Teach your children, well: Prescription-drug monitoring programs and parental time use

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MSU, Oct. 2025

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Introduction: The opioid crisis

- The opioid crisis
  - Between 2015 & 2017, 623K parents with opioid-abuse disorder lived with a child $\leq$ 18 (Clemens-Cope et al. 2019)
  - Between 2004–2012, 13.5% of parents misused opioids
  - The impact of the opioid crisis continues today (CDC, 2024)
- Impact on children
  - Maltreatment, foster-care admission, neo- and perinatal outcomes (Cunningham & Finlay, 2013; Ghertner, 2022; Suchman et al. 2017)
  - Also impact parenting skills and child development (Suchman et al., 2017)
  - Opioid overdoes associated with maltreatment and foster-care admissions (Bullinger & Ward, 2021, Ghertner, 2022)

Introduction: PDMPs

- Prescription-drug monitoring programs (PDMPs): Databases of prescriptions for controlled substances
  - Now present in all US states
  - Decrease opioid abuse and prescription-opioid-mortality (Kaestner & Ziedan, 2019, 2023; Neumark and Savych, 2023)
- Mixed effects on other outcomes
  - Negative employment & earnings effects (Kaestner & Ziedan, 2023)
  - Reduced labor-force attachment and credit scores (Gupta & Mazumder, 2023)
  - Substitution towards more harmful drugs (Alpert et al., 2018; Buchmueller and Carey, 2018; Powell and Pacula, 2021; Evans et al. 2019; Evans et al., 2022; Maclean et al. 2022)

Introduction: PDMPs and child outcomes

- Mixed effects for child outcomes, too
  - Mandated PDMPs reduces neonatal abstinence syndrome and improve infant health outcomes (Gihleb et al., 2020; Kaestner & Ziedan, 2021)
  - Reduce removals & foster-care placements due to child neglect & physical abuse (Gihleb et al., 2019)
  - Increases in substantiated child maltreatment (specifically neglect and physical abuse; Evans et al. 2022)
- Similar effects for other policies
  - More foster-care admissions due to OxyContin reformulation (Mackenzie-Liu, 2021)
  - Initially more homicides in Australia after shock to heroin supply (Moore & Schnepel, 2024)

Introduction: Parental investments in children

- Parental investments are critical for children's cognitive development (Fiorini & Keene, 2014; Del Boca et al., 2014)
- Expansion of EITC reduced some maternal investment in children (Bastian & Lochner, 2022)
- Medical marijuana increases parental time investments among parents who don't abuse marijuana (Bansak & Kim, 2024)
- The relationship between PDMPs and parental time investment is an open question

Introduction: This paper

- We use a robust DD approach to estimate the effect of the (staggered) adoption of PDMPs between 2003 and 2019

- We measure parental investments using time spent on various parenting activities

- We find that PDMPs increase both *active* (direct parent-child interaction) and *passive* (child is present) childcare
  - Active effects come from increases in child care *per se*, education care, and medical care
  - Our estimates $\Rightarrow$ that PDMPs increase active care by 6 minutes/day and passive care by 12 minutes, *on average*
  - A conservative calculation $\Rightarrow$ these translate to 45 minutes of active care and 90 minutes passive care, *among parents with substance-use disorders*

Introduction: This paper

- We find that PDMPs cause parents to substitute towards relatively engaging forms of investment (talking to, playing with, homework)
- Among parents with disabilities or mobility limitations, we find much larger *decreases* in active care, driven by reductions in time spent helping with homework
  - May be driven by cognitive issues associated with pain
  - Heterogeneity along similar dimensions may help reconcile other conflicting findings (e.g., PDMPs *reduce* foster-care but *increase* maltreatment)
- PDMPs are independent of Pill Mill laws, but marijuana laws amplify their positive effects
  - We find that positive effects occur entirely in areas with medical marijuana laws
  - Consistent with evidence that negative effects of OxyContin reformulation concentrated in areas without MML (Evans et al., 2022)

