Data supplement for Vuolo and Kelly, Effects of County-Level Opioid Dispensing Rates on Individual-Level Patterns of Prescription Opioid and Heroin Consumption: Evidence From National U.S. Data. Am J Psychiatry (doi: 10.1176/appi.ajp.2021.21060602)

TABLE S1. Fixed-effects models for individual-level prescription opioid and heroin outcomes in the NSDUH from 2006-2016, odds ratios and 95% confidence intervals

	Prescription opioids			Heroin			
	Model 1:	Model 2:	Model 3:	Model 4:	Model 5:	Model 6:	
	Past year misuse	Frequency of past	Dependence	Past year use	Frequency of	Dependence	
		year misuse			past year use		
County-level Opioid Dispensing Rate per 100	1.002***	1.001**	1.003***	0.999	0.998	0.999	
	(1.001, 1.002)	(1.001, 1.002)	(1.001, 1.004)	(0.996, 1.001)	(0.994, 1.002)	(0.996, 1.003)	
State-Level Policy Covariates							
Prescription Drug Monitoring Program	1.037	1.058	0.949	1.019	1.257	1.055	
	(0.962, 1.118)	(0.974, 1.150)	(0.764, 1.178)	(0.746, 1.393)	(0.784, 2.015)	(0.678, 1.641)	
Good Samaritan Policy	1.016	1.005	1.009	0.746*	0.925	0.671*	
·	(0.956, 1.081)	(0.928, 1.089)	(0.843, 1.207)	(0.596, 0.935)	(0.657, 1.303)	(0.492, 0.916)	
Any Naloxone Access Expansion	0.961	0.952	0.843	1.158	0.955	1.224	
	(0.898, 1.029)	(0.876, 1.035)	(0.704, 1.010)	(0.901, 1.488)	(0.625, 1.461)	(0.849, 1.766)	
Pain Management Clinic laws	0.998	0.990	0.938	1.176	1.324	1.244	
	(0.931, 1.071)	(0.909, 1.079)	(0.778, 1.131)	(0.878, 1.576)	(0.839, 2.087)	(0.806, 1.920)	
Medical Marijuana Laws	1.020	1.011	0.998	1.102	1.014	1.015	
J	(0.949, 1.097)	(0.924, 1.107)	(0.804, 1.238)	(0.839, 1.448)	(0.681, 1.511)	(0.745, 1.384)	
County-Level Covariates							
Percent Hispanic	0.997	0.997	1.000	1.014	1.016	1.009	
	(0.994, 1.000)	(0.993, 1.000)	(0.992, 1.008)	(0.995, 1.034)	(0.994, 1.039)	(0.986, 1.032)	
Percent Black	1.002	1.001	1.006	1.006	0.991	1.002	
	(0.998, 1.005)	(0.996, 1.005)	(0.996, 1.016)	(0.990, 1.023)	(0.972, 1.011)	(0.985, 1.019)	
Percent Unemployed	1.045***	1.060***	1.029	1.086	1.216**	1.079	
	(1.021, 1.070)	(1.030, 1.091)	(0.969, 1.092)	(0.990, 1.191)	(1.079, 1.370)	(0.966, 1.206)	
Percent Living in Poverty	0.993	0.997	1.003	0.947*	0.932*	0.945*	
	(0.980, 1.006)	(0.983, 1.011)	(0.979, 1.027)	(0.906, 0.990)	(0.876, 0.991)	(0.900, 0.992)	
Percent over 25 with a Bachelor's	1.009***	1.009***	0.991	1.013	1.025*	1.018	
	(1.004, 1.014)	(1.004, 1.015)	(0.981, 1.002)	(0.997, 1.030)	(1.003, 1.047)	(0.998, 1.039)	
Percent Foreign Born	0.999	0.997	1.003	0.986	0.983	0.998	
- G	(0.994,1.003)	(0.992, 1.002)	(0.993, 1.014)	(0.963,1.009)	(0.954,1.013)	(0.974, 1.022)	

Percent Female Headed Households	1.001	1.000	0.989	1.028	1.087	1.079
	(0.977, 1.025)	(0.974, 1.028)	(0.933, 1.049)	(0.945, 1.119)	(0.961, 1.229)	(0.980, 1.188)
