Supplementary Appendix

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Empirical Model Specifications

For our primary analysis, we employ logistic regressions under a difference-in-differences (DID) framework for each of our five outcomes using the empirical specification in equation (S1) below.

$$Y_{its} = \alpha + \beta_1 Oxy_{it} + \beta_2 Post_t + \beta_3 (Oxy_{it} * Post_t) + \delta X_{its} + \gamma P_{ts} + S_s + \varepsilon_{its} \quad (S1)$$

Equation (S1) is indexed as follows: individual i, state s, and year t, where each individual is only represented once given the cross-sectional nature of the data used in this analysis. Y_{its} represents one of our five outcomes of interest for individual i, who was interviewed at time t in state s. Oxy_{it} is an individual-level indicator for the exposed group; it equals one if individual i misused OxyContin prior to the reformulation and zero if individual i did not misuse OxyContin, but did misuse other prescription pain relievers, prior to the reformulation. Individuals who did not misuse any prescription pain relievers prior to the reformulation are excluded from the analysis. $Post_t$ is an indicator for the post-reformulation period; it equals zero for individuals surveyed in years prior to the reformulation (2005-2010), and it equals one for individuals surveyed in years following the reformulation (2011-2014). Thus, for an individual who misused OxyContin prior to the reformulation and who was surveyed after the reformulation, we observe $Oxy_{it} = 1$, $Post_t = 1$, and $Oxy_{it} * Post_t = 1$. For an individual surveyed after the reformulation who misused prescription opioids other than OxyContin prior to the reformulation, we observe $Oxy_{it} = 0$, $Post_t = 1$, and $Oxy_{it} * Post_t = 0$. X_{its} is a vector of individual-level controls for demographic and geographic characteristics. P_{ts} is a vector of PDMP policies for the state in which individual i resides in survey year t. S_s is a vector of state fixed effects that control for time invariant state-level characteristics.

The key coefficient of interest in this model is β_3 which captures the impact of the reformulation for individuals with prior OxyContin misuse relative to those without prior

OxyContin misuse. We estimate equation (S1) with and without individual, geographic, and PDMP policy controls, though state fixed effects were included in all models. We estimate all models in Stata 15 using the svy prefix to account for survey weights and sampling design.[1]

We also estimate logistic regressions under an event study framework (termed "Individual Years" in the body of the paper) for each of our outcomes as modeled by equation (S2):

$$Y_{its} = \alpha + \beta_1 Oxy_{it} + \sum(T_t * Oxy_{it})\beta_T + T_t + \delta X_{its} + \gamma P_{ts} + S_s + \varepsilon_{its} \quad \text{(S2)}$$

Equation (S2) interacts the set of binary survey-year indicators T_t with the individual-level exposure indicator Oxy_{it}. The reference period is the year 2010 (the year of the reformulation). Other covariates are defined as in equation (S1). The vector β_T describes the effect of exposed group membership over time. For years prior to the reformulation, the parallel trends assumption dictates that the coefficients of β_T should not be significantly different from 0. For years following the reformulation, the elements of β_T describe whether the nature of exposure effect suggested by equation (S1) is static or dynamic. From the output for equation (S2), we generate charts showing the point estimate and 95% confidence intervals of the elements of β_T.

Trends in the Outcome Variables

The DID framework relies on the assumption that the outcome measures for the exposed and control groups would have exhibited parallel trends in the absence of the intervention. This counterfactual is impossible to verify for the post-reformulation period; however, we have explored a number of methods for verifying the validity of this assumption in the pre-reformulation period, which we explain in detail below. All evidence suggests that our assumption holds that the outcome measures would have exhibited parallel trends in the absence of the intervention.

First, we visually inspect the trends of each outcome variable for the exposed and control groups. These trends are graphed on a log-odds scale in Figure S1 below, with each panel of the figure representing a different outcome measure. The red vertical line in the figure represents the timing of the reformulation. Overall, the trends for the exposed and control groups prior to the reformulation appear to be parallel.

Next, we parametrically test for the presence of non-parallel linear trends in the pre-reformulation period by estimating equation (S3) below for the years 2005-2010.

$$Y_{its} = \alpha + \beta_1 Oxy_{it} + \beta_2 Trend_t + \beta_3 (Oxy_{it} * Trend_t) + \delta X_{its} + \gamma P_{ts} + S_s + \varepsilon_{its} \quad (S3)$$

We estimate equation (S3) for each of the five outcome measures. The variable $Trend_t$ is a linear trend that equals 1 in 2005, 2 in 2006, and so on. All other variables are defined as in equation (S1). The coefficient β_3 tests for a differential trend between the exposed and control groups prior to the reformulation. We find no evidence of non-parallel linear trends for past-year prescription pain reliever misuse (β_3 p = 0.636), past-year prescription pain reliever use disorder (β_3 p = 0.083), past-year heroin use (β_3 p = 0.493), or past-year heroin-use disorder (β_3 p = 0.127). Equation (S3) failed to converge for the past-year heroin initiation outcome.

We test the joint significance of the exposed group and year interactions in the event study models and could not reject the null hypothesis that the interaction was equal to zero for past-year prescription pain reliever misuse (F-test p = 0.602), past-year prescription pain reliever use disorder (F-test p = 0.418), past-year heroin use (F-test p = 0.835), past-year heroin-use disorder (F-test p = 0.757), and past-year heroin initiation (F-test p = 0.797).