Data

- Main data source is American Time-Use Survey (Flood et al., 2023)
  - Time diaries that track daily time use in 15 minute increments
  - Report what they are doing and with whom
  - We focus on 2003-2019 and respondents with a child < 18 at home
  - Descriptive statistics not interesting, but available
- Information on timing of adoption of PDMPs is from Horowitz (2020), Kaestner & Ziedan (2019, 2024) and RAND (2024)
  - There are several "definitions" of PDMPs: "Electronic PDMPs," "Mandated PDMPs," etc.
  - We focus on "Modern PDMPs," which are "accessible to any authorized user" (Horowitz, 2020l Kaestner & Ziedan, 2019, 2024)
  - Modern PDMPs have been shown to reduce abuse and prescriptions (Kaestner & Ziedan, 2019, 2024; Wang, 2021)
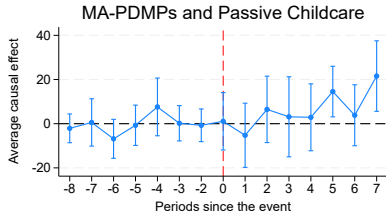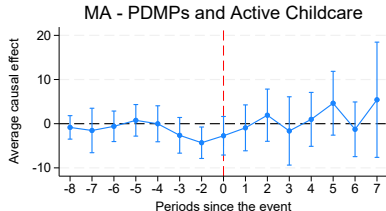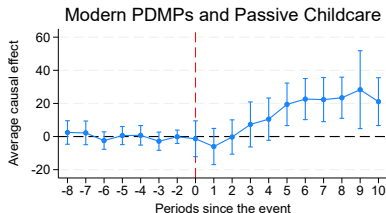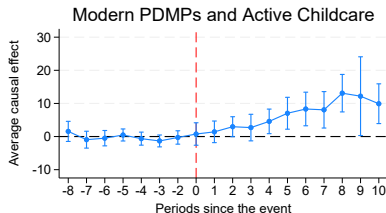 - Mandated PDMPs have no effect conditional on Modern PDMPs (Kaestner & Ziedan, 2019, 2024)

Empirical stategy

- Parental-time use evolves according to

$$Y_{ist} = \alpha_s + \delta_t + X_{it}'\gamma + W_{st}'\theta + \beta_{it}\text{PDMP}_{st} + \varepsilon_{st}$$

  - This embeds a parallel trends assumption and allows for treatment-effect heterogeneity
  - X_{it} contains gender, race, age, age^2, education, and marital status, W_{st} contains unemployment rate and minimum wage (& other variables described below)

- OLS estimates don't identify a sensible average treatment effect (Goodman-Bacon, 2021)
  - We use 2SDD (Gardner, 2001; Gardner et al. 2024):
    1. Estimate $Y_{ist} = \alpha_s + \delta_t + X_{it}'\gamma + W_{st}'\theta + \varepsilon_{st}$ in the sample of untreated observations
    2. Regress $Y_{ist} - \hat{\alpha}_s + \hat{\delta}_t + X_{it}'\hat{\gamma} + W_{st}'\hat{\theta}$ on PDMP$_{st}$ to obtain overall ATT (or leads and lags PDMP in event-study models)
  - SEs adjusted for first-stage estimation and clustered at state level

Modern PDMPs and Active Childcare

Modern PDMPs and Passive Childcare

MA - PDMPs and Active Childcare

MA-PDMPs and Passive Childcare

Strongly consistent with parallel trends ◇ Effect delays consistent with evidence on heroin shocks from Moore & Schnepel (2024) and PDMPs (Kaestner & Ziedan, 2019, 2023)

Baseline results: Effect summaries

	Active Childcare		Passive Childcare	
Modern PDMPs	5.4919***	6.0441***	11.0353**	12.3093***
	(1.2966)	(1.2985)	(4.5508)	(3.9083)
N	92837	92837	92837	92837
Mandated PDMPs	-0.2808	0.5301	0.7067	3.4435
	(2.1232)	(1.9310)	(4.4048)	(3.3911)
N	94468	94468	94468	94468
Controls		X		X