Household Income (thousands)	0.999	1.000	1.008*	0.995	0.997	0.990
	(0.995, 1.003)	(0.996, 1.005)	(1.000, 1.017)	(0.980, 1.009)	(0.975, 1.018)	(0.974, 1.005)
Metropolitan Area (vs. Large central)						
Large central	0.953	0.944	0.961	0.780	0.927	0.899
	(0.882, 1.031)	(0.862, 1.034)	(0.806, 1.147)	(0.580, 1.048)	(0.605, 1.419)	(0.645, 1.253)
Medium	0.955	0.959	0.960	0.821	0.974	0.684*
	(0.889, 1.025)	(0.883, 1.043)	(0.806, 1.142)	(0.631, 1.067)	(0.690, 1.374)	(0.497, 0.941)
Small	0.927	0.925	0.945	0.754	0.900	0.818
	(0.851, 1.010)	(0.837, 1.021)	(0.776, 1.152)	(0.519, 1.095)	(0.565, 1.433)	(0.498, 1.343)
Micropolitan	0.869**	0.862**	0.849	0.636**	0.670	0.557**
	(0.792, 0.955)	(0.773, 0.961)	(0.686, 1.052)	(0.451, 0.897)	(0.438, 1.026)	(0.358, 0.864)
Noncore	0.846**	0.815**	0.821	0.686	1.233	0.572*
	(0.755, 0.949)	(0.713, 0.931)	(0.604, 1.117)	(0.441, 1.067)	(0.705, 2.156)	(0.330, 0.990)
Individual-Level Covariates						
Female (vs. Male)	0.815***	0.814***	0.749***	0.509***	0.478***	0.530***
	(0.788, 0.843)	(0.782, 0.847)	(0.680, 0.825)	(0.447, 0.579)	(0.390, 0.586)	(0.442, 0.636)
Health Insurance	0.774***	0.749***	0.696***	0.578***	0.532***	0.543***
	(0.737, 0.813)	(0.711, 0.789)	(0.625, 0.776)	(0.499, 0.669)	(0.418, 0.677)	(0.448, 0.658)
U.S. Born	1.717***	1.889***	3.434***	3.337***	2.514*	3.860***
	(1.597, 1.846)	(1.736, 2.055)	(2.659, 4.435)	(2.045, 5.443)	(1.118, 5.651)	(1.971, 7.562)
Race/Ethnicity (vs. White)						
Black	0.542***	0.495***	0.367***	0.418***	0.285***	0.334***
	(0.503, 0.583)	(0.454, 0.540)	(0.291, 0.462)	(0.305, 0.572)	(0.172, 0.472)	(0.220, 0.506)
Native American	0.996	1.037	1.123	0.756	0.667	0.611
	(0.845, 1.174)	(0.854, 1.258)	(0.711, 1.773)	(0.419, 1.366)	(0.338, 1.315)	(0.280, 1.337)
Hawaiian Islander/Pacific Islander	0.777	0.767	0.750	0.757	0.690	0.609
	(0.557, 1.083)	(0.503, 1.171)	(0.335, 1.679)	(0.346, 1.656)	(0.143, 3.329)	(0.142, 2.616)
Asian	0.505***	0.496***	0.422***	0.136***	0.206***	0.033***
	(0.449, 0.567)	(0.434, 0.567)	(0.283, 0.627)	(0.063, 0.290)	(0.087, 0.489)	(0.007, 0.154)
Multi-racial	1.000	0.923	0.877	0.725	0.843	0.706
	(0.898, 1.113)	(0.804, 1.058)	(0.698, 1.101)	(0.465, 1.129)	(0.484, 1.467)	(0.379, 1.312)
Hispanic	0.693***	0.654***	0.495***	0.615**	0.443**	0.654*
	(0.656, 0.733)	(0.611, 0.700)	(0.401, 0.610)	(0.450, 0.840)	(0.261, 0.750)	(0.467, 0.916)

20k.49.9k 0.909*** 0.917*** 0.904 0.732*** 0.820 0.647*** 50k.74.9k (0.874.094) (0.874.096) (0.8081.011) (0.612.063) (0.613.1097) (0.509.0822) 50k.74.9k (0.784.0864) (0.795.0891) (0.660.882) (0.740.077) (0.383.0762) (0.363.0808) 75k-99.9k (0.712.0808) (0.742.0856) (0.591).840 (0.438.0751) (0.580.792) (0.598.0793) >100k (0.712.0808) (0.742.0856) (0.591).840 (0.438.0751) (0.458.0752) (0.458.0792) (0.598.0793) >100k (0.757.081) (0.680.0930) (0.550.5042) (0.451.025) (0.759.081) (0.680.0930) (0.550.5042) (0.451.025) (0.759.081) (0.680.0930) (0.550.5042) (0.451.025) (0.759.081) (0.680.0930) (0.550.5042) (0.451.025) (0.759.081) (0.680.0930) (0.550.5042) (0.759.081) (0.559.0823) (0.539.092) (0.579.0891) (0.559.0823) (0.579.092) (0.579.0891) (0.559.092) (0.559.092) (0.559.092) (0.559.092) <t< th=""><th>Income bracket (vs. <20k)</th><th></th><th></th><th></th><th></th><th></th><th></th></t<>	Income bracket (vs. <20k)						
50k-74.9k 0.823*** 0.842*** 0.768*** 0.605**** 0.541*** 0.594*** 75k-99.9k (0.784,0.86) (0.759,***) 0.795,0.891 (0.668,0.882) (0.470,0.79) (0.380,0.762) (0.360,0.808) >100k (0.712,0.808) (0.742,0.856) (0.591,0.840) (0.438,0.751) (0.368,0.792) (0.378,0.808) >100k (0.716,0.800) (0.715,0.818) (0.680,0.930) (0.550,0.942) (0.495,1.025) (0.479,0.890) Educational Attainment (vs. < High School degree	20k-49.9k	0.909***	0.917***	0.904	0.732***	0.820	0.647***
		(0.874, 0.946)	(0.874, 0.963)	(0.808, 1.011)	(0.621, 0.863)	(0.613, 1.097)	(0.509, 0.822)
75k-99.9k 0.759**** 0.799**** 0.704**** 0.574**** 0.540*** 0.562*** >100k 0.712,0.808 0.742,0.856) 0.591,0.840 0.438,0.751 0.368,0.792 0.0380,0793 >100k 0.757**** 0.705**** 0.795*** 0.729** 0.712 0.653*** Educational Attainment (vs. < High School)	50k-74.9k	0.823***	0.842***	0.768***	0.605***	0.541***	0.594***
		(0.784, 0.864)	(0.795, 0.891)	(0.668, 0.882)	(0.470, 0.779)	(0.383, 0.762)	(0.436, 0.808)
>100k 0.757**** 0.764**** 0.795*** 0.729* 0.712 0.653** Educational Attainment (vs. < High School)	75k-99.9k	0.759***	0.797***	0.704***	0.574***	0.540**	0.562**
Educational Attainment (vs. < High School) (0.716,0.800) (0.715,0.817) (0.680,0.930) (0.565,0.942) (0.495,1.025) (0.479,0.890) Educational Attainment (vs. < High School degree		(0.712, 0.808)	(0.742, 0.856)	(0.591, 0.840)	(0.438, 0.751)	(0.368, 0.792)	(0.398, 0.793)
Educational Attainment (vs. < High School) High School degree 0.823*** 0.823*** 0.778*** 0.693*** 0.702** 0.739*** Some College 0.856*** 0.866*** 0.720** 0.684,0824) 0.534,0924 (0.595,017) Some College 0.856*** 0.866*** 0.720*** 0.676*** 0.757* 0.763** BA/BS+ 0.609*** 0.609*** 0.322*** 0.193*** 0.274*** 0.182*** BA/BS+ 0.609*** 0.609*** 0.226** 0.193*** 0.274*** 0.182*** 12-17 year-olds 0.529*** 0.464*** 0.506*** 0.298*** 0.258*** 0.154*** Employment Status (vs. Full-time) 1.021 0.996 1.136 1.380** 1.354 1.180 Unemployed 1.297*** 1.259*** 1.882*** 2.891*** 2.046*** 2.948*** Other/Not in labor force 1.044 1.007 1.735*** 2.117*** 1.763** 2.321*** Marital status (vs. Married) (.1530,**91,104) (.0942,1.076)	>100k	0.757***	0.764***	0.795**	0.729*	0.712	0.653**
