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Online Appendix

The Effects of Naloxone Access Laws on Opioid Abuse, Mortality, and Crime

Jennifer L. Doleac and Anita Mukherjee

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OA. Online Appendix

OA1. Regional Analysis

There are regional differences in the types of opioids available as well as in health care access; these likely produce regional differences in the effects of broad naloxone access. For instance, we expect naloxone access to have more beneficial effects in the West because of the greater prevalence of black tar heroin in that region (Quinones, 2015; Ciccarone, 2009). Black tar heroin (in contrast to powder heroin) does not mix easily with fentanyl, so it would be more difficult for users or dealers to increase the potency of opioid consumption in response to naloxone laws. This should increase the effectiveness of naloxone in individual cases. In addition, we would expect more beneficial effects in places where those who become addicted to opioids or are saved by naloxone can more easily access drug treatment. For instance, states in the Northeast and West tend to provide broader access to Medicaid, which covers drug treatment.

Figures OA1 through OA4 show effects on ER visits, mortality, and opioid-related theft separately by Census region, while Table OA1 presents all of our main results separately for each region. The most striking difference from the average effects discussed above is that—as expected—those averages masked substantial heterogeneity in mortality effects. In the Midwest, we find that broadening naloxone access increased opioid-related mortality by 14% ($p < 0.05$) and fentanyl-related mortality by 84% ($p < 0.10$). Pre-trends are flat, evidence that the parallel trends assumption holds and that laws are not passed in response to differential increases in opioid or fentanyl use. Effects on mortality are also positive in the South, but negative in the Northeast and West (all not significant, except that the negative effect on fentanyl-related mortality is statistically significant in the West). Since the opioid crisis has been most consequential in the Midwest and South, these results suggest that naloxone access may have exacerbated the crisis in the places that were hardest-hit (and perhaps where public health resources could not keep up). Our other outcome measures suggest increases in opioid abuse in the Midwest, South, and the Northeast. In

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the West, the directions of effects are more mixed, suggesting that the (insignificant) decrease in mortality is the primary finding for this region.

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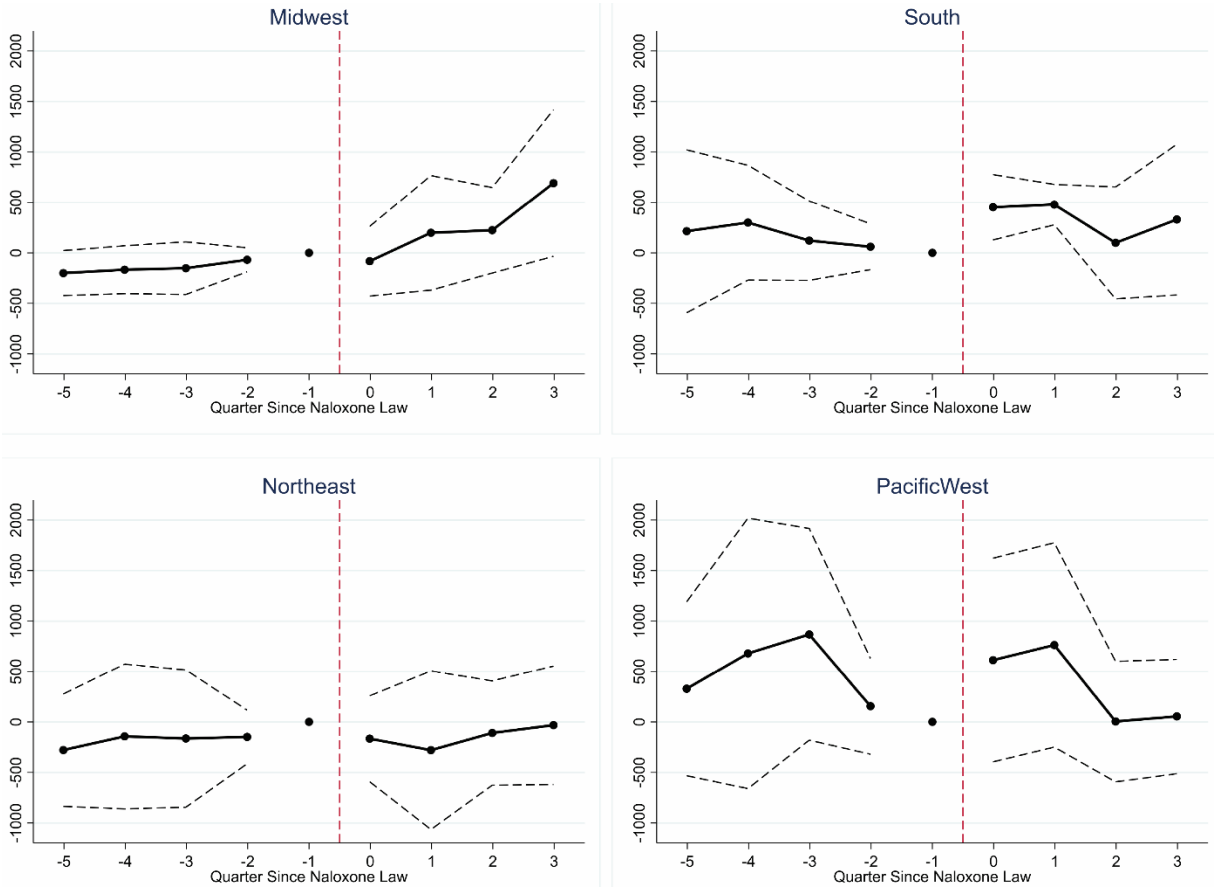
Figure OA1. Effect of naloxone access laws on opioid-related ER visits



Notes: See text description of Figure 4. Data source: HCUP. Sample includes metro areas. Date range: 2006-2015.