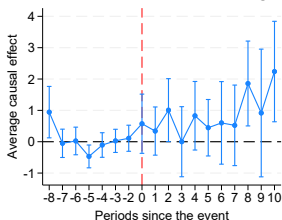Robustness tests: TWFE Electronic PDMPs

Griesler's (2019) estimate that 13.5% of parents abuse opioids $\Rightarrow$ effects of 45 and 90 minutes $\diamond$ Mandated PDMP results consistent with Kaestner & Ziedan, Horowitz
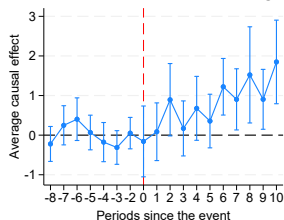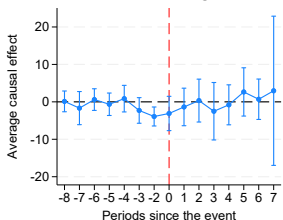
Active care components: Event studies
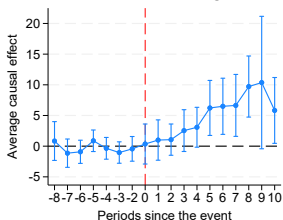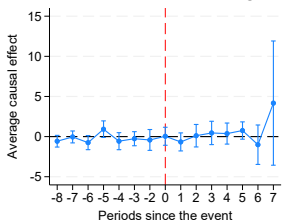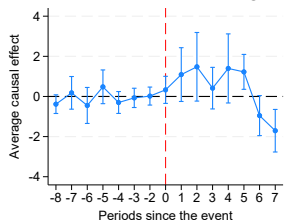
Active care components: Effect summaries

	Childcare		Schooling care		Medical care	
Modern PDMPs	3.8281***	4.6257***	0.9035**	0.7696**	0.7603***	0.6488**
	(1.1487)	(1.2503)	(0.3698)	(0.3646)	(0.2476)	(0.2756)
N	92837	92837	92837	92837	92837	92837
Mandated PDMPs	-1.2300	-0.5180	0.0766	0.1071	0.8727***	0.9265***
	(1.9601)	(1.8191)	(0.4464)	(0.4351)	(0.2917)	(0.2857)
N	94468	94468	94468	94468	94468	94468
Controls		X		X		X

Childcare components: Event studies
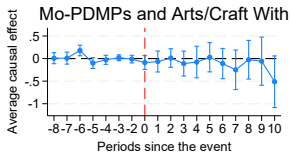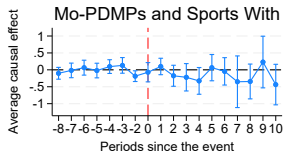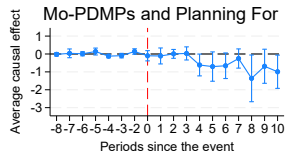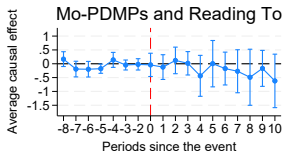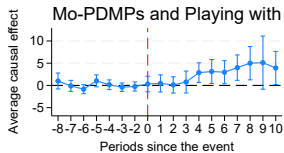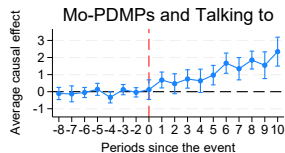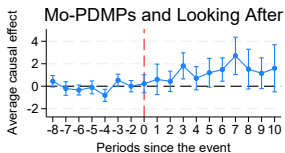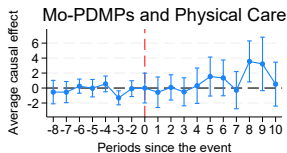
Childcare components: Effect summaries

	Physical care	Looking after	Talking to	Playing with
Modern PDMPs	0.8960	1.2050***	1.0746***	2.2968***
	(0.5850)	(0.3372)	(0.1893)	(0.8090)
N	92837	92837	92837	92837