Finally, we conduct a falsification test to determine if there were any unobserved factors differentially impacting our exposed and control groups just prior to the reformulation. To conduct this test, we first limit the sample to the pre-reformulation period, 2005 through 2010. Then, we create a false exposure period for the years 2008 through 2010 to test for the

differential impact of unobserved factors during this time. We estimate the difference-in-differences model described in equation (A4) using logistic regression for each of our five outcome variables.

$$Y_{its} = \alpha + \beta_1 Oxy_{it} + \beta_2 False_t + \beta_3 (Oxy_{it} * False_t) + \delta X_{its} + \gamma P_{ts} + S_s + \varepsilon_{its} \quad (A4)$$

The variable $False_t$ is a binary indicator that equals one for the survey years 2008 through 2010 and zero otherwise. All other variables are as described in equation (S1). The coefficient β_3 on the interaction between the exposed group and the false exposure period tests for the differential impact of unobserved factors prior to the reformulation. The results from the model are presented in Appendix Table S2. For each outcome variable, we find that the odds ratio for the interaction between the exposed group and the false exposure period is not statistically different from 1. This suggests that there is no evidence of any unobserved factors that may have differentially impacted the trends in the outcomes for the exposed and control groups in the years just prior to the reformulation.

Compositional Effects

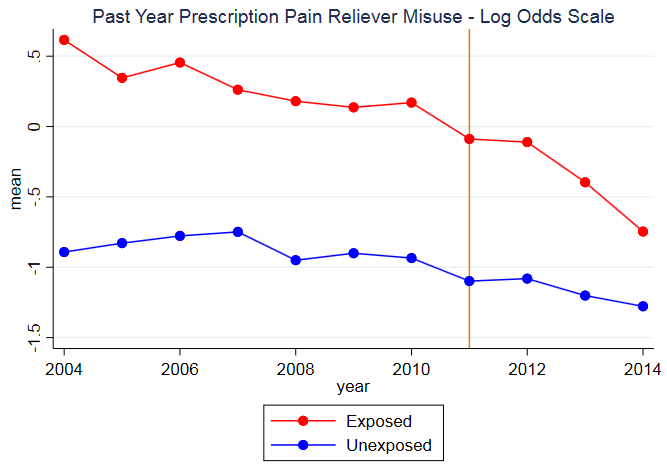
Our models rely on the assumption that the composition of the exposed and control groups are not changing differentially over time in ways that would affect the outcome measures. To assess this possibility, we visually inspect the composition of our exposed and control groups over time with respect to 5 key demographic and socioeconomic characteristics: age, gender, race/ethnicity, income (in poverty versus not), and educational attainment (high school graduate versus not). These trends are depicted in Figure S2 below. From visual inspection, it does not appear that the composition of the exposed and control groups changed in different ways with respect to these observable characteristics.

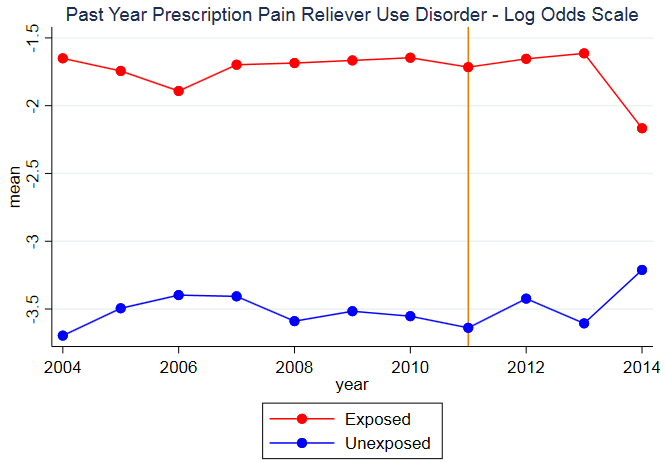
In addition, we conduct statistical tests to detect compositional changes associated with the intervention. We modify equation (S1) by replacing the dependent variable with one of the

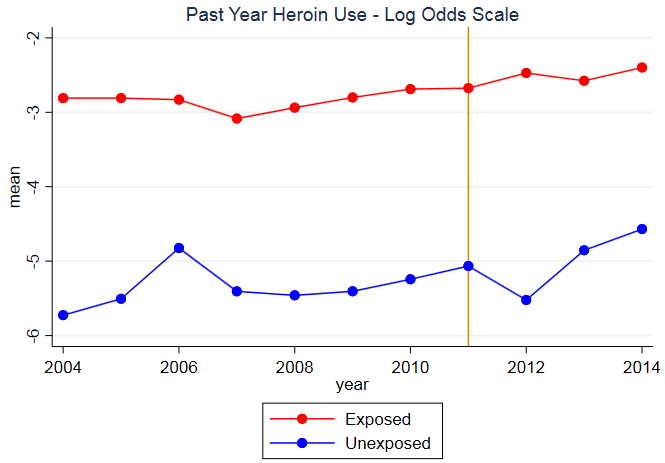
demographic or socioeconomic characteristics of interest described above. We keep all the control variables except for the characteristic being controlled (e.g., when white race was the dependent variable, we dropped race/ethnicity as an independent variable). If the reformulation results in a compositional shift in the sample, then the coefficient of interest, β_3 above, will be statistically significant in this test. The results of these tests are shown below in Appendix Table S3. We find no evidence of observable compositional changes associated with the intervention (as evidenced by the lack of statistical significance on the interaction term) for observable characteristics.