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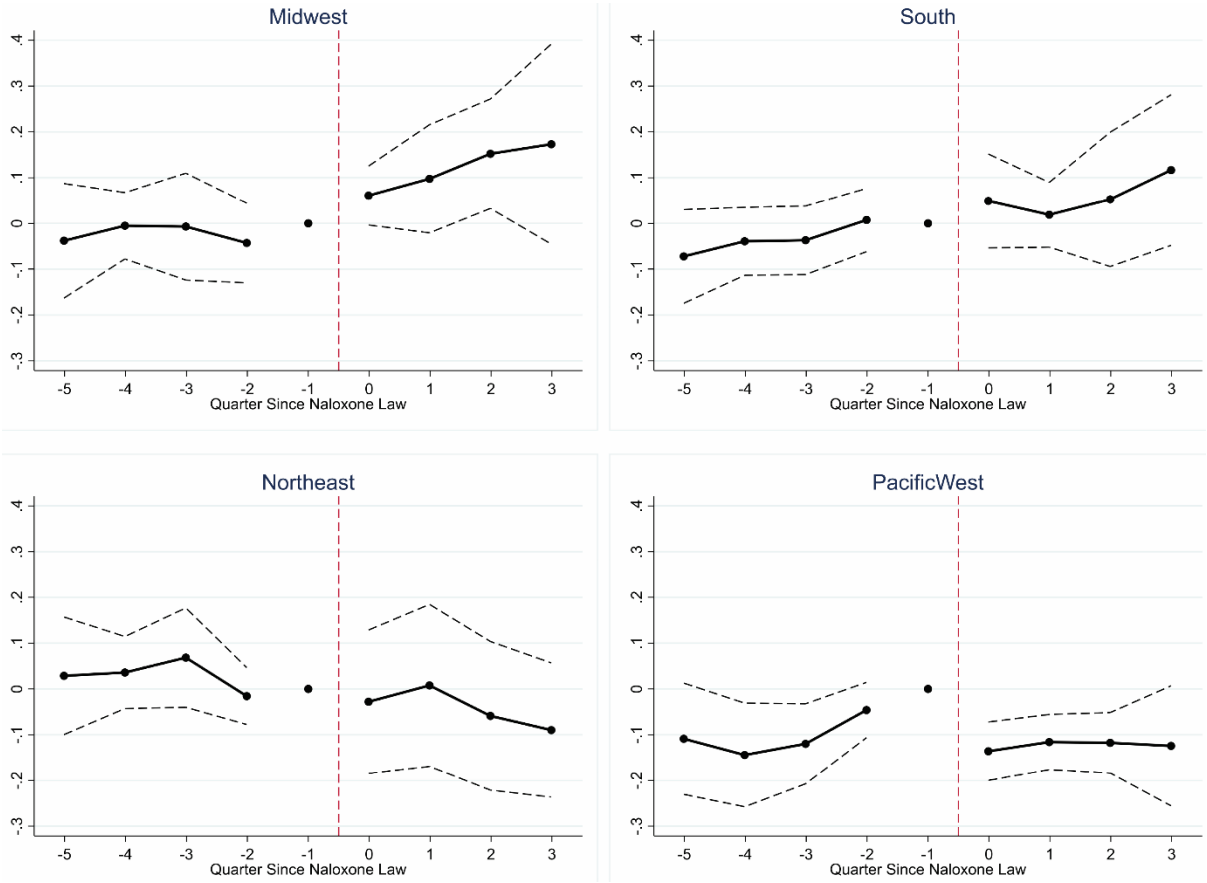
Figure OA2. Effect of naloxone access laws on opioid-related mortality



Notes: See text description of Figure 4. Data source: CDC. Sample includes counties that include at least one city with population $\geq$ 40,000. Date range: 2010-2015.

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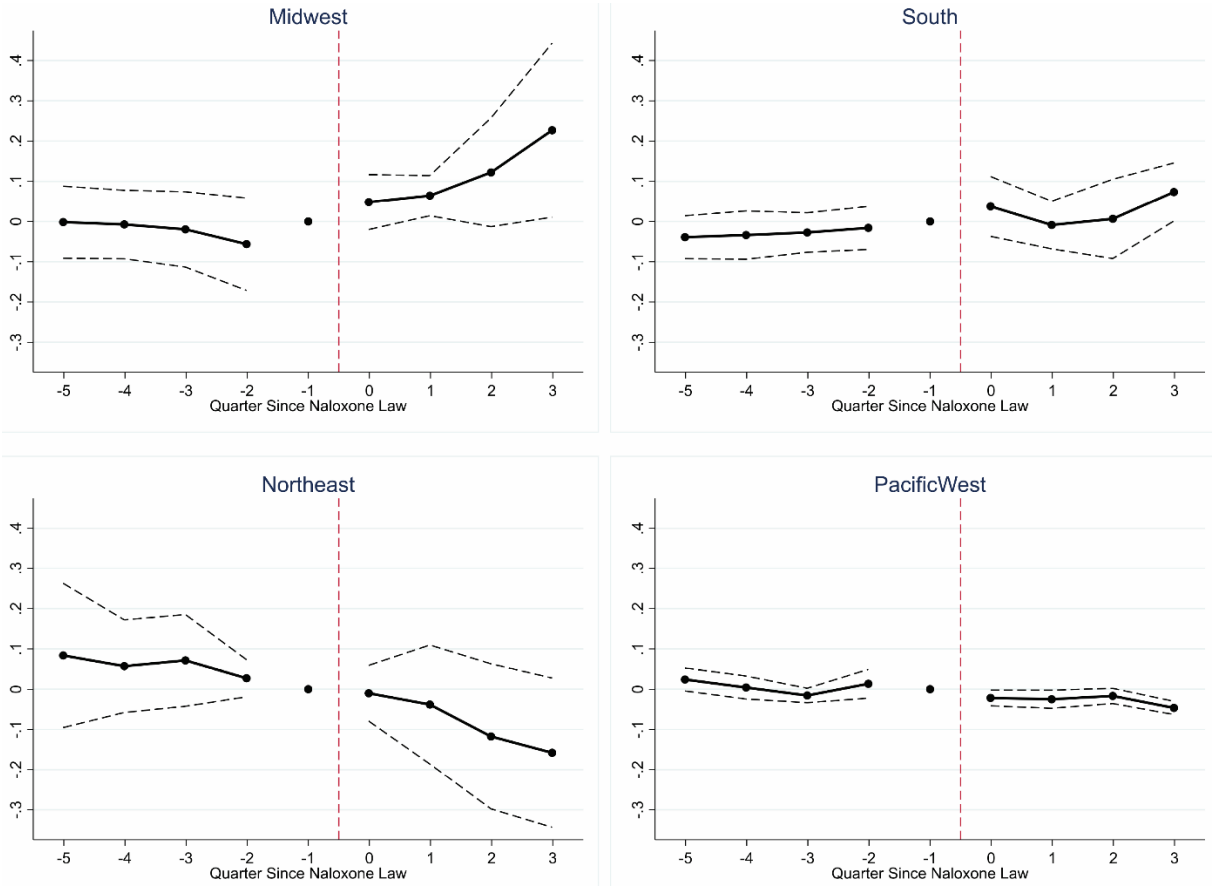
Figure OA3. Effect of naloxone access laws on fentanyl-related mortality



Notes: See text description of Figure 4. Data source: CDC. Sample includes counties that include at least one city with population $\geq$ 40,000. Date range: 2010-2015.