	Reading to	Planning for	Sports with	Arts/Crafts
Modern PDMPs	-0.1559	-0.4238***	-0.1447	-0.1223
	(0.2021)	(0.1190)	(0.1207)	(0.1186)
N	92837	92837	92837	92837

Mandated results omitted ⋄ Suggests substitution towards relatively "engaging" activities

Education care components: Event studies

	Homework	Homeschooling	Meetings for school	Waiting at school
Modern PDMPs	0.4475	0.2286	0.0713	0.0046
	(0.3576)	(0.1973)	(0.0856)	(0.0040)
N	92837	92837	92837	92837
Mandated PDMPs	-0.1684	0.3186	-0.0535	-0.0154**
	(0.3913)	(0.2171)	(0.0802)	(0.0068)
N	94468	94468	94468	94468

Increases (from event study) in homework and decreases in waiting at school also suggest substitution towards more engaging activities

Medical care components: Event studies
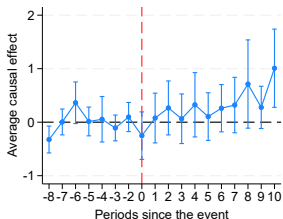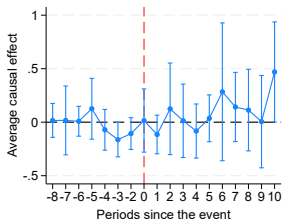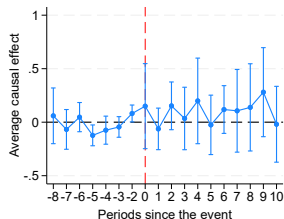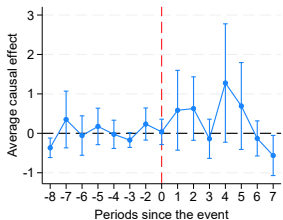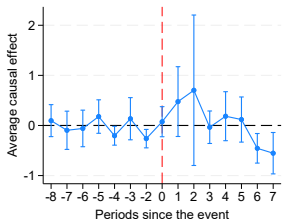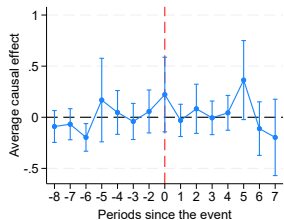
Medical care components: Effect summaries

	Providing	Obtaining	Waiting for
Modern PDMPs	0.2169	0.0669	0.0940
	(0.1730)	(0.1179)	(0.1112)
N	92837	92837	92837
Mandated PDMPs	0.5211**	0.2523	0.0439
	(0.2204)	(0.2099)	(0.0675)
N	94468	94468	94468

Other uses of adult time: Event studies
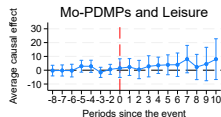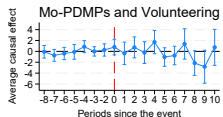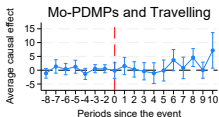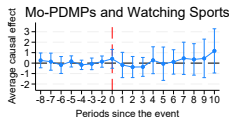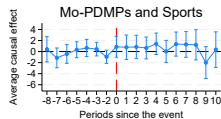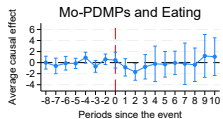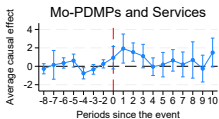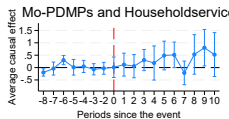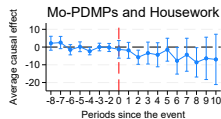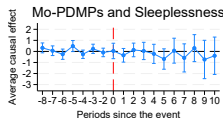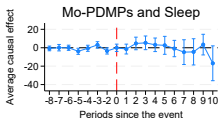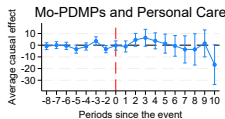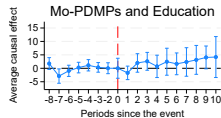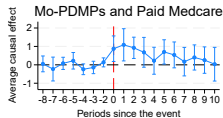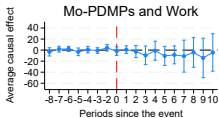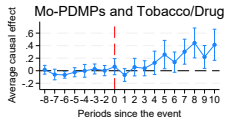
Other uses of adult time: Effect summaries