High School degree 0.823*** 0.823*** 0.778*** 0.693*** 0.702* 0.739*** Some College (0.781,0.868) (0.776,0.873) (0.682,0.888) (0.584,0.824) (0.534,0.924) (0.595,0.917) Some College (0.856***) 0.866*** 0.720*** 0.676*** 0.757* 0.763* BA/BS+ (0.600***) 0.609*** 0.322*** 0.193*** 0.274*** 0.182*** 12-17 year-olds (0.569,0.651) (0.564,0.658) (0.266,0.390) (0.126,0.294) (0.157,0.479) (0.112,0.296) 12-17 year-olds (0.522***) 0.464*** 0.506*** 0.298*** 0.258*** 0.154*** Employment Status (vs. Full-time) (0.880,0.560) (0.418,0.612) (0.219,0.408) 0.137,0.379) (0.886,1.573) Unemployed 1.021 0.996 1.136 1.380** 1.354 1.180 Unemployed 1.297*** 1.259*** 1.882*** 2.891*** 2.046*** 2.948*** Other/Not in labor force 1.044 1.007 1.735*** <td< td=""><td></td><td>(0.716, 0.800)</td><td>(0.715, 0.817)</td><td>(0.680, 0.930)</td><td>(0.565, 0.942)</td><td>(0.495, 1.025)</td><td>(0.479, 0.890)</td></td<>		(0.716, 0.800)	(0.715, 0.817)	(0.680, 0.930)	(0.565, 0.942)	(0.495, 1.025)	(0.479, 0.890)
Control Cont	Educational Attainment (vs. < High School)						
Some College 0.856*** 0.866*** 0.720*** 0.676*** 0.757* 0.763* BA/BS+ (0.810,0.905) (0.813,0.921) (0.630,0.822) (0.556,0.823) (0.575,0.997) (0.595,0.978) BA/BS+ (0.609***) (0.609***) 0.322*** 0.193*** 0.274*** 0.182*** 12-17 year-olds (0.569,0.651) (0.564,0.658) (0.266,0.390) (0.126,0.294) (0.157,0.479) (0.124*** 12-17 year-olds (0.485,0.560) (0.428,0.504) (0.418,0.612) (0.299,408) 0.258*** 0.258*** 0.154*** Employment Status (vs. Full-time) 1 0.996 1.136 1.380** 1.354 1.180 Unemployed 1.297*** 1.259*** 1.882*** 2.891*** 2.046*** 2.948*** Other/Not in labor force 1.044 1.007 1.735*** 2.117*** 1.763*** 2.321*** Marital status (vs. Married) 1.630*** 1.469*** 2.554*** 4.833*** 3.040* 3.583*** Widowed 1.523*** 1.529***	High School degree	0.823***	0.823***	0.778***	0.693***	0.702*	0.739**
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		(0.781, 0.868)	(0.776, 0.873)	(0.682, 0.888)	(0.584, 0.824)	(0.534, 0.924)	(0.595, 0.917)
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	Some College	0.856***	0.866***	0.720***	0.676***	0.757*	0.763*
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		(0.810, 0.905)	(0.813, 0.921)	(0.630, 0.822)	(0.556, 0.823)	(0.575, 0.997)	(0.595, 0.978)
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	BA/BS+	0.609***	0.609***	0.322***	0.193***	0.274***	0.182***
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		(0.569, 0.651)	(0.564, 0.658)	(0.266, 0.390)	(0.126, 0.294)	(0.157, 0.479)	(0.112, 0.296)
Employment Status (vs. Full-time) Part-time 1.021 0.996 1.136 1.380** 1.354 1.180 Unemployed 1.297*** 1.259*** 1.882*** 2.891*** 2.046*** 2.948*** Other/Not in labor force 1.044 1.007 1.735*** 2.117*** 1.763*** 2.321*** Marital status (vs. Married) (0.987,1.104) (0.942,1.076) 2.554*** 4.833*** 3.040* 3.583*** Widowed 1.630*** 1.469*** 2.554*** 4.833*** 3.040* 3.583*** Divorced/Separated 1.523*** 1.529*** 1.986*** 3.132*** 3.664*** 2.850*** Never married 1.706*** 1.728*** 2.031*** 4.211*** 4.390*** 4.544***	12-17 year-olds	0.522***	0.464***	0.506***	0.298***	0.258***	0.154***