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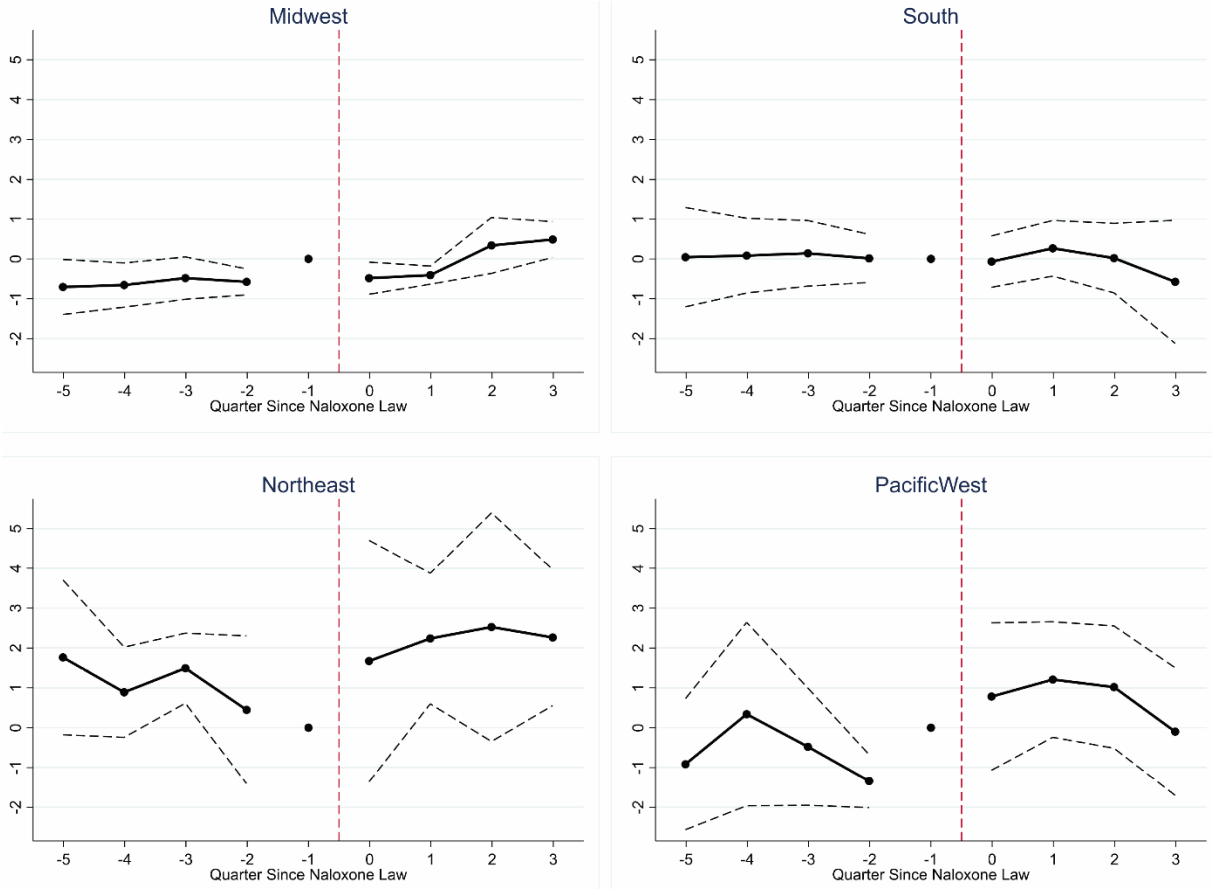
Figure OA4. Effect of naloxone access laws on opioid-related theft



Notes: See text description of Figure 4. Data source: NIBRS. Sample includes jurisdictions with population $\geq$ 40,000. Date range: 2010-2015.

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Table OA1. Effect of naloxone laws by region

	Possession of opioids	Selling opioids	Opioid-related ER visits	Opioid-related deaths	Fentanyl-related deaths	Opioid-related crime	Opioid-related theft
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Midwest							
Naloxone Law	4.925*	0.874**	293.9	0.094**	0.076*	5.481*	0.034
	(2.140)	(0.363)	(240.2)	(0.041)	(0.041)	(2.542)	(0.278)
Observations	9,432	9,432	404	12,240	12,240	9,432	9,432
2010 baseline	21.99	5.165	1223	0.664	0.090	34.98	0.955
South							
Naloxone Law	3.783	1.694*	309.1**	0.052	0.033	5.333	0.136
	(3.415)	(0.780)	(111.9)	(0.037)	(0.020)	(4.349)	(0.312)
Observations	11,520	11,520	260	25,488	25,488	11,520	11,520
2010 baseline	23.95	7.398	1636	0.589	0.086	40.32	1.327
Northeast							
Naloxone Law	6.408**	5.286*	-24.93	-0.047	-0.092	12.10**	0.860
	(1.803)	(2.073)	(142.5)	(0.064)	(0.081)	(3.146)	(0.619)
Observations	3,888	3,888	260	8,136	8,136	3,888	3,888
2010 baseline	31.72	14.78	2032	0.523	0.074	57.56	1.973
West							
Naloxone Law	-1.854	0.649	57.08	-0.059	-0.023***	-0.226	1.417***
	(3.130)	(1.252)	(41.82)	(0.040)	(0.006)	(2.589)	(0.363)
Observations	4,968	4,968	184	9,648	9,648	4,968	4,968
2010 baseline	20.40	4.568	2498	0.619	0.068	34.03	1.843

Notes: * $p < .10$, ** $p < .05$, *** $p < .01$. Standard errors are clustered by state and shown in parentheses. Sample includes jurisdictions with population $\geq$ 40,000 (for NIBRS data), counties with any such jurisdictions (for CDC data), and metro areas (for HCUP data). Date range: 2010-2015 for NIBRS and CDC data, 2006-2015 for HCUP data. All regressions include: jurisdiction FEs, month of year FEs, year FEs, state-specific linear trends, police per capita (except column 3), and the following laws/regulations: Good Samaritan laws, PDMP, Doctor Shopping, Pain Clinic regulations, Physician exams, Pharmacy verification, require ID, and tamper-resistant PF. Coefficients show the effect of expanding naloxone access on arrests per million residents (columns 1 and 2), number of ER visits (column 3), deaths per 100,000 residents (columns 4 and 5), and reported crimes per million residents (columns 6 and 7). All coefficients except ER visits are also population-weighted.