	Tobacco/drug use	Work	Work (2)	Paid medical care	Education	Personal care
Modern PDMPs	0.1603***	-6.6015	-7.3085	0.6448***	1.4230	0.0248
	(0.0421)	(6.0530)	(6.2635)	(0.1985)	(1.3287)	(2.7248)
N	92837	92837	92837	92837	92837	92837
	Sleep	Sleeplessness	Housework	Services	Household services	Home production
Modern PDMPs	-0.0736	-0.1858	-4.4681**	0.9578**	0.2652	-4.6288
	(3.1609)	(0.2678)	(1.8496)	(0.4117)	(0.1829)	(5.4184)
N	92837	92837	92837	92837	92837	92837
	Eating	Sports	Watching sports	Volunteering	Travel	Leisure
Modern PDMPs	-0.2674	0.6931	0.1417	0.0076	1.3522	4.1491**
	(0.7458)	(0.5698)	(0.3265)	(0.5713)	(0.9983)	(1.8481)
N	92837	92837	92837	92837	92837	92837

Mandatory results omitted from here forward ⋄ ATUS don't decompose tobacco drug use ⋄ Consistent with evidence on substitution towards other substances ⋄ Paid medical care might ⇒ addiction treatment or alternative pain treatment (consistent with Neumark and Savych, 2023) ⋄ ↓ housework & ↑ services also consistent with substitution towards "quality time"

Effect summaries by gender

	Women				
	Active childcare	Passive childcare	Childcare	Schooling care	Medical care
Modern PDMPs	3.2718**	4.8405	2.2873	0.0852	0.8993**
	(1.5002)	(4.4494)	(1.5050)	(0.5964)	(0.3970)
N	53452	53452	53452	53452	53452

	Men				
	Active childcare	Passive childcare	Childcare	Schooling care	Medical care
Modern PDMPs	10.5344***	21.5620***	8.5386***	1.5611***	0.4347
	(1.8028)	(4.8561)	(1.6057)	(0.3348)	(0.3230)
N	39379	39379	39379	39379	39379

Larger effects for men suggest intrahousehold substitution and that men have more leeway to adjust their time use vis-a-vis childcare

Effect summaries by marital status

	Married				
	Active childcare	Passive childcare	Childcare	Schooling care	Medical care
Modern PDMPs	7.1548***	18.7067***	5.0741***	1.1795**	0.9012**
	(1.8968)	(4.1350)	(1.8475)	(0.5767)	(0.3640)
N	58121	58121	58121	58121	58121

	Single				
	Active childcare	Passive childcare	Childcare	Schooling care	Medical care
Modern PDMPs	2.6176*	-2.1213	2.3418*	0.1093	0.1665
	(1.3607)	(6.6576)	(1.3314)	(0.3210)	(0.4274)
N	34716	34716	34716	34716	34716

Suggests single parents more time constrained (although they still increase childcare time)

Effect summaries by race

	White				
	Active childcare	Passive childcare	Childcare	Schooling care	Medical care
Modern PDMPs	5.6372***	10.1478**	4.5583***	0.4577	0.6212*
	(1.5562)	(5.1292)	(1.3895)	(0.3483)	(0.3293)
N	76005	76005	76005	76005	76005

	Black				
	Active childcare	Passive childcare	Childcare	Schooling care	Medical care
Modern PDMPs	4.4402	-2.9843	2.4356	0.8159	1.1888*
	(5.0634)	(14.4728)	(5.0263)	(1.0266)	(0.6350)
N	9819	9819	9819	9819	9819

