

Naloxone Access Law in States- 2019

The first state



New Mexico
(2001)

Wyoming
Kansas



No naloxone access law

Research Question

Are naloxone access laws helping to reduce opioid overdose deaths?

Preview of Results

- Depends on the provision, the law may or may not help reduce the opioid overdose deaths.
- Some evidence of spillover effects of law enactment

Heterogeneity in the Law

- Prescriptions could be authorized to third parties.
- Administering naloxone to a layperson could be immune from criminal/ civil liability.
- Criminal liability could be removed for possession of naloxone.
- In some states, prescribing by a standing order is authorized; while in other states, it is not.
- Immunity from criminal prosecution/ civil liability/ professional sanction for prescribing, dispensing or distributing naloxone for prescribers and dispensers

Heterogeneity in the Law

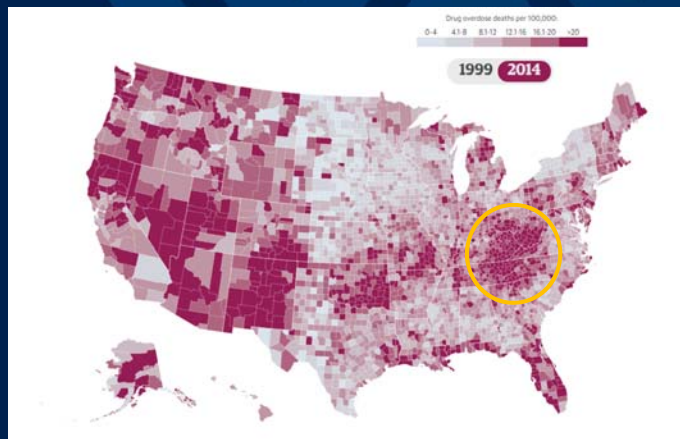
- Immunity from criminal prosecution for prescribers for prescribing, dispensing or distributing naloxone



- Immunity from civil liability for prescribers for prescribing, dispensing or distributing naloxone



Motivation- Map of Drug Overdose Deaths per 100,000 in 2014



Source: The Guardian

Spatial Analysis

- Visual evidence of clustering among states
- A common index: Moran's I

	1999	2016
Moran's I	0.407	0.581
Z-statistics	5.413	5.842
P-value	0.01	0.00

Empirical Model

$$TODDrate_{it} = \beta_0 + \beta_1 NAL_{it} T_{it} + \sum_{j=2}^n \beta_j X_{ijt} + \rho WTODDrate_{jt} + \sigma WNAL_{jt} T_{jt} + \theta WX_{jt} + v_i + z_t + \varepsilon_{it}$$

TODDrate – Total Overdose Deaths rate

X

- Income Inequality Index
- Unemployment Rate
- Education
- Poverty Rate
- Uninsured Rate
- Population Density
- Heroin Related Crimes
- Drug Prescriptions
- Employment Ratio

NAL Naloxone Access Law
 i 48 contiguous states + D.C.
 t 1999 - 2016
 W Continuity weight matrix
 v State fixed effect
 z Year fixed effect

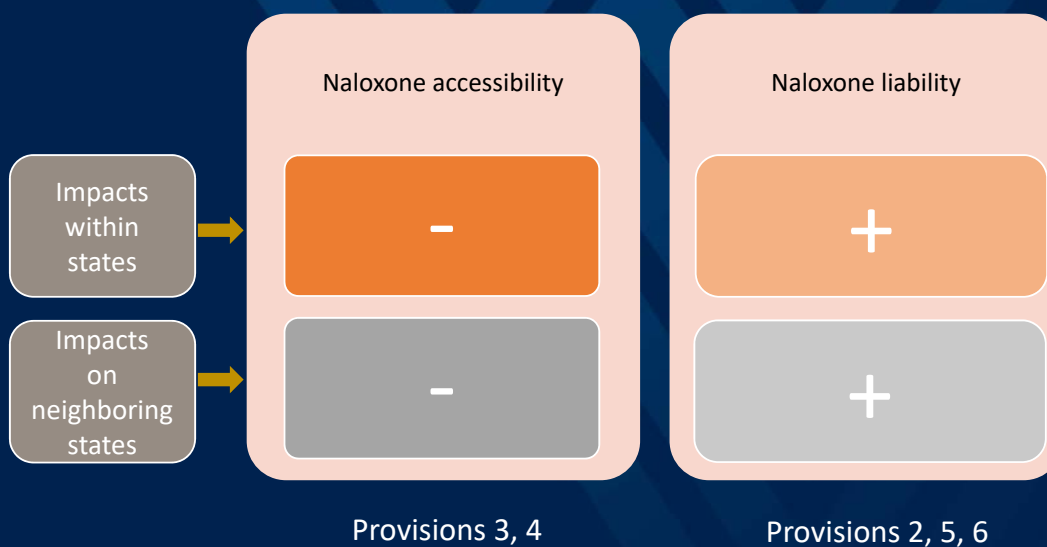
Dependent Variables

1. A binary variable for passage of a naloxone access law
2. The number of days since the effective date of the law
3. A breakdown of access law by their specific provisions