Part-time 1.021 0.996 1.136 1.380** 1.354 1.180 Unemployed 1.297*** 1.259*** 1.882*** 2.891*** 2.046*** 2.948*** Other/Not in labor force 1.044 1.007 1.735*** 2.117*** 1.763*** 2.321*** Marital status (vs. Married) (0.987,1.104) (0.942,1.076) (1.510,1.993) (1.703,2.631) (1.281,2.426) (1.764,3.054) Widowed 1.630*** 1.469*** 2.554*** 4.833*** 3.040* 3.583*** Divorced/Separated 1.523*** 1.529*** 1.986*** 3.132*** 3.664*** 2.850*** Never married 1.706*** 1.728*** 2.031*** 4.211*** 4.390*** 4.544***		(0.485, 0.560)	(0.428, 0.504)	(0.418, 0.612)	(0.219, 0.408)	(0.172, 0.387)	(0.091, 0.258)
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	Employment Status (vs. Full-time)						
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	Part-time	1.021	0.996	1.136	1.380**	1.354	1.180
Other/Not in labor force (1.215,1.384) (1.161,1.365) (1.634,2.168) (2.330,3.589) (1.527,2.741) (2.322,3.743) Other/Not in labor force 1.044 1.007 1.735*** 2.117*** 1.763*** 2.321*** (0.987,1.104) (0.942,1.076) (1.510,1.993) (1.703,2.631) (1.281,2.426) (1.764,3.054) Marital status (vs. Married) Widowed 1.630*** 1.469*** 2.554*** 4.833*** 3.040* 3.583*** (1.396,1.903) (1.173,1.839) (1.760,3.706) (2.856,8.177) (1.216,7.600) (1.689,7.603) Divorced/Separated 1.523*** 1.529*** 1.986*** 3.132*** 3.664*** 2.850*** (1.426,1.626) (1.416,1.650) (1.666,2.367) (2.282,4.297) (2.282,5.882) (1.916,4.238) Never married 1.706*** 1.728*** 2.031*** 4.211*** 4.390*** 4.544***		(0.971, 1.074)	(0.935, 1.061)	(0.977, 1.321)	(1.111, 1.714)	(0.999, 1.835)	(0.886, 1.573)
Other/Not in labor force 1.044 1.007 $1.735***$ $2.117***$ $1.763***$ $2.321***$ $(0.987,1.104)$ $(0.942,1.076)$ $(1.510,1.993)$ $(1.703,2.631)$ $(1.281,2.426)$ $(1.764,3.054)$ Marital status (vs. Married) Widowed $1.630***$ $1.469***$ $2.554***$ $4.833***$ $3.040*$ $3.583***$ $(1.396,1.903)$ $(1.173,1.839)$ $(1.760,3.706)$ $(2.856,8.177)$ $(1.216,7.600)$ $(1.689,7.603)$ Divorced/Separated $1.523***$ $1.529***$ $1.986***$ $3.132***$ $3.664***$ $2.850***$ $(1.426,1.626)$ $(1.416,1.650)$ $(1.666,2.367)$ $(2.282,4.297)$ $(2.282,5.882)$ $(1.916,4.238)$ Never married $1.706***$ $1.728***$ $2.031***$ $4.211***$ $4.390***$ $4.544***$	Unemployed	1.297***	1.259***	1.882***	2.891***	2.046***	2.948***