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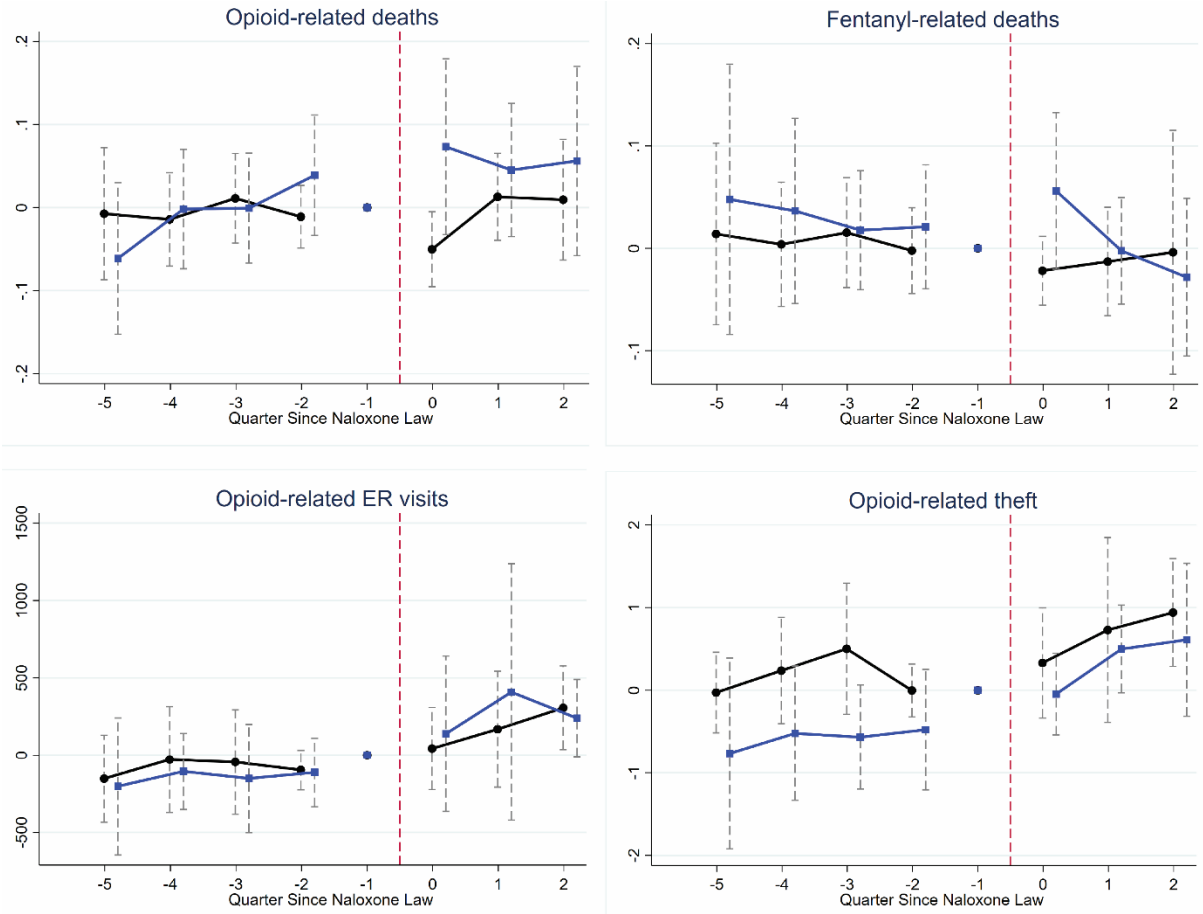
OB. Additional Figures and Tables

Figure OB1. Effect of naloxone access laws on outcomes by year of passage



Notes: See text description of Figure 4. The black line (circle markers) indicates results for states that expanded naloxone in 2014 or before; the blue line (square markers) indicates results for states that expanded naloxone in 2015. Data source: CDC (for mortality), HCUP (for ER admissions), and NIBRS (for arrests and crime). Date range: 2010-2015 (CDC and NIBRS), 2006-2015 (HCUP).

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Table OB1. Relationship between Google searches and drug treatment admissions

	Drug treatment admissions for opioid abuse (TEDS data)
Google searches for "drug rehab" topic	306.1**
	(115.9)
Observations	293
2010 baseline	8837.8

Notes: Standard errors in parentheses. * $p < .10$, ** $p < .05$, *** $p < .01$. Number of drug treatment admissions related to opioids are measured at the state-year level. Sample includes state-year observations from the Treatment Episode Data Set (TEDS), produced by the Substance Abuse and Mental Health Services Administration (SAMHSA). Date range: 2010-2015.

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Table OB2. Effect of naloxone laws using only timing variation

	Possession of opioids (1)	Selling opioids (2)	Opioid-related ER visits (3)	Opioid-related deaths (4)	Fentanyl-related deaths (5)	Opioid-related crime (6)	Opioid-related theft (7)
Naloxone Law	3.835**	1.884**	161.471	-0.003	-0.013	6.069**	0.390
	(1.833)	(0.706)	(105.606)	(0.027)	(0.031)	(2.446)	(0.231)
Observations	27,216	27,216	616	49,752	49,752	27,216	27,216
2010 baseline	24.07	7.37	2,420	0.595	0.080	40.596	1.379

Notes: * $p < .10$, ** $p < .05$, *** $p < .01$. Standard errors are clustered by state and shown in parentheses. Data sources: NIBRS (monthly, 2010-2015), CDC (monthly, 2010-2015), and HCUP (quarterly, 2006-2015). Sample is restricted to the 40 states that expanded naloxone access by December 31, 2015. All regressions include: jurisdiction FEs, month of sample FEs, state-specific linear trends, police per capita (except column 3), the dates of Medicaid expansion (as in Simon, Soni and Cawley (2017)), and the following laws/regulations: Good Samaritan laws, PDMP, Doctor Shopping, Pain Clinic regulations, Physician exams, Pharmacy verification, require ID, and tamper-resistant PF. Coefficients show the effect of expanding naloxone access on arrests per million residents (columns 1 and 2), number of ER visits (column 3), deaths per 100,000 residents (columns 4 and 5), and reported crimes per million residents (columns 6 and 7). All coefficients except those in column (3) are also population-weighted.