Consistent with Gihleb, Giuntella and Zhang's (2019) findings that foster-care reductions are mostly for white families

Effect summaries by # of children

	Controlling for number of children				
	Active childcare	Passive childcare	Childcare	Schooling care	Medical care
Modern PDMPs	5.4964***	10.5815***	4.2101***	0.6651*	0.6212**
	(1.2309)	(3.5083)	(1.1933)	(0.3848)	(0.2701)
N	92837	92837	92837	92837	92837

	One child				
	Active childcare	Passive childcare	Childcare	Schooling care	Medical care
Modern PDMPs	7.6280***	6.8620	6.8101**	0.4533	0.3646
	(2.6847)	(4.8342)	(2.7109)	(0.3328)	(0.3383)
N	38124	38124	38124	38124	38124

Effect summaries by # of children

	More than one child				
	Active childcare	Passive childcare	Childcare	Schooling care	Medical care
Modern PDMPs	4.6437*	16.0165***	2.8334	0.9699*	0.8404**
	(2.6348)	(3.4115)	(2.5786)	(0.5222)	(0.3892)
N	54713	54713	54713	54713	54713

	More than two children				
	Active childcare	Passive childcare	Childcare	Schooling care	Medical care
Modern PDMPs	4.3687	16.8740***	1.6270	0.4548	2.2869***
	(4.2024)	(5.1217)	(4.0378)	(0.9239)	(0.5747)
N	19324	19324	19324	19324	19324

Smaller active and larger passive effects for families with more kids
suggests subject to time constraints

Effect summaries by age of child

	Youngest child ≥ 6				
	Active childcare	Passive childcare	Childcare	Schooling care	Medical care
Modern PDMPs	8.4356***	30.3170***	5.3960**	1.3190***	1.7206***
	(2.8422)	(4.4853)	(2.6257)	(0.3950)	(0.5712)
N	38936	38936	38936	38936	38936

	Youngest child < 6				
	Active childcare	Passive childcare	Childcare	Schooling care	Medical care
Modern PDMPs	3.9400***	0.4534	3.6231***	0.4464	-0.1295
	(1.0001)	(4.1660)	(1.0267)	(0.5848)	(0.2780)
N	53901	53901	53901	53901	53901

Also: Time of week

Effect summaries by disability status

	Parents with disabilities				
	Active childcare	Passive childcare	Childcare	Schooling care	Medical care
Modern PDMPs	-134.1909***	109.2377***	32.4439***	-168.9670***	2.3323
	(33.7290)	(39.8148)	(10.9570)	(38.8682)	(4.6763)
N	2620	2620	2620	2620	2620

	Parents with difficulty climbing stairs				
	Active childcare	Passive childcare	Childcare	Schooling care	Medical care
Modern PDMPs	-161.0662***	45.9037**	35.6759***	-194.6546***	-2.0875
	(31.1485)	(22.0591)	(10.4367)	(39.6430)	(5.4720)
N	1322	1322	1322	1322	1322

Differential effect size might be because there is a greater intention to treat in these subpopulations

Effect summaries by disability status: components

	Childcare			
	Physical care	Looking after	Talking to	Playing with
Modern PDMPs	11.8789***	11.2419***	9.0791***	3.3041
	(3.5712)	(2.6013)	(3.2002)	(6.8147)
N	2620	2620	2620	2620
	Reading to	Planning for	Sports with	Arts/Crafts
Modern PDMPs	-3.6906***	1.0319	-0.5589	0.1574
	(1.1353)	(1.0387)	(0.6597)	(0.2507)
N	2620	2620	2620	2620

Mobility status

Effect summaries by disability status: Components

	Schooling care			
	Homework	Homeschooling	Meetings for school	Waiting at school
Modern PDMPs	-169.6475***	-0.4089	0.5202	0.0025
	(39.5636)	(1.2993)	(0.7554)	(0.0025)
N	2620	2620	2620	2620

	Medical care		
	Providing	Obtaining	Waiting for
Modern PDMPs	2.2526	2.4856	-2.4955
	(1.6263)	(2.2918)	(2.9618)
N	2620	2620	2620

