

Appendix A: Mortality Data from CDCWONDER

Types of deaths examined: underlying cause-of-death codes:

X40–44 (unintentional), X60–64 (suicide), X85 (homicide), or Y10–Y14 (undetermined intent)

Drug death codes:

Opioids:			Appendix Table 3
Natural and semisynthetic opioids (T40.2) Methadone (T40.3) Synthetic opioids, other than methadone (T40.4)	Table 2 in paper (Main specification) Appendix Table 5 (Woodwork effect) Appendix Table 7 (Falsification)	Appendix Table 1	
Heroin (T40.1)	Appendix Table 2		
Other narcotics codes: added to above to create all T deaths			
Cocaine (T40.5) Other and unspecified narcotics (T40.6) Cannabis (T40.7) Lysergide [LSD] (T40.8) Other and unspecified psychodysleptics [hallucinogens] (T40.9)			

Note: Appendix Table 4 shows the effect of Medicaid expansion on the fraction of people enrolled in Medicaid.
Appendix Table 5 contains the results of regression shown in Table 2, Appendix Tables 1-3 with two additional control variables.

Appendix Table 1: Diff in Diff Results, N=404 for all regressions except Fraction enrolled which is 349 due to missing data. Mean Opioid and heroin related mortality=10.3153 (7.2072)

Y = log opioid and heroin mortality	Measure of Treatment (Medicaid Expansion)				
VARIABLES	Kaestner No prior expansion	Kaestner full	Sharp with earlier expansions	Sharp with no earlier expansions	Fraction of State Pop. Enrolled in Medicaid
Medicaid expansion	-0.004 (0.137)	0.012 (0.096)	-0.000 (0.082)	0.085 (0.085)	0.094 (0.845)
State passed MML (Binary)	0.299** (0.089)	0.296** (0.088)	0.298** (0.091)	0.275** (0.087)	0.305** (0.090)
State passed MAPDMP (Binary)	0.090 (0.069)	0.090 (0.067)	0.090 (0.074)	0.075 (0.071)	0.059 (0.075)
State passed Naloxone access (Binary)	0.055 (0.065)	0.055 (0.065)	0.055 (0.065)	0.055 (0.065)	0.067 (0.060)
Food insecure (%)	0.000 (0.006)	0.000 (0.006)	0.000 (0.006)	0.000 (0.006)	0.000 (0.007)
% low-income uninsured children	0.038* (0.016)	0.038* (0.017)	0.038* (0.016)	0.040* (0.017)	0.032 (0.016)
Max. TANF benefit family of 3 (\$)	-0.000 (0.001)	-0.000 (0.001)	-0.000 (0.001)	-0.000 (0.001)	-0.001 (0.002)
Max. SNAP benefit 3 person family (\$)	-0.003 (0.003)	-0.003 (0.003)	-0.003 (0.003)	-0.003 (0.003)	-0.005** (0.001)
Democrat governor (Binary)	-0.050 (0.061)	-0.049 (0.063)	-0.049 (0.062)	-0.048 (0.062)	-0.047 (0.060)
Max. EITC payment 3 person family (\$)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
State minimum wage (\$)	0.020 (0.060)	0.018 (0.062)	0.020 (0.060)	0.003 (0.059)	0.018 (0.071)
Nonwhite (%)	-5.141 (3.493)	-5.212 (3.461)	-5.147 (3.498)	-5.514 (3.516)	-2.866 (3.148)
Age 18 to 24 (%)	-1.608 (6.329)	-1.672 (6.589)	-1.642 (6.475)	-0.905 (6.497)	0.569 (5.809)
Hispanic (%)	4.860 (5.216)	4.914 (5.137)	4.889 (5.180)	5.054 (4.956)	4.137 (5.644)
Less than high school (%)	-10.390** (3.271)	-10.312** (3.151)	-10.373** (3.303)	-10.148** (3.284)	-8.936* (3.777)
Constant	4.849 (3.218)	4.873 (3.292)	4.843 (3.277)	5.097 (3.329)	5.080 (2.588)
Robust standard errors clustered at the state level in parentheses. All models include state and year fixed-effects. MML=medical marijuana law, MAPDMP=must access prescription drug monitoring program, TANF=Temporary Assistance for Needy Families, SNAP=Supplemental Nutrition Assistance Program, EITC=Earned Income Tax Credit See Table 1 for full details of treatment groups. ** p<0.01, * p<0.05					

Appendix Table 2: Diff in Diff Results, N=305 for all regressions except Fraction enrolled which is 261 due to missing data. Mean heroin-related mortality= 3.9705 (3.0861)