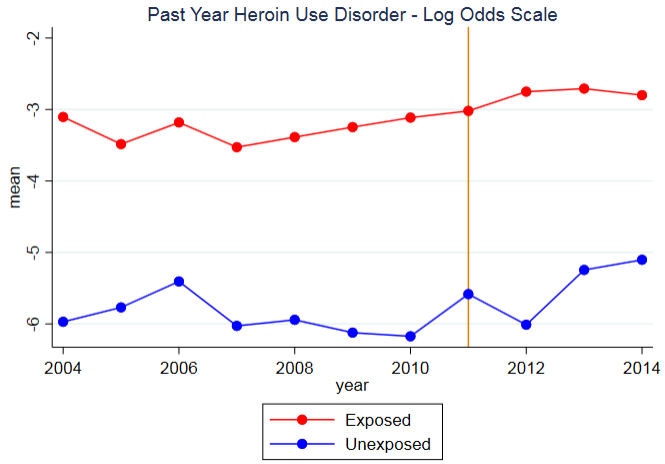
It could be the case, however, that there are differential changes between the two groups in unobservable characteristics. For instance, if after the reformulation, individuals in one of the groups were more likely to die from overdose prior to being surveyed, the magnitude of our results would be overestimated.

Figure S1: Trends in Mean Prescription Pain Reliver and Heroin Use, Misuse, Use Disorder and Initiation Outcomes over Study Period on Log Odds Scale, by Exposure






Past Year Heroin Use - Log Odds Scale
mean
-2
-3
-4
-5
-6
2004
2006
2008
2010
2012
2014
year
Exposed
Unexposed


Past Year Heroin Use Disorder - Log Odds Scale
mean
-2
-3
-4
-5
-6
2004
2006
2008
2010
2012
2014
year
Exposed
Unexposed

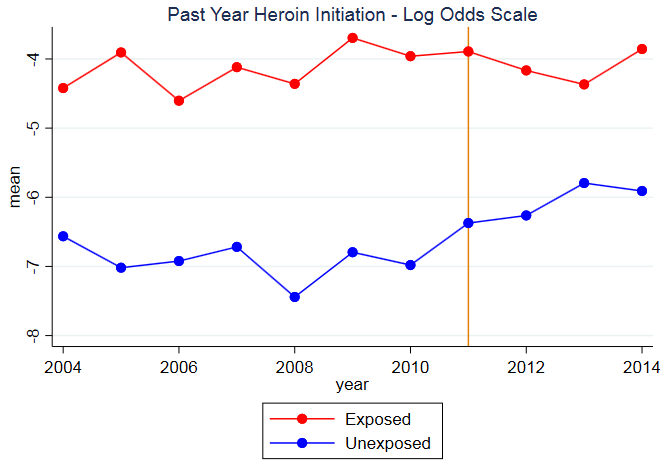
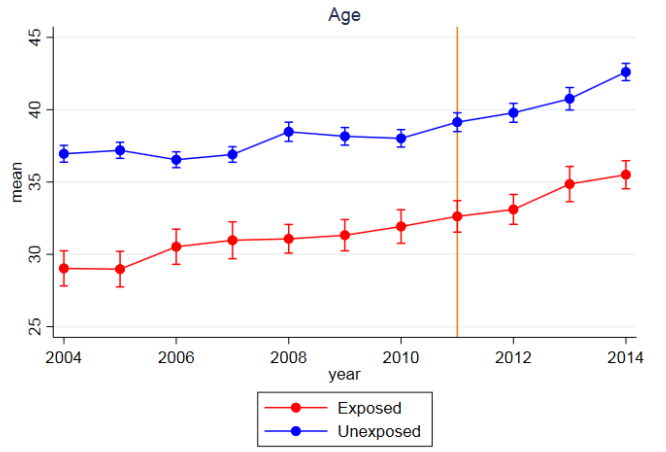
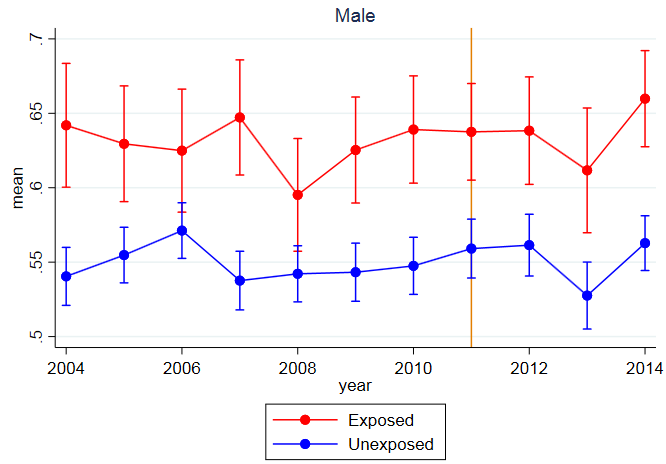
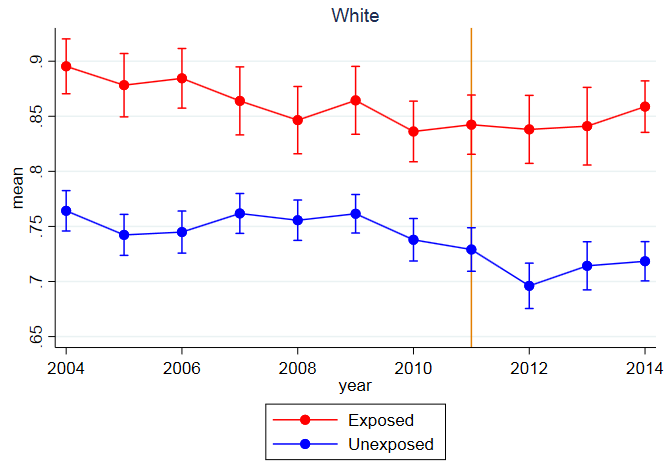
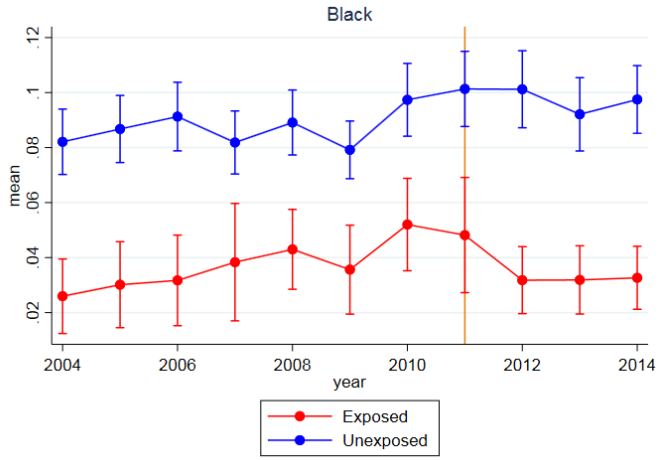