Naloxone Access Law Provisions

- NAL 1:** Having a naloxone access law
- NAL 2:** Immunity from criminal liability, civil liability and professional sanctions for prescribers and dispensers for prescribing, dispensing or distributing naloxone to a layperson
- NAL 3:** Third party authorization to prescribe naloxone
- NAL 4:** Pharmacists are allowed to dispense or distribute naloxone without a patient-specific prescription from another medical professional
- NAL 5:** Immunity from criminal and civil liability administering naloxone to a layperson
- NAL 6:** Removing criminal liability for possession of naloxone

Results- Law Provisions



Conclusions

- 1) Opioid overdose death rate is a regional epidemic
- 2) The naloxone access law has impacts on opioid overdose deaths
- 3) Some evidence of spillover effects of law enactment

Discussions/ Conclusions

Our findings show that opioid overdose death is not a local phenomena. We recommend neighboring states to cooperate to restrain opioid overdose deaths.

Conclusions- Possible Explanations

- Not having enough access to the medicine
- Law is unclear
- Naloxone decreases the consumption cost
- Being aware of having access to naloxone may increase the propensity to consume drugs (moral hazard)
- Naloxone save lives but it is not decreasing overdose deaths (unintended consequences)

Limitations

1. There are different types and prices for naloxone in states.
2. For those 19 states with newly enacted laws in 2015 and 2016, we do not have post implementation data.

Future Works

- Applying a hierarchical analysis using county level data
- Employ a mechanism that differentiates the relationship between neighbors by whether or not they have an access law
- Investigate the factors influencing the adoption of the law

Takeaway

Encouraging those who have experienced an overdose to enter into treatment is an important component of an overdose prevention plan.

Takeaway



Thank you!

Questions and comments?

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Previous Studies

- **McClellan et al., 2018** • **Rees et al., 2017**
 - **Doleac and Mukherjee, 2018**
- Naloxone access and Good Samaritan laws reduce the opioid-related deaths by 14 and 15 percent, respectively.
- Heroin related overdose deaths are not associated with the naloxone access law.
- Naloxone access increases opioid-related emergency room visits and opioid-related thefts, it does not reduce overdose deaths.

Naloxone Access Law effective date

State	Naloxone Access Law effective date	State	Naloxone Access Law effective date
Alabama	June 10, 2015	Missouri	August 28, 2015
Alaska	March 15, 2016	Nebraska	May 28, 2015
Arizona	August 6, 2016	Nevada	October 1, 2015
Arkansas	July 15, 2015	New Hampshire	June 2, 2015
California	January 1, 2008	New Jersey	July 1, 2013
Colorado	May 10, 2013	New Mexico	April 3, 2001
Connecticut	October 1, 2003	New York	April 1, 2006
Washington, D.C.	March 19, 2013	North Carolina	April 9, 2013
Delaware	August 4, 2014	North Dakota	August 1, 2015
Florida	June 10, 2015	Ohio	March 11, 2014
Georgia	April 24, 2014	Oklahoma	November 1, 2013
Hawaii	June 6, 2016	Oregon	June 6, 2013
Idaho	July 1, 2015	Pennsylvania	November 29, 2014
Illinois	January 1, 2010	Rhode Island	June 18, 2012
Indiana	April 17, 2015	South Carolina	June 3, 2015
Iowa	May 27, 2016	South Dakota	July 1, 2016
Kentucky	June 25, 2013	Tennessee	July 1, 2014
Louisiana	August 15, 2015	Texas	September 1, 2015
Maine	April 29, 2014	Utah	May 13, 2014
Maryland	October 1, 2013	Vermont	July 1, 2013
Massachusetts	August 2, 2012	Virginia	July 1, 2013
Michigan	October 14, 2014	Washington	June 10, 2010
Minnesota	May 10, 2014	West Virginia	May 27, 2015
Mississippi	July 1, 2015	Wisconsin	April 9, 2014

Results

For detailed explanation of the results shown in the next two slides please see the following article on “The Impact of Naloxone Access Laws on Opioid Overdose Deaths in the U.S.” which can be found at the following websites:

<https://scholar.google.com/citations?user=x450LjEAAA&hl=en>

Or

<https://rrs.scholasticahq.com/article/7932-the-impact-of-naloxone-access-laws-on-opioid-overdose-deaths-in-the-u-s>

Results- Binary Variable and Days After the Law

	Dependent Variable: opioid overdose deaths rate			
	Dummy		Days after law	
	Direct	Indirect	Direct	Indirect
Naloxone access law	0.238	5.767***	-	-
Days after law	-	-	0.251	7.656***
Days after NAL^2	-	-	-0.00001	-0.001***
Medical marijuana	1.318***	2.687*	1.109**	1.772
Heroin arrest rate	0.008***	0.007	0.008***	0.009*
Drug prescriptions	0.010***	0.021*	0.010***	0.024**
Employment ratio	34.104***	-68.280**	36.500***	-59.90*
Population density	0.002**	-0.006	0.003	0.009
Income inequality index	-0.011	-0.035	-0.015	-0.052
College graduate rate	-0.060	0.118	-0.034	0.151
Education spending per student	0.116	0.045	0.124	-0.019
Poverty rate	0.169	1.570***	-0.043	1.210
Unemployment rate	-0.161	-0.529	-0.163	-0.359
Uninsured rate	0.052	0.333*	0.071	0.420**
Per capita income	-2.130***	4.246*	-2.571***	1.84
Year/State FE	X		X	
R ²	0.85		0.85	

Results- Law Provisions

Dependent Variable: opioid overdose deaths rate			
Determinants	Direct Effect	Indirect Effect	Total Effect
NAL #2	-0.199	2.970**	2.771
NAL #3	-0.555	-5.948***	-6.503**
NAL #4	-0.237	4.165	3.928
NAL #5	1.994***	9.659***	11.653***
NAL #6	0.373	5.710**	6.084**
Medical marijuana	0.815*	0.308	1.124
Heroin arrest rate	0.008***	0.005	0.014**
Opioid prescription	0.012***	0.030**	0.042***
Employment ratio	31.699***	-49.547	-17.847
Population Density	0.001	-0.002	-0.0003
Income inequality index	-0.008	-0.026	-0.034
College graduate rate	-0.048	0.163	0.114
Education spending per student	0.155	0.432	0.587
Poverty rate	0.011	0.636	0.647
Unemployment rate	0.035	0.274	0.310
Uninsured rate	-0.0007	0.030	0.030
Per Capita Income	-2.179***	3.584	1.404
Year/State FE		X	
Rho		0.47***	
R ²		0.86	

Note: *, **, and *** refer to 10%, 5%, and 1% significance levels, respectively.

Naloxone Access Law Provisions, 1999-2016

Provision 1: Having immunity from criminal prosecution for prescribing, dispensing or distributing Naloxone to a layperson for prescribers.

Provision 2: Having immunity from civil liability for prescribing, dispensing or distributing Naloxone to a layperson for prescribers.

Provision 3: Having immunity from professional sanctions for prescribing, dispensing or distributing Naloxone to a layperson for prescribers.

Provision 4: Having immunity from criminal prosecution for prescribing, dispensing or distributing Naloxone to a layperson for dispensers.

Provision 5: Having immunity from civil liability for prescribing, dispensing or distributing Naloxone to a layperson for dispensers.

Provision 6: Having immunity from professional sanctions for prescribing, dispensing or distributing Naloxone to a layperson for dispensers.

Provision 7: Prescribers are allowed to provide Naloxone to third parties.

Provision 8: Pharmacists are allowed to dispense or distribute without a patient-specific prescription from another medical professional.

Provision 9: Immunity from criminal liability when administering Naloxone for a Layperson.

Provision 10: Immunity from civil liability when administering Naloxone for a layperson.