Y= log heroin mortality	Measure of Treatment (Medicaid Expansion)				
VARIABLES	Kaestner No prior expansion	Kaestner full	Sharp with earlier expansions	Sharp with no earlier expansions	Fraction of State Pop. Enrolled in Medicaid
Medicaid expansion	-0.086 (0.131)	-0.138 (0.136)	-0.170 (0.117)	-0.153 (0.151)	-0.752 (1.601)
State passed MML (Binary)	0.147 (0.101)	0.155 (0.104)	0.185 (0.102)	0.181 (0.101)	0.175 (0.096)
State passed MAPDMP (Binary)	0.180* (0.086)	0.161 (0.095)	0.207* (0.084)	0.193* (0.085)	0.218* (0.106)
State passed Naloxone access (Binary)	-0.037 (0.067)	-0.043 (0.069)	-0.030 (0.065)	-0.037 (0.066)	-0.004 (0.083)
Food insecure (%)	-0.002 (0.015)	-0.003 (0.015)	-0.002 (0.014)	-0.002 (0.015)	-0.006 (0.015)
% low-income uninsured children	0.013 (0.027)	0.010 (0.028)	0.011 (0.026)	0.013 (0.026)	0.016 (0.030)
Max. TANF benefit family of 3 (\$)	-0.003* (0.001)	-0.003* (0.001)	-0.003** (0.001)	-0.003* (0.001)	-0.001 (0.002)
Max. SNAP benefit 3 person family (\$)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	0.011 (0.007)
Democrat governor (Binary)	-0.119 (0.091)	-0.117 (0.090)	-0.121 (0.087)	-0.114 (0.086)	-0.189* (0.085)
Max. EITC payment 3 person family (\$)	0.003** (0.001)	0.003** (0.001)	0.003** (0.001)	0.003** (0.001)	0.003** (0.001)
State minimum wage (\$)	-0.059 (0.061)	-0.041 (0.053)	-0.055 (0.059)	-0.027 (0.055)	-0.068 (0.068)
Nonwhite (%)	-6.513 (5.347)	-5.590 (5.021)	-5.938 (5.080)	-5.759 (5.166)	-6.620 (6.250)
Age 18 to 24 (%)	2.858 (9.065)	1.844 (8.954)	0.092 (9.233)	0.470 (9.060)	12.848 (9.816)
Hispanic (%)	13.234 (8.703)	13.338 (8.617)	13.037 (8.355)	13.190 (8.379)	4.779 (10.226)
Less than high school (%)	0.158 (6.654)	0.920 (6.760)	1.498 (6.621)	1.166 (6.767)	7.032 (7.693)
Constant	-13.476* (5.635)	-14.648* (5.690)	-14.838** (5.503)	-14.838* (5.627)	-26.313** (4.431)
Robust standard errors clustered at the state level in parentheses. All models include state and year fixed-effects. MML=medical marijuana law, MAPDMP=must access prescription drug monitoring program, TANF=Temporary Assistance for Needy Families, SNAP=Supplemental Nutrition Assistance Program, EITC=Earned Income Tax Credit See Table 1 for full details of treatment groups. ** p<0.01, * p<0.05					

Appendix Table 3: Diff in Diff Results, N=404 for all regressions except Fraction enrolled which is 349 due to missing data. Mean all T mortality= 11.6062 (7.5501)