Past Year Heroin Initiation - Log Odds Scale
mean
-4
-5
-6
-7
-8
2004
2006
2008
2010
2012
2014
year
Exposed
Unexposed

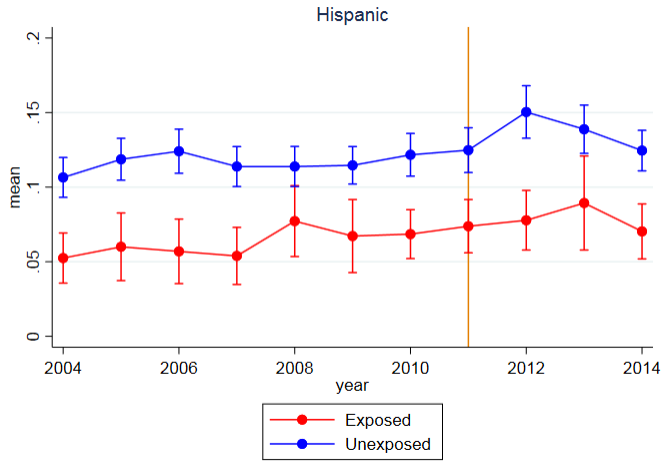
Figure S2: Descriptive Statistics of Selected Adult Characteristics over Study Period, by Exposure – Test of Sample Composition

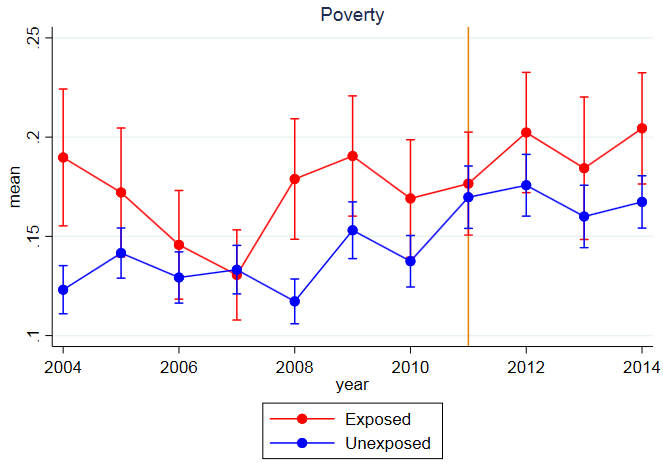







Black
mean
.02
.04
.06
.08
.1
.12
2004
2006
2008
2010
2012
2014
year
Exposed
Unexposed


Hispanic
mean
0
.05
.1
.15
.2
2004
2006
2008
2010
2012
2014
year
Exposed
Unexposed


Poverty
mean
.1
.15
.2
.25
2004
2006
2008
2010
2012
2014
year
Exposed
Unexposed

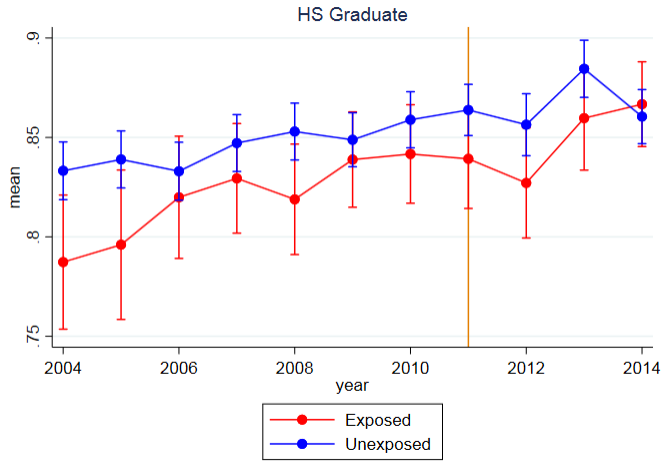

HS Graduate
mean
.75
.8
.85
.9
2004
2006
2008
2010
2012
2014
year
Exposed
Unexposed