Provision 11: Removing criminal liability for possession of Naloxone

Effective Dates of Naloxone Access Law Provisions, 1999-2016

Year	PR 1	PR 2	PR 3	PR 4	PR 5	PR 6	PR 7	PR 8	PR 9	PR 10	PR 11
2001	NM	NM		NM	NM		NM		NM	NM	
2002											
2003	CT	CT		CT	CT						
2004											
2005											
2006											
2007							NY				
2008	CA	CA		CA	CA						
2009											
2010			IL WA			IL WA	IL WA	IL	IL WA		
2011											
2012	MA						MA		RI		MA
2013	CO NI NC VT	CO NI NC VT	CO KY MD NI	CO NI VT	CO NI VT	CO KY MD NI	CO KY MD NI VT VA	CA DE GA MA MI MN NM NY OK PA TN TX VA	CA DE GA MA MI MN NM NY OK PA TN TX VA	CA DE GA MA MI MN NM NY OK PA TN TX VA	CA DE GA MA MI MN NM NY OK PA TN TX VA
2014	DE GA MA MI MN NM NY OK PA TN TX VA	DE GA MA MI MN NM NY OK PA TN TX VA	CA DE GA MA MI MN NM NY OK PA TN TX VA	DE GA MA MI MN NM NY OK PA TN TX VA	DE GA MA MI MN NM NY OK PA TN TX VA	DE GA MA MI MN NM NY OK PA TN TX VA	CA DE GA MA MI MN NM NY OK PA TN TX VA	CA DE GA MA MI MN NM NY OK PA TN TX VA	CA DE GA MA MI MN NM NY OK PA TN TX VA	CA DE GA MA MI MN NM NY OK PA TN TX VA	CA DE GA MA MI MN NM NY OK PA TN TX VA
2015	AL AK FL ID IL LA MD MS NE NV NH ND OH SC TX VA WV	AL AK FL ID IL LA MD MS NE NV NH ND OH SC TX VA WV	AK FL ID IL LA MD MS NE NV NH ND OH SC TX VA WV	AL AK FL ID IL LA MD MS NE NV NH ND OH SC TX VA WV	AL AK FL ID IL LA MD MS NE NV NH ND OH SC TX VA WV	AL AK FL ID IL LA MD MS NE NV NH ND OH SC TX VA WV	AL AK FL ID IL LA MD MS NE NV NH ND OH SC TX VA WV	AL AK FL ID IL LA MD MS NE NV NH ND OH SC TX VA WV	AL AK FL ID IL LA MD MS NE NV NH ND OH SC TX VA WV	AL AK FL ID IL LA MD MS NE NV NH ND OH SC TX VA WV	AL AK FL ID IL LA MD MS NE NV NH ND OH SC TX VA WV
2016	AZ ME MD SD WA	IA ME SD WA	AZ ME MD SD	AZ CT ME MD SD	ME MD NM SD	AZ ME MD NM SD	AZ ME MD NM SD	AZ FL IA ME MD NM SD	ME MD NM SD	AZ IA ME MD NM	IA LA ME MD NM



Data Sources

- ❖ Drug Overdose Deaths: Multiple Cause of Death Data/ NVSS: CDC Wonder provided by Center for Disease Control and Prevention
- ❖ Naloxone Overdose Prevention Laws: The Policy Surveillance Program: A LawAtlas Project
- ❖ Poverty rate/ unemployment rate/ population density/ uninsured rate: The U.S. Census Bureau
- ❖ Income inequality/ College Attainment: The U.S. State- Level Income Inequality Data and Annual State-Level Measures of Human Capital Attainment: Mark W. Frank
- ❖ Shape file of U.S. states: The U.S. Census Bureau (Tiger) report
- ❖ Heroin related arrests: FBI
- ❖ Drug prescriptions: Automated Reports and Consolidated Ordering System (ARCOS)
- ❖ Employment in mining, construction, and manufacturing and labor force: BLS



Previous Studies

Control Variables	Studies
Income distribution	Galea et al., 2003; Nandi et al., 2006
Unemployment, per capita GDP, urbanization	Gatti, 2007
Heroin source/type, price and purity	Unick et al., 2014
Educational attainment	Richardson et al., 2015
State medical cannabis laws	Bachhuber et al., 2014
Uninsured adults and health care cost	Shah et al., 2012
Non-spatial analysis of the law on OODD	McClellan et al., 2018; Rees et al., 2017, Doleac and Mukherjee, 2018

Summary Statistics

Variables	Mean	St. Dev.	Min	Max
Drug overdose deaths rate (per 100K pop)	7.05	5.12	0.26	40
Days after Naloxone access law (days/1,000)	0.234	0.712	0	5.745
Naloxone access Law	-	-	0	1
Population density (Pop./mi ²)	342.31	1,242.48	5.028	10,013
Income inequality (income share for the top 10%)	44.72	4.98	33.27	62.17
College attainment (the total number of college graduates/ the total state population) (%)	0.19	0.04	0.10	0.46
Poverty rate (%)	13.38	3.34	5.60	23.90
Unemployment rate (%)	5.71	2.06	2.30	13.70
Uninsured rate (%)	12.69	4.14	3.00	26.10
Per capita income (\$1,000)	38.03	9.09	20.56	75.75
Spending on education (\$1,000)	9.226	2.838	4.169	20.609
Presence of medical marijuana law	0.25	0.43	0	1
Heroin arrest rate (arrests/100k pop)	138.05	103.15	0.61	761.43
Opioid prescription (kg/100k pop)	56.527	41.023	6.911	496.506
Employment ratio (%)	0.14	0.04	0.002	0.26
Number of observations		882		

Questions -

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