Y= log all T mortality	Measure of Treatment (Medicaid Expansion)				
VARIABLES	Kaestner No prior expansion	Kaestner full	Sharp with earlier expansions	Sharp with no earlier expansions	Fraction of State Pop. Enrolled in Medicaid
Medicaid expansion	0.040 (0.121)	-0.013 (0.080)	-0.023 (0.073)	0.029 (0.078)	-0.203 (0.757)
State passed MML (Binary)	0.213** (0.073)	0.218** (0.075)	0.222** (0.077)	0.208** (0.075)	0.208** (0.075)
State passed MAPDMP (Binary)	0.085 (0.060)	0.088 (0.059)	0.094 (0.066)	0.083 (0.062)	0.066 (0.063)
State passed Naloxone access (Binary)	0.074 (0.052)	0.075 (0.053)	0.076 (0.052)	0.075 (0.053)	0.078 (0.049)
Food insecure (%)	0.002 (0.006)	0.003 (0.006)	0.003 (0.006)	0.003 (0.006)	0.003 (0.007)
% low-income uninsured children	0.037* (0.016)	0.035* (0.016)	0.035* (0.015)	0.036* (0.016)	0.030* (0.014)
Max. TANF benefit family of 3 (\$)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	-0.000 (0.002)
Max. SNAP benefit 3 person family (\$)	-0.002 (0.003)	-0.002 (0.003)	-0.002 (0.003)	-0.002 (0.003)	-0.005** (0.001)
Democrat governor (Binary)	-0.031 (0.045)	-0.036 (0.046)	-0.036 (0.045)	-0.035 (0.046)	-0.032 (0.045)
Max. EITC payment 3 person family (\$)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
State minimum wage (\$)	-0.006 (0.045)	-0.004 (0.044)	-0.005 (0.045)	-0.012 (0.046)	-0.010 (0.053)
Nonwhite (%)	-4.656 (2.925)	-4.512 (2.866)	-4.499 (2.908)	-4.704 (2.934)	-2.605 (2.500)
Age 18 to 24 (%)	-3.648 (5.609)	-3.326 (5.703)	-3.582 (5.567)	-3.114 (5.578)	-1.409 (4.920)
Hispanic (%)	3.346 (4.237)	3.038 (4.225)	3.006 (4.235)	3.120 (4.127)	2.297 (4.698)
Less than high school (%)	-8.857** (2.886)	-9.086** (2.856)	-9.006** (2.938)	-8.944** (2.938)	-7.243* (3.301)
Constant	4.408 (3.024)	4.417 (3.050)	4.337 (3.034)	4.533 (3.077)	4.647* (2.236)
Robust standard errors clustered at the state level in parentheses. All models include state and year fixed-effects. MML=medical marijuana law, MAPDMP=must access prescription drug monitoring program, TANF=Temporary Assistance for Needy Families, SNAP=Supplemental Nutrition Assistance Program, EITC=Earned Income Tax Credit See Table 1 for full details of treatment groups. ** p<0.01, * p<0.05					

Appendix Table 4: Diff in Diff Results, N=353 for all regressions. Mean fraction enrolled=.1943 (.059)

Y=fraction of state population enrolled in Medicaid	Measure of Treatment (Medicaid Expansion)			
VARIABLES	Kaestner No prior expansion	Kaestner full	Sharp with earlier expansions	Sharp with no earlier expansions
Medicaid expansion	0.034** (0.012)	0.037** (0.008)	0.031** (0.008)	0.040** (0.008)
State passed MML (Binary)	-0.002 (0.005)	-0.006 (0.006)	-0.007 (0.006)	-0.010 (0.005)
State passed MAPDMP (Binary)	0.008 (0.006)	0.014* (0.006)	0.003 (0.007)	0.003 (0.007)
State passed Naloxone access (Binary)	0.003 (0.006)	0.003 (0.005)	0.002 (0.006)	0.002 (0.005)
Food insecure (%)	0.000 (0.001)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)
% low-income uninsured children	-0.005** (0.001)	-0.004** (0.001)	-0.005** (0.001)	-0.005** (0.001)
Max. TANF benefit family of 3 (\$)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)
Max. SNAP benefit 3 person family (\$)	0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)
Democrat governor (Binary)	0.005 (0.004)	0.003 (0.004)	0.001 (0.004)	0.002 (0.004)
Max. EITC payment 3 person family (\$)	0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)
State minimum wage (\$)	0.013** (0.004)	0.007 (0.004)	0.010** (0.003)	0.003 (0.004)
Nonwhite (%)	-0.087 (0.181)	-0.210 (0.145)	-0.135 (0.170)	-0.218 (0.167)
Age 18 to 24 (%)	-0.206 (0.510)	-0.071 (0.454)	0.217 (0.481)	0.236 (0.505)
Hispanic (%)	-0.204 (0.413)	-0.380 (0.320)	-0.371 (0.369)	-0.322 (0.332)
Less than high school (%)	-0.134 (0.318)	-0.074 (0.300)	-0.277 (0.290)	-0.147 (0.280)
Constant	0.170 (0.194)	0.417* (0.200)	0.475* (0.204)	0.473* (0.194)
Robust standard errors clustered at the state level in parentheses. All models include state and year fixed-effects. MML=medical marijuana law, MAPDMP=must access prescription drug monitoring program, TANF=Temporary Assistance for Needy Families, SNAP=Supplemental Nutrition Assistance Program, EITC=Earned Income Tax Credit See Table 1 for full details of treatment groups. ** p<0.01, * p<0.05				

Appendix Table 5: Diff in Diff Results for Woodwork effects N=354 for all regressions except Fraction enrolled which is 347 due to missing data.