Marital status (vs. Married) (0.987,1.104) (0.942,1.076) (1.510,1.993) (1.703,2.631) (1.281,2.426) (1.764,3.054) Widowed 1.630*** 1.469*** 2.554*** 4.833*** 3.040* 3.583*** (1.396,1.903) (1.173,1.839) (1.760,3.706) (2.856,8.177) (1.216,7.600) (1.689,7.603) Divorced/Separated 1.523*** 1.529*** 1.986*** 3.132*** 3.664*** 2.850*** (1.426,1.626) (1.416,1.650) (1.666,2.367) (2.282,4.297) (2.282,5.882) (1.916,4.238) Never married 1.706*** 1.728*** 2.031*** 4.211*** 4.390*** 4.544***		(1.215, 1.384)	(1.161, 1.365)	(1.634, 2.168)	(2.330, 3.589)	(1.527, 2.741)	(2.322, 3.743)
Marital status (vs. Married) Widowed 1.630*** 1.469*** 2.554*** 4.833*** 3.040* 3.583*** (1.396,1.903) (1.173,1.839) (1.760,3.706) (2.856,8.177) (1.216,7.600) (1.689,7.603) Divorced/Separated 1.523*** 1.529*** 1.986*** 3.132*** 3.664*** 2.850*** (1.426,1.626) (1.416,1.650) (1.666,2.367) (2.282,4.297) (2.282,5.882) (1.916,4.238) Never married 1.706*** 1.728*** 2.031*** 4.211*** 4.390*** 4.544***	Other/Not in labor force	1.044	1.007	1.735***	2.117***	1.763***	2.321***
Widowed 1.630^{***} 1.469^{***} 2.554^{***} 4.833^{***} 3.040^{**} 3.583^{***} (1.396,1.903) (1.173,1.839) (1.760,3.706) (2.856,8.177) (1.216,7.600) (1.689,7.603) Divorced/Separated 1.523*** 1.529*** 1.986*** 3.132*** 3.664*** 2.850*** (1.426,1.626) (1.416,1.650) (1.666,2.367) (2.282,4.297) (2.282,5.882) (1.916,4.238) Never married 1.706*** 1.728*** 2.031*** 4.211*** 4.390*** 4.544***		(0.987, 1.104)	(0.942, 1.076)	(1.510, 1.993)	(1.703, 2.631)	(1.281, 2.426)	(1.764, 3.054)
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	Marital status (vs. Married)						
Divorced/Separated 1.523*** 1.529*** 1.986*** 3.132*** 3.664*** 2.850*** (1.426,1.626) (1.416,1.650) (1.666,2.367) (2.282,4.297) (2.282,5.882) (1.916,4.238) Never married 1.706*** 1.728*** 2.031*** 4.211*** 4.390*** 4.544***	Widowed	1.630***	1.469***	2.554***	4.833***	3.040*	3.583***
(1.426,1.626) (1.416,1.650) (1.666,2.367) (2.282,4.297) (2.282,5.882) (1.916,4.238) Never married 1.706*** 1.728*** 2.031*** 4.211*** 4.390*** 4.544***		(1.396, 1.903)	(1.173, 1.839)	(1.760, 3.706)	(2.856, 8.177)	(1.216, 7.600)	(1.689, 7.603)
Never married 1.706*** 1.728*** 2.031*** 4.211*** 4.390*** 4.544***	Divorced/Separated	1.523***	1.529***	1.986***	3.132***	3.664***	2.850***
		(1.426, 1.626)	(1.416, 1.650)	(1.666, 2.367)	(2.282, 4.297)	(2.282, 5.882)	(1.916, 4.238)
$(1.619,1.797) \qquad (1.626,1.836) \qquad (1.745,2.364) \qquad (3.170,5.593) \qquad (2.960,6.511) \qquad (3.067,6.731)$	Never married	1.706***	1.728***	2.031***	4.211***	4.390***	4.544***
		(1.619,1.797)	(1.626, 1.836)	(1.745,2.364)	(3.170,5.593)	(2.960,6.511)	(3.067,6.731)

Note: *p < .05; **p < .01; ***p < .001. Exponentiated coefficients from logistic regression displayed (binary for past year misuse/use and dependence; ordinal for frequency); 95% confidence intervals in parentheses. All models include state and year fixed-effects, cluster-corrected standard errors for county, cohort effects measured by birth year (squared), and utilize sampling weights.