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Table OB3. Effect of naloxone laws by year of passage

	Possession of opioids	Selling opioids	Opioid-related ER visits	Opioid-related deaths	Fentanyl-related deaths	Opioid-related crime	Opioid-related theft
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Naloxone Law (≤ 2014)	4.062*	2.562***	253.378**	-0.026	-0.007	6.392*	0.371
	(2.063)	(0.892)	(118.798)	(0.029)	(0.043)	(3.132)	(0.250)
Naloxone Law (2015)	3.986	1.046	318.566	0.063	0.004	5.596	0.472
	(2.552)	(0.867)	(377.075)	(0.045)	(0.038)	(3.341)	(0.306)
Observations	29,808	29,808	1,108	55,512	55,512	29,808	29,808
2010 baseline	23.52	6.972	1738	0.601	0.080	39.34	1.367

Notes: * $p < .10$, ** $p < .05$, *** $p < .01$. Standard errors are clustered by state and shown in parentheses. Data sources: NIBRS (monthly, 2010-2015), CDC (monthly, 2010-2015), and HCUP (quarterly, 2006-2015). Naloxone Law (≤ 2014) indicates that the law was passed in 2014 or earlier; Naloxone Law (≥ 2015) indicates that the law was passed in 2015 or later. All regressions include: jurisdiction FEs, month of sample FEs, state-specific linear trends, police per capita (except column 3), the dates of Medicaid expansion (as in Simon, Soni and Cawley (2017)), and the following laws/regulations: Good Samaritan laws, PDMP, Doctor Shopping, Pain Clinic regulations, Physician exams, Pharmacy verification, require ID, and tamper-resistant PF. Coefficients show the effect of expanding naloxone access on arrests per million residents (columns 1 and 2), number of ER visits (column 3), deaths per 100,000 residents (columns 4 and 5), and reported crimes per million residents (columns 6 and 7). All coefficients except those in column (3) are also population-weighted.

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Table OB4. Effect of naloxone laws by availability of drug treatment

	Q1 (low)	Q2	Q3	Q4 (high)	Q1 (low)	Q2	Q3	Q4 (high)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Opioid-related deaths				**Fentanyl-related deaths**			
Naloxone Law	0.032	0.032	0.016	-0.028	0.052*	0.012	0.010	-0.038
	(0.035)	(0.040)	(0.034)	(0.054)	(0.026)	(0.018)	(0.035)	(0.054)
Observations	13,896	13,896	13,896	13,824	13,896	13,896	13,896	13,824
2010 baseline	0.555	0.599	0.576	0.694	0.078	0.081	0.070	0.099

Notes: * $p < .10$, ** $p < .05$, *** $p < .01$. Standard errors are clustered by state and shown in parentheses. Sample includes counties with any cities with population ≥ 40,000. Date range: 2010-2015. All regressions include: jurisdiction FEs, month of sample FEs, state-specific linear trends, police per capita, and the following laws/regulations: Good Samaritan laws, PDMP, Doctor Shopping, Pain Clinic regulations, Physician exams, Pharmacy verification, require ID, and tamper-resistant PF. Coefficients are population-weighted and show the effect of expanding naloxone access on deaths per 100,000 residents.

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Table OB5. Effect of naloxone laws by Medicaid expansion status

	Opioid-related ER Visits (1)	Opioid-related deaths (2)	Fentanyl-related deaths (3)
No Medicaid Expansion by 2015			
Naloxone Law	439.0**	0.042	0.018
	(201.0)	(0.040)	(0.023)
Observations	460	25,272	25,272
2010 baseline	1102	0.575	0.084
Medicaid Expansion by 2015			
Naloxone Law	47.48	-0.020	-0.025
	(133.4)	(0.033)	(0.047)
Observations	648	30,240	30,240
2010 baseline	2186	0.615	0.077

Notes: * $p < .10$, ** $p < .05$, *** $p < .01$. Standard errors are clustered by state and shown in parentheses. Sample includes counties containing jurisdictions with population ≥ 40,000 (for CDC data), and metro areas (for HCUP data). Date range: 2010-2015 for CDC data, 2006-2015 for HCUP data. All regressions include: jurisdiction FEs, month of sample FEs, state-specific linear trends, police per capita, and the following laws/regulations: Good Samaritan laws, PDMP, Doctor Shopping, Pain Clinic regulations, Physician exams, Pharmacy verification, require ID, and tamper-resistant PF. Coefficients on CDC data are population-weighted as the dependent variables are rates (number of deaths per 100,000 residents). Medicaid expansion dates are same as in Simon, Soni and Cawley (2017) and include: AZ, AR, CA, CO, CT, DE, HI, IL, IA, KY, MD, MA, MN, NV, NJ, NM, NY, ND, OH, OR, RI, VT, WA, WV, WI, MI, NH, PA, IN, and AK.

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Table OB6. Mortality results with Goodman-Bacon correction for pre-treatment trends

	Main results		Goodman-Bacon correction	
	Opioid-related deaths	Fentanyl-related deaths	Opioid-related deaths	Fentanyl-related deaths
	(1)	(2)	(3)	(4)
Naloxone Law	0.006	-0.003	0.015	0.006
	(0.027)	(0.030)	(0.027)	(0.030)
Observations	55,512	55,512	55,512	55,512

Notes: * $p < .10$, ** $p < .05$, *** $p < .01$. Standard errors are clustered by state and shown in parentheses. Sample includes counties with any cities with population ≥ 40,000. Date range: 2010-2015. All regressions include: jurisdiction FEs, month of sample FEs, state-specific linear trends, police per capita, and the following laws/regulations: Good Samaritan laws, PDMP, Doctor Shopping, Pain Clinic regulations, Physician exams, Pharmacy verification, require ID, and tamper-resistant PF. Coefficients are population-weighted and show the effect of expanding naloxone access on deaths per 100,000 residents.

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Table OB7. Effects by population cutoffs

	Possession of opioids (1)	Selling opioids (2)	Opioid-related ER visits (3)	Opioid-related deaths (4)	Fentanyl-related deaths (5)	Opioid-related crime (6)	Opioid-related theft (7)
Panel A: Rural areas							
Naloxone Law	1.862	-0.833	48.70	-0.017	0.000	1.298	0.310
	(2.174)	(1.403)	(43.02)	(0.037)	(0.015)	(3.634)	(0.237)
Observations	169,692	169,692	1,014	155,616	155,616	169,692	169,692
2010 baseline	29.78	11.21	304.2	0.578	0.102	50.40	2.473
Panel B: All areas							
Naloxone Law	3.132*	0.839	335.3**	0.001	-0.003	3.987	0.402**
	(1.671)	(0.699)	(132.6)	(0.025)	(0.025)	(2.384)	(0.193)
Observations	199,500	199,500	1,108	211,128	211,128	199,500	199,500
2010 baseline	26.07	8.697	2063	0.596	0.084	43.84	1.817
Observations	29,808	29,808	1,108	55,512	55,512	29,808	29,808
2010 baseline	23.52	6.972	1738	0.601	0.080	39.34	1.367

Notes: * $p < .10$, ** $p < .05$, *** $p < .01$. Standard errors are clustered by state and shown in parentheses. Sample includes jurisdictions with population < 40,000 (for NIBRS data), counties without any urban jurisdictions (for CDC data), and rural areas (for HCUP data). Date range: 2010-2015 for NIBRS and CDC data, 2006-2015 for HCUP data. All regressions include: jurisdiction FEs, month of sample FEs, state-specific linear trends, police per capita (except column 3), and the following laws/regulations: Good Samaritan laws, PDMP, Doctor Shopping, Pain Clinic regulations, Physician exams, Pharmacy verification, require ID, and tamper-resistant PF. Coefficients show the effect of expanding naloxone access on arrests per million residents (columns 1 and 2), number of ER visits (column 3), deaths per 100,000 residents (columns 4 and 5), and reported crimes per million residents (columns 6 and 7). All coefficients except ER visits are also population-weighted.