Table S1: Estimating the Effects of the OxyContin Reformulation: Odds Ratios from Models for Prescription Pain Reliever Misuse and Use Disorder and Heroin Use, Use Disorder, and Initiation Outcomes, Difference-in-Difference Framework, Full Model including all Covariates

	Past Year Prescription Pain Reliever Misuse		Past Year Prescription Pain Reliever Use Disorder		Past Year Heroin Use		Past Year Heroin Use Disorder		Past Year Heroin Initiation	
	without controls	with controls	without controls	with controls	without controls	with controls	without controls	with controls	without controls	with controls
Exposure	3.031***	2.683***	5.928***	5.349***	11.475***	9.547***	13.313***	11.536***	18.124***	10.875***
	[2.807,3.271]	[2.479,2.905]	[5.238,6.709]	[4.705,6.081]	[8.582,15.343]	[7.159,12.733]	[9.290,19.078]	[8.117,16.394]	[12.074,27.206]	[7.083,16.696]
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(P<0.001)	(P<0.001)
Post-reformulation	0.738***	0.808***	1.034	1.055	1.387**	1.300	1.554**	1.373	2.466***	2.654***
	[0.695,0.784]	[0.753,0.868]	[0.895,1.195]	[0.896,1.243]	[1.014,1.896]	[0.923,1.832]	[1.029,2.348]	[0.883,2.137]	[1.423,4.273]	[1.502,4.690]
	(<0.001)	(<0.001)	(0.646)	(0.517)	(0.040)	(0.134)	(0.036)	(0.160)	(0.001)	(0.001)
Exposure x Post-reformulation	0.767***	0.791***	0.913	0.934	0.994	1.014	1.046	1.063	0.402***	0.422**
	[0.676,0.870]	[0.694,0.902]	[0.741,1.125]	[0.756,1.153]	[0.689,1.435]	[0.697,1.476]	[0.653,1.674]	[0.657,1.718]	[0.212,0.764]	[0.218,0.818]
	(<0.001)	(<0.001)	(0.392)	(0.524)	(0.975)	(0.941)	(0.853)	(0.804)	(0.005)	(0.011)
Age		0.920***		0.980*		0.960**		0.990		0.871***
		[0.910,0.930]		[0.958,1.003]		[0.927,0.994]		[0.943,1.039]		[0.794,0.956]
		(<0.001)		(0.082)		(0.021)		(0.672)		(0.004)
Age, squared		1.001***		1.000		1.000		1.000		1.001
		[1.001,1.001]		[1.000,1.000]		[1.000,1.001]		[0.999,1.001]		[0.999,1.002]
		(<0.001)		(0.431)		(0.235)		(0.982)		(0.281)
Gender (Ref: Male)										
Female		1.029		0.907*		0.627***		0.686***		0.786*
		[0.976,1.084]		[0.820,1.002]		[0.533,0.738]		[0.558,0.842]		[0.593,1.041]
		(0.291)		(0.056)		(<0.001)		(<0.001)		(0.093)
Race/Ethnicity (Ref: White, non-Hispanic)										
Black, non-Hispanic		1.232***		1.214		1.274		1.287		0.213**
		[1.122,1.353]		[0.961,1.534]		[0.889,1.827]		[0.845,1.960]		[0.056,0.807]
		(<0.001)		(0.103)		(0.187)		(0.240)		(0.023)
Other, non-Hispanic		1.298***		1.286**		0.735		0.625		0.830
		[1.136,1.483]		[1.016,1.627]		[0.473,1.143]		[0.333,1.175]		[0.398,1.733]
		(<0.001)		(0.036)		(0.172)		(0.144)		(0.620)
Hispanic		1.235***		0.972		1.063		1.163		0.577**
		[1.133,1.347]		[0.809,1.167]		[0.716,1.579]		[0.744,1.818]		[0.365,0.911]