Y=log opioid mortality	Measure of Treatment (Medicaid Expansion)				
VARIABLES	Kaestner No prior expansion	Kaestner full	Sharp with earlier expansions	Sharp with no earlier expansions	Fraction of State Pop. Enrolled in Medicaid
Medicaid expansion	0.086 (0.182)	0.084 (0.131)	0.015 (0.116)	0.147 (0.107)	0.123 (1.052)
State passed MML (Binary)	0.383** (0.129)	0.383** (0.129)	0.386** (0.138)	0.349** (0.129)	0.400** (0.122)
State passed MAPDMP (Binary)	0.106 (0.099)	0.115 (0.096)	0.109 (0.104)	0.087 (0.098)	0.044 (0.104)
State passed Naloxone access (Binary)	0.075 (0.086)	0.075 (0.086)	0.076 (0.086)	0.073 (0.089)	0.106 (0.079)
Food insecure (%)	-0.002 (0.008)	-0.001 (0.008)	-0.001 (0.008)	-0.001 (0.008)	0.004 (0.009)
% low-income uninsured children	0.062** (0.021)	0.062** (0.022)	0.060** (0.020)	0.063** (0.021)	0.046* (0.020)
Max. TANF benefit family of 3 (\$)	-0.000 (0.001)	-0.000 (0.001)	-0.000 (0.001)	-0.000 (0.001)	-0.002 (0.002)
Max. SNAP benefit 3 person family (\$)	-0.005 (0.004)	-0.006 (0.004)	-0.005 (0.004)	-0.006 (0.004)	-0.006** (0.002)
Democrat governor (Binary)	-0.039 (0.075)	-0.047 (0.077)	-0.050 (0.076)	-0.052 (0.076)	-0.043 (0.069)
Max. EITC payment 3 person family (\$)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)
State minimum wage (\$)	0.088 (0.088)	0.076 (0.091)	0.086 (0.091)	0.057 (0.088)	0.116 (0.104)
Nonwhite (%)	-6.435 (4.159)	-6.697 (4.120)	-6.304 (4.108)	-6.907 (4.131)	-2.566 (3.272)
Age 18 to 24 (%)	-0.652 (8.417)	-0.211 (8.513)	-0.008 (8.399)	1.268 (8.409)	2.031 (7.051)
Hispanic (%)	6.493 (6.301)	6.198 (6.278)	6.011 (6.413)	6.349 (6.158)	4.532 (6.102)
Less than high school (%)	-11.816** (4.073)	-11.604** (3.710)	-12.256** (4.110)	-11.821** (3.955)	-11.921** (4.428)
Constant	10.287* (4.296)	10.683* (4.462)	10.458* (4.452)	11.018* (4.541)	11.495** (2.909)
Robust standard errors clustered at the state level in parentheses. All models include state and year fixed-effects. MML=medical marijuana law, MAPDMP=must access prescription drug monitoring program, TANF=Temporary Assistance for Needy Families, SNAP=Supplemental Nutrition Assistance Program, EITC=Earned Income Tax Credit See Table 1 for full details of treatment groups. ** p<0.01, * p<0.05					

Appendix Table 6: Diff in Diff Results, with two additional control variables (unemployment rate and poverty rate)

Y= death rate	Measure of Treatment (Medicaid Expansion)				
VARIABLES	Kaestner No prior expansion	Kaestner full	Sharp with earlier expansions	Sharp with no earlier expansions	Fraction of State Pop. Enrolled in Medicaid
Medicaid expansion coefficients					
Y= log opioid	0.078 (0.176)	0.024 (0.119)	0.027 (0.100)	0.126 (0.097)	-0.095 (0.949)
Y= log opioid and heroin	-0.014 (0.134)	-0.009 (0.093)	-0.002 (0.078)	0.080 (0.081)	0.068 (0.814)
Y=log heroin	-0.082 (0.129)	-0.123 (0.135)	-0.164 (0.116)	-0.143 (0.152)	-0.938 (1.539)
Y=all T codes	0.031 (0.118)	-0.033 (0.077)	-0.025 (0.068)	0.024 (0.074)	-0.232 (0.722)
Y=fraction enrolled	0.034** (0.012)	0.037** (0.008)	0.031** (0.008)	0.039** (0.008)	
With state specific time trends					
Y= log opioid	0.167 (0.135)	-0.012 (0.079)	0.012 (0.071)	-0.026 (0.082)	-0.490 (0.952)
Y= log opioid and heroin	0.092 (0.082)	-0.030 (0.063)	-0.010 (0.048)	-0.065 (0.056)	-0.763 (0.687)
Y=log heroin	0.082 (0.133)	0.061 (0.104)	0.050 (0.082)	0.009 (0.086)	-0.730 (1.205)
Y=all T codes	0.094 (0.081)	-0.029 (0.057)	-0.028 (0.046)	-0.083 (0.053)	-0.924 (0.599)
Y=fraction enrolled	0.030 (0.018)	0.025* (0.011)	0.018* (0.009)	0.025** (0.008)	

Each row is a separate regression which contains all the covariates in table 2 plus the unemployment rate and the poverty rate. Robust standard errors clustered at the state level in parentheses. . All models include state and year fixed-effects.