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Table OB8. Impact of naloxone laws with different population cutoffs for "urban"

	Minimum population for jurisdictions included in the sample									
	10,000	15,000	20,000	25,000	30,000	35,000	40,000	45,000	50,000	55,000
Opioid-related mortality										
Naloxone Law	0.000	-0.000	0.000	0.000	0.002	0.006	0.006	0.007	0.007	0.009
	(0.026)	(0.026)	(0.026)	(0.026)	(0.026)	(0.026)	(0.027)	(0.026)	(0.027)	(0.027)
Observations	152,568	121,896	100,800	83,880	69,984	60,984	55,512	49,536	45,144	41,256
2010 Baseline	0.605	0.605	0.603	0.601	0.603	0.599	0.601	0.598	0.601	0.603
Opioid-related theft										
Naloxone Law	0.471**	0.488**	0.500**	0.482**	0.492**	0.484**	0.414*	0.347*	0.380*	0.383*
	(0.195)	(0.192)	(0.213)	(0.221)	(0.225)	(0.234)	(0.214)	(0.202)	(0.204)	(0.217)
Observations	108,912	83,028	64,644	52,368	41,292	34,416	29,808	25,560	22,536	20,232
2010 Baseline	1.631	1.546	1.530	1.488	1.436	1.389	1.367	1.356	1.355	1.339

Notes: * $p < .10$, ** $p < .05$, *** $p < .01$. Standard errors are clustered by state and shown in parentheses. Sample includes jurisdictions with population greater than the reported cutoffs (for NIBRS data on opioid-related theft) and counties with any such jurisdictions (for CDC data on mortality). Date range: 2010-2015. All regressions include: jurisdiction FEs, month of sample FEs, state-specific linear trends, police per capita, and the following laws/regulations: Good Samaritan laws, PDMP, Doctor Shopping, Pain Clinic regulations, Physician exams, Pharmacy verification, require ID, and tamper-resistant PF. Coefficients are population-weighted and show the effect of expanding naloxone access on deaths per 100,000residents (panel 1), and reported crimes per million residents (panel 2).

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Table OB9. Effect of naloxone laws on broader categories of deaths and crime

Deaths due to opioids or unspecified-drug poisoning	
Naloxone Law	0.003
	(0.029)
Observations	55,512
2010 baseline	0.942
All theft	
Naloxone Law	4.810
	(12.84)
Observations	29,808
2010 baseline	1832

Notes: * $p < .10$, ** $p < .05$, *** $p < .01$. Standard errors are clustered by state and shown in parentheses. Sample includes jurisdictions with population ≥ 40,000 (for NIBRS data on arrests and crime), counties with any such jurisdictions (for CDC data on mortality). Date range: 2010-2015 for NIBRS and CDC data. All regressions include: jurisdiction FEs, month of sample FEs, state-specific linear trends, police per capita, and the following laws/regulations: Good Samaritan laws, PDMP, Doctor Shopping, Pain Clinic regulations, Physician exams, Pharmacy verification, require ID, and tamper-resistant PF. Coefficients are population-weighted and show the effect of expanding naloxone access on deaths per 100,000 residents (panel 1), and reported crimes per million residents (panel 2).

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Table OB10. Effect of naloxone laws on Google searches for "Naloxone"

	Google trends: "Naloxone" searches (metro areas)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Naloxone Law	13.942***	3.903***	1.921**	1.937**	1.910**	1.877**	1.831**	1.847**
	(1.321)	(1.211)	(0.814)	(0.807)	(0.817)	(0.808)	(0.813)	(0.809)
Observations	20,232	20,232	20,232	20,232	20,232	20,232	20,232	20,232
2010 baseline	25.49	25.49	25.49	25.49	25.49	25.49	25.49	25.49
Adjusted R^2	0.047	0.084	0.106	0.106	0.106	0.106	0.106	0.106
Controls:								
Jurisdiction FE	X	X	X	X	X	X	X	X
Month of sample FE		X	X	X	X	X	X	X
State-specific linear trends			X	X	X	X	X	X
Police per capita				X	X	X	X	X
Good Samaritan Laws					X	X	X	X
PDMP, Doctor Shopping, Pain Clinic regs						X	X	X
Physician exam, Pharm verification, Require ID							X	X
Tamper Resistant PF								X

Notes: * $p < .10$, ** $p < .05$, *** $p < .01$. Standard errors are clustered by state and shown in parentheses. Estimates indicate naloxone access laws' impact on search intensities, indexed on a 0-100 scale. Observations are at the metro area-month level. Data source: Google Trends. Sample includes metro areas. Date range: 2010-2015.

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Table OB11. Effect of naloxone laws on Google searches for "Drug rehab"

	Google trends: "Drug rehab" searches (metro areas)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Naloxone Law	-2.093***	0.266	-0.725	-0.695	-0.773*	-0.744*	-0.744*	-0.799*
	(0.473)	(0.646)	(0.435)	(0.448)	(0.457)	(0.440)	(0.441)	(0.450)
Observations	21,528	21,528	21,528	21,528	21,528	21,528	21,528	21,528
2010 baseline	55.72	55.72	55.72	55.72	55.72	55.72	55.72	55.72
Adjusted R^2	0.002	0.159	0.168	0.168	0.168	0.168	0.168	0.169
Controls:								
Jurisdiction FE	X	X	X	X	X	X	X	X
Month of sample FE		X	X	X	X	X	X	X
State-specific linear trends			X	X	X	X	X	X
Police per capita				X	X	X	X	X
Good Samaritan Laws					X	X	X	X
PDMP, Doctor Shopping, Pain Clinic regs						X	X	X
Physician exam, Pharm verification, Require ID							X	X
Tamper Resistant PF								X

Notes: * $p < .10$, ** $p < .05$, *** $p < .01$. Standard errors are clustered by state and shown in parentheses. Estimates indicate naloxone access laws' impact on search intensities, indexed on a 0-100 scale. Observations are at the metro area-month level. Data source: Google Trends. Sample includes metro areas. Date range: 2010-2015.