Childcare *per se* ↑s ⋄ ↓s in reading, homework suggest a shift away from cognitive activities (maybe pain or addiction) ⋄ Heterogeneity w.r.t. underlying conditions is crucial for *direction* of effect ⋄ May help reconcile, e.g., ↓ foster-care (Gihleb et al. 2019) but ↑ maltreatment (Evans et al., 2022)

Effect summaries: Pill Mill laws

	Controlling for Pill Mill laws				
	Active childcare	Passive childcare	Childcare	Schooling care	Medical care
Modern PDMPs	5.1354***	6.2917	3.5891***	0.8016**	0.7448***
	(1.3686)	(3.9558)	(1.2817)	(0.3599)	(0.2732)
N	92837	92837	92837	92837	92837

	Interactions				
	Active childcare	Passive childcare	Childcare	Schooling care	Medical care
Modern PDMPs	4.5254***	7.9723**	3.3460**	0.6964*	0.4830
	(1.4654)	(3.9755)	(1.3892)	(0.3659)	(0.3050)
Modern PDMPs×PML	3.2013	-8.8194	1.2758	0.5516	1.3739***
	(4.1856)	(7.0025)	(4.0945)	(0.5821)	(0.5098)
N	92837	92837	92837	92837	92837

Effects of PDMP are independent of PMLs

Effect summaries: Medical marijuana

	Controlling for medical marijuana laws				
	Active childcare	Passive childcare	Childcare	Schooling care	Medical care
Modern PDMPs	5.0779***	6.8076**	3.6916***	0.7068*	0.6795**
	(1.2501)	(3.3492)	(1.2144)	(0.3913)	(0.2913)
N	92837	92837	92837	92837	92837
	Interactions				
	Active childcare	Passive childcare	Childcare	Schooling care	Medical care
Modern PDMPs	2.3217	4.5246	1.2060	0.7467**	0.3691
	(1.6173)	(3.7730)	(1.3840)	(0.3513)	(0.2967)
Modern PDMPs×MML	6.7675***	11.1883**	6.1199***	0.0273	0.6204
	(1.884)	(5.6822)	(1.5531)	(0.2741)	(0.4859)
N	92837	92837	92837	92837	92837

For most outcomes, positive effects of PDMPs only accrue in MML states ◇ Consistent with Evan et al.'s (2022) finding for OxyContin reformulation

Effect summaries: Recreational marijuana

	Controlling for recreational marijuana Laws				
	Active childcare	Passive childcare	Childcare	Schooling care	Medical care
Modern PDMPs	5.4328***	3.6413	3.8238***	0.6986**	0.9105***
	(1.2634)	(4.8455)	(1.1718)	(0.3056)	(0.2769)
N	92837	92837	92837	92837	92837

	Interactions				
	Active childcare	Passive childcare	Childcare	Schooling care	Medical care
Modern PDMPs	4.3193***	7.2018*	3.0865**	0.6732*	0.5596*
	(1.3272)	(4.3629)	(1.2201)	(0.3661)	(0.2904)
Modern PDMPs×RML	11.2230***	26.0059***	9.2657***	1.0161*	0.9412***
	(1.7460)	(4.1746)	(1.5523)	(0.5349)	(0.2827)
N	92837	92837	92837	92837	92837

PDMPs have an independent effect amplified by RML ⬦ Medical use
(and ability to write prescription) might be important for substitution
away from opioids to marijuana

Effect summaries: Treatment center admissions

	Cocaine, heroin, methamphetamines, and alcohol				
	Active childcare	Passive childcare	Childcare	Schooling care	Medical care
Modern PDMPs	3.6789**	9.2351***	2.2743	0.6769	0.7277**
	(1.5969)	(3.5172)	(1.4240)	(0.4244)	(0.3601)
N	91669	91669	91669	91669	91669