		(\<0.001)		(0.758)		(0.762)		(0.509)		(0.018)
Education (Ref: High School Degree)										
		1.217***		1.449***		1.338***		1.433***		1.289
Less than High School Degree		[1.127,1.314]		[1.273,1.650]		[1.075,1.666]		[1.103,1.863]		[0.914,1.819]
		(\<0.001)		(\<0.001)		(0.009)		(0.007)		(0.148)
		0.941*		0.853**		0.920		1.055		0.870
Some College/Associate Degree		[0.885,1.000]		[0.752,0.966]		[0.750,1.129]		[0.831,1.339]		[0.607,1.247]
		(0.052)		(0.012)		(0.427)		(0.658)		(0.449)
		0.902**		0.504***		0.401***		0.244***		0.332***
College Degree (e.g. BA, BS)		[0.826,0.986]		[0.411,0.618]		[0.246,0.652]		[0.142,0.420]		[0.171,0.643]
		(0.024)		(<0.001)		(<0.001)		(<0.001)		(0.001)
		0.780***		0.476***		0.276***		0.298**		0.198***
Graduate/Professional Degree (e.g. MD, PhD)		[0.701,0.868]		[0.370,0.612]		[0.135,0.567]		[0.112,0.791]		[0.060,0.648]
		(\<0.001)		(<0.001)		(<0.001)		(0.015)		(0.007)
		1.000***		0.999***		0.999***		0.999***		1.000
Income, as Percent of Federal Poverty Level		[1.000,1.000]		[0.999,0.999]		[0.998,0.999]		[0.998,0.999]		[0.999,1.001]
		(<0.001)		(<0.001)		(<0.001)		(<0.001)		(0.445)
Urbanicity (Ref: Urban)										
		0.945		0.905		0.748**		0.843		0.491***
Rural		[0.880,1.016]		[0.781,1.047]		[0.591,0.946]		[0.630,1.128]		[0.337,0.716]
		(0.127)		(0.179)		(0.015)		(0.250)		<0.001)
State PDMP Category (Ref: No PDMP)										
		0.970		1.111		1.197		1.206		1.515
Voluntary PDMP		[0.889,1.058]		[0.936,1.319]		[0.892,1.608]		[0.813,1.791]		[0.902,2.543]
		(0.490)		(0.230)		(0.231)		(0.352)		(0.116)
		0.838**		1.135		1.841***		1.943**		1.939*
PDMP w/ Mandatory Access		[0.714,0.983]		[0.831,1.549]		[1.169,2.898]		[1.063,3.553]		[0.904,4.162]
		(0.030)		(0.426)		(0.008)		(0.031)		(0.089)
		0.865		0.918		0.929		1.081		1.199
PDMP w/ Mandatory Enrollment		[0.718,1.042]		[0.633,1.332]		[0.551,1.567]		[0.557,2.099]		[0.495,2.903]
		(0.127)		(0.652)		(0.783)		(0.818)		(0.688)
		0.760**		0.786		1.654		2.271**		3.399**
PDMP w/ Mandatory Access and Enrollment		[0.599,0.965]		[0.531,1.163]		[0.868,3.150]		[1.094,4.714]		[1.033,11.185]
		(0.024)		(0.228)		(0.126)		(0.028)		(0.044)
Constant	0.480***	3.383***	0.038***	0.085***	0.002***	0.012***	0.003***	0.006***	0.000***	0.026***
	[0.404,0.572]	[2.611,4.384]	[0.027,0.054]	[0.048,0.149]	[0.001,0.006]	[0.004,0.038]	[0.001,0.008]	[0.002,0.024]	[0.000,0.002]	[0.003,0.196]

	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Observations	82,600	81,400	82,600	81,400	81,800	80,600	80,900	79,700	73,900	72,800
P-values from test of parallel trends	0.636		0.083		0.493		0.127		—	

Survey-adjusted odds ratios from logit regressions with confidence intervals presented in brackets and P-values in parentheses. "Exposure" is an indicator for OxyContin misuse prior to the reformulation, and "Post-reformulation" is an indicator for individuals surveyed after the reformulation (i.e. 2011 - 2014 survey years).

Models also control for state of residence (state-level fixed effects)

Reformulation date set at 1/1/2011

* p<0.10, ** p<0.05, *** p<0.01

x – Indicates interaction term

Table S2: Falsification Test, Odds Ratios from Models for Prescription Pain Reliever Misuse and Use Disorder and Heroin Use, Use Disorder, and Initiation Outcomes, Difference-in-Difference Framework, Full Model including all Covariates

	Past Year Prescription Pain Reliever Misuse		Past Year Prescription Pain Reliever Use Disorder		Past Year Heroin Use		Past Year Heroin Use Disorder		Past Year Heroin Initiation	
	without controls	with controls	without controls	with controls	without controls	with controls	without controls	with controls	without controls	with controls
Exposure	3.150***	2.696***	5.224***	4.707***	9.633***	9.041***	9.919***	10.729***	13.870***	7.990***
	[2.818,3.522]	[2.397,3.032]	[4.355,6.266]	[3.888,5.698]	[6.343,14.631]	[5.956,13.726]	[5.718,17.204]	[6.164,18.676]	[8.172,23.541]	[4.553,14.020]
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
False Treatment Period	0.771***	0.778***	1.004	0.988	1.112	1.124	0.876	0.894	1.467	1.874**
	[0.720,0.826]	[0.719,0.841]	[0.846,1.192]	[0.827,1.179]	[0.705,1.752]	[0.700,1.805]	[0.489,1.566]	[0.485,1.649]	[0.806,2.669]	[1.013,3.465]
	(<0.001)	(<0.001)	(0.962)	(0.891)	(0.648)	(0.629)	(0.654)	(0.719)	(0.209)	(0.045)
Exposure x False Treatment Period	0.902	0.921	1.012	1.020	0.983	0.967	1.429	1.351	0.698	0.677
	[0.765,1.064]	[0.777,1.092]	[0.788,1.301]	[0.792,1.314]	[0.580,1.665]	[0.570,1.641]	[0.705,2.894]	[0.667,2.736]	[0.322,1.515]	[0.305,1.501]
	(0.220)	(0.341)	(0.923)	(0.877)	(0.948)	(0.901)	(0.322)	(0.403)	(0.363)	(0.337)
Age		0.913***		0.982		0.973		1.007		0.877
		[0.900,0.926]		[0.951,1.015]		[0.931,1.017]		[0.947,1.070]		[0.728,1.056]
		(<0.001)		(0.292)		(0.231)		(0.832)		(0.167)
Age, squared		1.001***		1.000		1.000		1.000		1.000
		[1.001,1.001]		[1.000,1.001]		[1.000,1.001]		[0.999,1.001]		[0.997,1.003]
		(<0.001)		(0.657)		(0.361)		(0.988)		(0.901)
Gender (Ref: Male)										
Female		0.980		0.973		0.618***		0.769*		0.831
		[0.917,1.048]		[0.853,1.109]		[0.482,0.791]		[0.564,1.049]		[0.564,1.225]
		(0.555)		(0.679)		(<0.001)		(0.097)		(0.350)
Race/Ethnicity (Ref: White, non-Hispanic)										
Black, non-Hispanic		1.151**		1.049		1.341		1.685*		0.145***
		[1.017,1.303]		[0.791,1.392]		[0.821,2.189]		[0.982,2.892]		[0.042,0.503]
		(0.026)		(0.741)		(0.241)		(0.058)		(0.002)
Other, non-Hispanic		1.320***		1.295		0.750		0.469*		0.995
		[1.100,1.584]		[0.933,1.796]		[0.425,1.323]		[0.212,1.039]		[0.327,3.023]
		(0.003)		(0.122)		(0.320)		(0.062)		(0.993)
Hispanic		1.122*		1.008		1.455		1.730*		0.613
		[0.997,1.263]		[0.796,1.278]		[0.772,2.743]		[0.909,3.291]		[0.270,1.388]