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Table OB12. Effect of naloxone laws on arrests for possession of opioids

	Possession of opioids (arrests)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Naloxone Law	3.766	6.570**	3.113*	2.963*	3.795**	4.211**	4.148**	4.030**
	(3.449)	(2.829)	(1.663)	(1.659)	(1.795)	(1.733)	(1.759)	(1.673)
Observations	29,808	29,808	29,808	29,808	29,808	29,808	29,808	29,808
2010 baseline	23.52	23.52	23.52	23.52	23.52	23.52	23.52	23.52
Adjusted R^2	0.003	0.046	0.100	0.101	0.102	0.103	0.103	0.103
Controls:								
Jurisdiction FE	X	X	X	X	X	X	X	X
Month of sample FE		X	X	X	X	X	X	X
State-specific linear trends			X	X	X	X	X	X
Police per capita				X	X	X	X	X
Good Samaritan Laws					X	X	X	X
PDMP, Doctor Shopping, Pain Clinic regs						X	X	X
Physician exam, Pharm verification, Require ID							X	X
Tamper Resistant PF								X

Notes: * $p < .10$, ** $p < .05$, *** $p < .01$. Standard errors are clustered by state and shown in parentheses. Observations are at the jurisdiction-month level. Data source: NIBRS. Sample includes jurisdictions with population ≥ 40,000. Date range: 2010-2015. Coefficients are population-weighted and show the effect of expanding naloxone access on arrests per million residents.

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Table OB13. Effect of naloxone laws on arrests for selling opioids

	Selling opioids (arrests)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Naloxone Law	0.873	1.206*	1.651**	1.509**	1.911**	1.933***	1.919***	1.917***
	(0.613)	(0.638)	(0.668)	(0.631)	(0.702)	(0.687)	(0.688)	(0.675)
Observations	29,808	29,808	29,808	29,808	29,808	29,808	29,808	29,808
2010 baseline	6.972	6.972	6.972	6.972	6.972	6.972	6.972	6.972
Adjusted R^2	0.000	0.007	0.017	0.020	0.020	0.021	0.021	0.021
Controls:								
Jurisdiction FE	X	X	X	X	X	X	X	X
Month of sample FE		X	X	X	X	X	X	X
State-specific linear trends			X	X	X	X	X	X
Police per capita				X	X	X	X	X
Good Samaritan Laws					X	X	X	X
PDMP, Doctor Shopping, Pain Clinic regs						X	X	X
Physician exam, Pharm verification, Require ID							X	X
Tamper Resistant PF								X

Notes: * $p < .10$, ** $p < .05$, *** $p < .01$. Standard errors are clustered by state and shown in parentheses. Observations are at the jurisdiction-month level. Data source: NIBRS. Sample includes jurisdictions with population ≥ 40,000. Date range: 2010-2015. Coefficients are population-weighted and show the effect of expanding naloxone access on arrests per million residents.

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Table OB14. Effect of naloxone laws on opioid-related ER visits

	Opioid-related ER visits						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Naloxone Law	1928***	1136**	236.8**	256.2*	244.2*	265.7**	265.9**
	(484.4)	(430.3)	(98.50)	(129.8)	(125.4)	(122.2)	(121.6)
Observations	1,108	1,108	1,108	1,108	1,108	1,108	1,108
2010 baseline	2063	2063	2063	2063	2063	2063	2063
Adjusted R^2	0.235	0.437	0.928	0.928	0.928	0.929	0.929
Controls:							
Jurisdiction FE	X	X	X	X	X	X	X
Month of sample FE		X	X	X	X	X	X
State-specific linear trends			X	X	X	X	X
Good Samaritan Laws				X	X	X	X
PDMP, Doctor Shopping, Pain Clinic regs					X	X	X
Physician exam, Pharm verification, Require ID						X	X
Tamper Resistant PF							X

Notes: * $p < .10$, ** $p < .05$, *** $p < .01$. Standard errors are clustered by state and shown in parentheses. Estimates indicate naloxone access laws' impact on the number of opioid-related ER visits. Observations are at the metro area-quarter level. Data source: NIBRS. Sample includes metropolitan areas. Date range: 2006-2015.

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Table OB15. Effect of naloxone laws on opioid-related mortality

	Mortality due to any opioid overdose							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Naloxone Law	0.232***	0.058	0.013	0.014	0.009	0.006	0.005	0.006
	(0.068)	(0.063)	(0.025)	(0.025)	(0.027)	(0.027)	(0.027)	(0.027)
Observations	55,512	55,512	55,512	55,512	55,512	55,512	55,512	55,512
2010 baseline	0.601	0.601	0.601	0.601	0.601	0.601	0.601	0.601
Adjusted R^2	0.026	0.042	0.095	0.095	0.095	0.095	0.095	0.095
Controls:								
Jurisdiction FE	X	X	X	X	X	X	X	X
Month of sample FE		X	X	X	X	X	X	X
State-specific linear trends			X	X	X	X	X	X
Police per capita				X	X	X	X	X
Good Samaritan Laws					X	X	X	X
PDMP, Doctor Shopping, Pain Clinic regs						X	X	X
Physician exam, Pharm verification, Require ID							X	X
Tamper Resistant PF								X

Notes: * $p < .10$, ** $p < .05$, *** $p < .01$. Standard errors are clustered by state and shown in parentheses. Observations are at the county-month level. Data source: CDC. Sample includes counties that include at least one city with population ≥ 40,000. Date range: 2010-2015. Coefficients are population-weighted and show the effect of expanding naloxone access on deaths per 100,000 residents.

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Table OB16. Effect of naloxone laws on fentanyl-related deaths

	Mortality due to synthetic opioid overdose (fentanyl)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Naloxone Law	0.156***	0.034	-0.001	-0.001	-0.002	-0.005	-0.005	-0.003
	(0.050)	(0.040)	(0.033)	(0.033)	(0.032)	(0.032)	(0.032)	(0.030)
Observations	55,512	55,512	55,512	55,512	55,512	55,512	55,512	55,512
2010 baseline	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080
Adjusted R^2	0.047	0.075	0.166	0.166	0.166	0.168	0.168	0.169
Controls:								
Jurisdiction FE	X	X	X	X	X	X	X	X
Month of sample FE		X	X	X	X	X	X	X
State-specific linear trends			X	X	X	X	X	X
Police per capita				X	X	X	X	X
Good Samaritan Laws					X	X	X	X
PDMP, Doctor Shopping, Pain Clinic regs						X	X	X
Physician exam, Pharm verification, Require ID							X	X
Tamper Resistant PF								X

Notes: * $p < .10$, ** $p < .05$, *** $p < .01$. Standard errors are clustered by state and shown in parentheses. Observations are at the county-month level. Data source: CDC. Sample includes counties that include at least one city with population ≥ 40,000. Date range: 2010-2015. Coefficients are population-weighted and show the effect of expanding naloxone access on deaths per 100,000 residents.