	All drugs				
	Active childcare	Passive childcare	Childcare	Schooling care	Medical care
Modern PDMPs	3.7347*	8.8005**	2.3505	0.6611	0.7231
	(2.2611)	(4.1969)	(2.2223)	(0.4343)	(0.4499)
N	91669	91669	91669	91669	91669

Smaller average effects might imply larger overall effects in areas with greater tendencies towards substance abuse

Conclusion

- Unambiguous new evidence that PDMPs have positive consequences for child welfare
  - Increases in childcare, education care, and medical care
  - Substitution towards "quality time"
- Time use is an important measure of parental investment, a key determinant of cognitive development
- Heterogeneity is critical, parents with disabilities and mobility issues experience large *declines* in time use
- PDMPs interact with other substance-abuse policies
  - Marijuana laws amplify the positive effects of PDMPs
  - Positive effects occur entirely in areas with MML

Appendix slides

Descriptive statistics Back

	N	Mean	Std. Dev.	Min	Max
Active Childcare	92837	60.88	100.2	0	1151
Passive Childcare	92837	289.56	275.44	0	1440
Childcare	92837	53.93	93.59	0	1140
Child's School care	92837	5.3	23.99	0	640
Child's Medical care	92837	1.65	19.48	0	1045
White	92837	0.82	0.39	0	1
Age	92837	37.09	12.23	15	85
Age of Youngest Child	92837	7.52	5.31	0	17
Female	92837	0.58	0.49	0	1
Married	92837	0.63	0.48	0	1
High School	92837	0.81	0.39	0	1
Some College	92837	0.59	0.49	0	1
College	92837	0.33	0.47	0	1

	Active Childcare	Passive Childcare	Childcare	Schooling care	Medical care
Modern PDMPs	0.6571	-4.5191	0.0291	0.5160**	0.1119
	(1.1600)	(3.2833)	(1.1621)	(0.2427)	(0.2478)
N	92837	92837	92837	92837	92837
Mandated PDMPs	0.503	3.5536	-0.4805	0.0354	0.9480***
	(1.9687)	(3.4209)	(1.8710)	(0.4237)	(0.2990)
N	94468	94468	94468	94468	94468

	Active childcare	Passive childcare	Childcare	Schooling care	Medical care
Electronic PDMPs	3.8392***	4.7130*	3.2026***	0.2386	0.3979
	(1.1310)	(2.7414)	(1.1416)	(0.3085)	(0.3480)
N	50148	50148	50148	50148	50148

	Childcare			
	Physical care	Looking after	Talking to	Playing with
Modern PDMPs	0.5937	13.1891***	14.1533***	7.6039
	(4.9630)	(4.3219)	(4.5507)	(4.8505)
N	1322	1322	1322	1322
	Reading to	Planning for	Sports with	Arts/Crafts
Modern PDMPs	0.2138	0.9453*	-0.7292	-0.2940
	(1.0376)	(0.5604)	(1.2423)	(0.3067)
N	1322	1322	1322	1322

Effect summaries by mobility status: Components

	Schooling care			
	Homework	Homeschooling	Meetings for school	Waiting at school
Modern PDMPs	-194.6219***	-0.6701	0.4691**	0.0049
	(39.7219)	(1.6203)	(0.2014)	(0.0050)
N	1322	1322	1322	1322

	Medical care		
	Providing	Obtaining	Waiting for
Modern PDMPs	-0.9788	0.6475	-1.7562
	(2.4470)	(1.8620)	(3.7916)
N	1322	1322	1322

	Weekdays				
	Active childcare	Passive childcare	Childcare	Schooling care	Medical care
Modern PDMPs	5.6349***	11.3859*	3.3161*	0.7474	1.5714***
	(1.8022)	(6.0744)	(1.7721)	(0.5051)	(0.3543)
N	45796	45796	45796	45796	45796

	Weekends				
	Active childcare	Passive childcare	Childcare	Schooling care	Medical care
Modern PDMPs	6.4047***	9.5951**	5.7113***	0.8782*	-0.1848
	(2.0174)	(4.6467)	(1.9881)	(0.4994)	(0.3610)
N	47041	47041	47041	47041	47041