		(0.057)		(0.944)		(0.246)		(0.095)		(0.240)
Education (Ref: High School Degree)										
		1.211***		1.538***		1.629***		1.855***		1.159
Less than High School Degree		[1.100,1.333]		[1.297,1.823]		[1.179,2.251]		[1.260,2.733]		[0.718,1.871]
		(<0.001)		(<0.001)		(0.003)		(0.002)		(0.544)
		0.963		0.892		0.913		1.079		0.846
Some College/Associate Degree		[0.892,1.039]		[0.760,1.045]		[0.673,1.238]		[0.740,1.573]		[0.521,1.372]
		(0.331)		(0.157)		(0.556)		(0.692)		(0.497)
		0.911		0.459***		0.481*		0.210***		0.299**
College Degree (e.g. BA, BS)		[0.811,1.022]		[0.354,0.595]		[0.215,1.079]		[0.071,0.626]		[0.107,0.835]
		(0.113)		(<0.001)		(0.076)		(0.005)		(0.021)
		0.793***		0.469***		0.316*		0.385		0.095***
Graduate/Professional Degree (e.g. MD, PhD)		[0.692,0.910]		[0.328,0.670]		[0.092,1.082]		[0.067,2.233]		[0.026,0.351]
		(0.001)		(<0.001)		(0.067)		(0.287)		(<0.001)
		1.000***		0.999***		0.999**		0.998**		1.000
Income, as Percent of Federal Poverty Level		[1.000,1.000]		[0.999,1.000]		[0.998,1.000]		[0.997,1.000]		[0.999,1.001]
		(<0.001)		(<0.001)		(0.033)		(0.025)		(0.648)
Urbanicity (Ref: Urban)										
		0.922*		0.906		0.592***		0.680		0.501***
Rural		[0.843,1.008]		[0.753,1.090]		[0.415,0.844]		[0.425,1.088]		[0.301,0.833]
		(0.074)		(0.296)		(0.004)		(0.107)		(0.008)
State PDMP Category (Ref: No PDMP)										
		1.130*		1.280*		1.202		1.241		
Voluntary PDMP		[0.981,1.301]		[0.960,1.706]		[0.634,2.276]		[0.583,2.642]		
		(0.090)		(0.092)		(0.573)		(0.575)		
		1.262		1.690		8.110**		1.000		
PDMP w/ Mandatory Access		[0.767,2.077]		[0.622,4.592]		[1.453,45.268]		[1.000,1.000]		
		(0.358)		(0.303)		(0.017)		(.)		
		1.115		0.839		0.576		1.379		
PDMP w/ Mandatory Enrollment		[0.717,1.736]		[0.426,1.655]		[0.150,2.209]		[0.257,7.388]		
		(0.628)		(0.613)		(0.421)		(0.707)		
	0.492***	3.647***	0.049***	0.089***	0.003***	0.008***	0.002***	0.002***	0.001***	0.050*
Constant	[0.390,0.620]	[2.600,5.114]	[0.033,0.071]	[0.044,0.179]	[0.001,0.013]	[0.001,0.047]	[0.000,0.014]	[0.000,0.020]	[0.000,0.003]	[0.002,1.305]
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(0.072)
Observations	49,680	48,890	49,680	48,890	49,235	48,459	47,391	46,273	42,822	42,120

Survey-adjusted odds ratios from logit regressions with confidence intervals presented in brackets and P-values in parentheses. "Exposure" is an indicator for OxyContin misuse prior to the reformulation, and "Post-reformulation" is an indicator for individuals surveyed after the reformulation (i.e. 2011 - 2014 survey years).

Models also control for state of residence (state-level fixed effects)

PDMP variables excluded from heroin initiation models because they failed to converge when the variables were included.

The sample period is limited to survey years 2005-2010.