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Table OB17. Effect of naloxone laws on opioid-related crime

	All opioid-related crime							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Naloxone Law	3.463	8.808**	4.964**	4.581*	5.742**	6.312**	6.230**	6.053**
	(4.627)	(3.740)	(2.379)	(2.313)	(2.467)	(2.293)	(2.337)	(2.213)
Observations	29,808	29,808	29,808	29,808	29,808	29,808	29,808	29,808
2010 baseline	39.34	39.34	39.34	39.34	39.34	39.34	39.34	39.34
Adjusted R^2	0.001	0.052	0.099	0.102	0.102	0.104	0.104	0.104
Controls:								
Jurisdiction FE	X	X	X	X	X	X	X	X
Month of sample FE		X	X	X	X	X	X	X
State-specific linear trends			X	X	X	X	X	X
Police per capita				X	X	X	X	X
Good Samaritan Laws					X	X	X	X
PDMP, Doctor Shopping, Pain Clinic regs						X	X	X
Physician exam, Pharm verification, Require ID							X	X
Tamper Resistant PF								X

Notes: * $p < .10$, ** $p < .05$, *** $p < .01$. Standard errors are clustered by state and shown in parentheses. Observations are at the jurisdiction-month level. Data source: NIBRS. Sample includes jurisdictions with population ≥ 40,000. Date range: 2010-2015. Coefficients are population-weighted and show the effect of expanding naloxone access on reported crimes per million residents.

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Table OB18. Effect of naloxone laws on opioid-related theft

	Opioid-related theft							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Naloxone Law	0.340	0.609*	0.423*	0.419*	0.428*	0.445*	0.434*	0.414*
	(0.341)	(0.331)	(0.224)	(0.224)	(0.222)	(0.224)	(0.224)	(0.214)
Observations	29,808	29,808	29,808	29,808	29,808	29,808	29,808	29,808
2010 baseline	1.367	1.367	1.367	1.367	1.367	1.367	1.367	1.367
Adjusted R^2	0.001	0.008	0.022	0.022	0.022	0.023	0.023	0.023
Controls:								
Jurisdiction FE	X	X	X	X	X	X	X	X
Month of sample FE		X	X	X	X	X	X	X
State-specific linear trends			X	X	X	X	X	X
Police per capita				X	X	X	X	X
Good Samaritan Laws					X	X	X	X
PDMP, Doctor Shopping, Pain Clinic regs						X	X	X
Physician exam, Pharm verification, Require ID							X	X
Tamper Resistant PF								X

Notes: * $p < .10$, ** $p < .05$, *** $p < .01$. Standard errors are clustered by state and shown in parentheses. Observations are at the jurisdiction-month level. Data source: NIBRS. Sample includes jurisdictions with population ≥ 40,000. Date range: 2010-2015. Coefficients are population-weighted and show the effect of expanding naloxone access on reported crimes per million residents.

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Table OB19. Effect of naloxone laws with robustness to law timing

	Possession of opioids (1)	Selling opioids (2)	Opioid-related ER visits (3)	Opioid-related deaths (4)	Fentanyl-related deaths (5)	Opioid-related crime (6)	Opioid-related theft (7)
Entire U.S.							
Naloxone Law	4.030**	1.917***	262.3**	0.017	0.007	6.053**	0.414*
	(1.673)	(0.675)	(109.2)	(0.025)	(0.027)	(2.213)	(0.214)

Notes: * $p < .10$, ** $p < .05$, *** $p < .01$. Standard errors are clustered by state and shown in parentheses. Data sources: NIBRS (monthly, 2010-2015), CDC (monthly, 2010-2015), and HCUP (quarterly, 2006-2015). In this table, we examine different dates for five states: 5/2013 for CO, 10/2012 for CT; 8/2015 for LA; and 4/2014 for ME because there were some third-party prescriptions allowed as of these dates. We also test 6/2010 for WA because a Good Samaritan Law at that time made naloxone available to individuals at risk of overdose. All regressions include: jurisdiction FEs, month of sample FEs, state-specific linear trends, police per capita (except column 3), and the following laws/regulations: Good Samaritan laws, PDMP, Doctor Shopping, Pain Clinic regulations, Physician exams, Pharmacy verification, require ID, and tamper-resistant PF. Coefficients show the effect of expanding naloxone access on arrests per million residents (columns 1 and 2), number of ER visits (column 3), deaths per 100,000 residents (columns 4 and 5), and reported crimes per million residents (columns 6 and 7). All coefficients except those in column (3) are also population-weighted.

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Table OB20. Robustness to specification used in Rees et al. (2019)

	Mortality due to any opioid overdose							
	Rees et al. estimate	Our estimate	Aggregate to state level	+ Aggregate to year level	+ Use ln(Rate) as outcome	+ Drop 2015	+ Add controls	+ Match dates
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Naloxone Law	-0.188*	0.006	0.054	0.502	0.041	0.036	0.052	0.093*
	(0.098)	(0.027)	(0.059)	(0.525)	(0.049)	(0.067)	(0.060)	(0.048)
Observations	816	55,512	3,600	300	300	250	250	250
2010 baseline	–	0.601	0.596	7.151	1.894	1.894	1.894	1.894

Notes: * $p < .10$, ** $p < .05$, *** $p < .01$. Standard errors are clustered by state and shown in parentheses. Data source for columns (2) through (8): CDC (2010-2015). Column (1) presents the main estimate shown in column (3) of Table 4 in Rees et al. (2019), which uses state-year observations from 1999-2014. Column (2) presents our estimate from column (2) of Table 4. The remaining columns present cumulative changes to our data and specification, to match those in Rees et al. (2019) as closely as possible. Column (3) aggregates our data (for all jurisdictions) to the state level. Column (4) further aggregates our data to the year level, using the method in Rees et al. (2019) by which states are considered as having broadened naloxone access if they did so at any point during the year. Column (5) converts the dependent variable to log rates. Column (6) drop observations from 2015, as Rees et al. (2019) does not use this data, and column (7) adds the other control variables used in Rees et al. (2019). Finally, column (8) uses the dates of naloxone access used in Rees et al. (2019), which vary slightly due to that paper's focus on naloxone access in any form (not broadened access). This different definition results in different years of naloxone access for the following states: CT (2003), CA (2008), IL (2010), WA (2010), RI (2012), CO (2013), KY (2013), VA (2013), MD (2013), and ME (2014). Coefficient in column (1) is weighted by state population as reported in Rees et al. (2019); coefficients in columns (2) through (8) are weighted by 2010 state population.