** p<0.01, * p<0.05

Appendix Table 7: Diff in Diff Results Falsification N=402

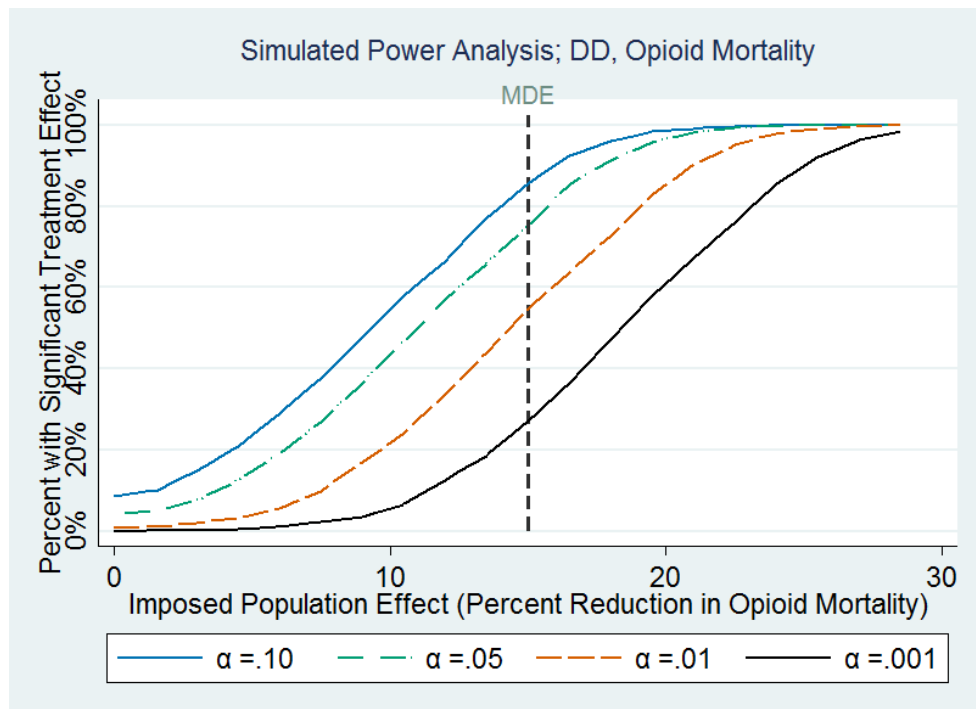
Y=log opioid mortality VARIABLES	Pseudo-expansion states
Medicaid expansion	0.038 (0.113)
State passed MML (Binary)	0.337** (0.118)
State passed MAPDMP (Binary)	0.108 (0.091)
State passed Naloxone access (Binary)	0.039 (0.086)
Food insecure (%)	-0.001 (0.008)
% low-income uninsured children	0.055* (0.021)
Max. TANF benefit family of 3 (\$)	0.000 (0.001)
Max. SNAP benefit 3 person family (\$)	-0.003 (0.003)
Democrat governor (Binary)	-0.094 (0.077)
Max. EITC payment 3 person family (\$)	0.000 (0.000)
State minimum wage (\$)	0.038 (0.078)
Nonwhite (%)	-5.924 (4.207)
Age 18 to 24 (%)	-3.965 (7.927)
Hispanic (%)	8.762 (5.900)
Less than high school (%)	-12.471** (4.081)
Constant	7.028 (3.711)

Robust standard errors clustered at the state level in parentheses. Model includes state and year fixed-effects.

** p<0.01, * p<0.05

Appendix B: Power Analysis.

We conduct a power analysis along the lines of Black et al. (2019) (see references in paper). We used the Sharp no early expanders definition of Medicaid expansion in the power analysis. The results suggest we may have enough power. When we run the power analysis without controls our coefficient (SE) is 0.448 (0.117) and our MDE is 14.3 as seen in the figure below.



When we run the analysis with control variables, our MDE remains quite similar (indeed they are nearly indistinguishable from each other) and our coefficient estimate (SE) is 0.137 (0.103) suggesting that we are nearly sufficiently powered even with the inclusion of covariates. See figure below.