* p<0.10, ** p<0.05, *** p<0.01

x – Indicates interaction term

Table S3: Odds Ratios of Selected Adult Characteristics – Test of Sample Composition

	Age		Male		White		Black		Hispanic		In Poverty		HS Graduate	
	without controls	**with controls**	**without controls**	**with controls**	**without controls**	**with controls**	**without controls**	**with controls**	**without controls**	**with controls**	**without controls**	**with controls**	**without controls**	**with controls**
Exposure	-6.712***	-6.341***	1.384***	1.415***	1.871***	2.234***	0.415***	0.381***	0.609***	0.505***	1.282***	1.190***	0.862***	0.920*
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(0.001)	(0.001)	(0.097)
Post-reformulation	2.983***	2.610***	1.016	1.061*	0.842***	0.808***	1.116**	1.065	1.153***	1.273***	1.297***	1.353***	1.175***	1.228***
	(<0.001)	(<0.001)	(0.558)	(0.069)	(<0.001)	(<0.001)	(0.037)	(0.337)	(0.003)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Exposure x Post-reformulation	0.073	-0.005	1.025	1.028	1.058	1.081	0.820	0.839	1.048	1.000	0.922	0.955	1.000	0.971
	(0.866)	(0.990)	(0.671)	(0.635)	(0.513)	(0.391)	(0.209)	(0.278)	(0.709)	(0.999)	(0.279)	(0.558)	(0.996)	(0.724)
Age				1.007		0.981***		1.043***		1.013		0.952***		1.059***
				(0.136)		(0.003)		(<0.001)		(0.225)		(<0.001)		(<0.001)
Age, squared				1.000		1.000***		1.000***		1.000***		1.000***		0.999***
				(0.118)		(<0.001)		(<0.001)		(0.004)		(<0.001)		(<0.001)
Gender (Ref: Male)														
Female		0.132		0.967								2.766***		0.844***
		(0.42)		(0.469)								(<0.001)		(0.004)
Race/Ethnicity (Ref: White, non-Hispanic)														
Black, non-Hispanic		0.547*		1.087								1.578***		0.922
		(0.096)		(0.186)								(<0.001)		(0.320)
Other, non-Hispanic		-1.806***		1.185***								1.657***		0.388***
		(<0.001)		(<0.001)								(<0.001)		(<0.001)
Hispanic		-3.420***		1.219***		0.632***		0.895*		2.174***		2.609***		
		(<0.001)		(<0.001)		(<0.001)		(0.095)		(<0.001)		(<0.001)		
Education (Ref: High School Degree)														
Less than High School Degree		0.233		0.766***		1.048		0.955		0.893**		0.813***		
		(0.421)		(<0.001)		(0.218)		(0.417)		(0.039)		(<0.001)		
Some College/Associate Degree		-0.544**		0.731***		1.477***		0.602***		0.582***		0.309***		
		(0.011)		(<0.001)		(<0.001)		(<0.001)		(<0.001)		(<0.001)		
College Degree (e.g. BA, BS)		-0.276		0.680***		1.465***		0.635***		0.486***		0.249***		
		(0.360)		(<0.001)		(<0.001)		(<0.001)		(<0.001)		(<0.001)		

Graduate/Professional Degree (e.g. MD, PhD)		1.884***		1.001***		1.002***		0.997***		0.998***				1.004***
		(<0.001)		(<0.001)		(<0.001)		(<0.001)		(<0.001)				(<0.001)
Income, as Percent of Federal Poverty Level		0.011***		0.987		3.030***		0.211***		0.411***		0.912*		0.771***
		(<0.001)		(0.706)		(<0.001)		(<0.001)		(<0.001)		(0.061)		(<0.001)
Urbanicity (Ref: Urban)														
Rural		1.992***		1.061		1.052		0.961		0.954		1.170***		1.160**
		(<0.001)		(0.153)		(0.369)		(0.627)		(0.519)		(0.008)		(0.011)
State PDMP Category (Ref: No PDMP)														
Voluntary PDMP		1.025***		0.958		1.057		0.887		1.074		1.271**		1.283**
		(<0.001)		(0.576)		(0.594)		(0.435)		(0.645)		(0.026)		(0.017)
PDMP w/ Mandatory Access		1.863***		1.029		1.188*		0.864		0.766**		1.289**		1.184
		(0.001)		(0.739)		(0.097)		(0.454)		(0.028)		(0.034)		(0.152)
PDMP w/ Mandatory Enrollment		2.730***		0.863		1.227		0.823		0.800		1.359**		1.517***
		(<0.001)		(0.116)		(0.112)		(0.339)		(0.208)		(0.027)		(0.001)
PDMP w/ Mandatory Access and Enrollment		3.358***				1.086***		1.054		0.840***		1.676***		1.475***
		(<0.001)				(0.008)		(0.261)		(<0.001)		(<0.001)		(<0.001)
Constant	36.147***	31.770***	1.325***	1.024	4.075***	2.290***	0.220***	0.249***	0.006***	0.012***	0.195***	0.332***	3.398***	0.555***
	(<0.001)	(<0.001)	(0.001)	(0.859)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(0.001)
Observations	82,602	81,373	82,602	81,373	82,602	81,373	82,602	81,373	82,602	81,373	81,373	81,373	82,602	81,373

Survey-adjusted odds ratios from logit regressions with P-values in parentheses.

"Exposure" is an indicator for OxyContin misuse prior to the reformulation, and "Post-reformulation" is an indicator for individuals surveyed after the reformulation (i.e. 2011 - 2014 survey years).

Models also control for state of residence (state-level fixed effects).

Reformulation date set at 1/1/2011.

* p<0.10, ** p<0.05, *** p<0.01

x – Indicates interaction term

References

1. StataCorp. Stata Statistical Software: Release 15. College Station, TX2015.