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Opioid Prescription Rates And Child Removals: Evidence From Florida

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ABSTRACT A critical aspect of the opioid epidemic is its effect on the ability of opioid-dependent parents to care for their children. In this article we investigate the association between the rate of removals of children from their homes and the opioid prescription rate in Florida counties during 2012–15. We performed a panel data analysis of opioid prescriptions that also controlled for the prescription rates of benzodiazepines and stimulants and for other risk factors for child removal. We found that a one-standard-deviation increase in the opioid prescription rate was associated with a 32 percent increase in the removal rate for parental neglect. When we obtained subset samples by percentage of white residents, the estimated relationships were approximately twice as large in the counties with the highest concentration of whites than in the counties with the lowest. Policy makers should consider the opioid epidemic's effects on child welfare when determining the appropriate public health response.

Opioid abuse has rapidly become an urgent issue (health or otherwise) facing the US, with approximately two million Americans having opioid use disorder.¹ While there have been declines in recent years, there were roughly sixty million opioid prescriptions per quarter in 2015,² and the morphine milligram equivalent per capita is approximately three times the 1999 level and four times the level in Europe.¹ Opioid abuse is facilitated by overprescription by providers, diversion of prescribed drugs, and illicitly manufactured opioids. The direct effects of abuse can be devastating. Overdose death rates have continued to rise, with over 33,000 deaths attributable to opioids in 2015.³ Health care costs associated with opioid abuse have been estimated at \$26 billion per year.⁴

One of the many indirect costs of opioid use disorder is parents' reduced ability to care for their children. In the most extreme circumstan-

es, opioid abuse can lead to children's removal from their homes and placement in foster care. Removal has been associated with many deleterious effects on children, including higher rates of juvenile delinquency and teen motherhood,⁵ mental and physical health problems,⁶ and higher rates of adult criminality.⁷ The fiscal costs of placing a child in foster care, excluding health care and food assistance, is roughly \$20,000 per year.⁸ Recently states have sued opioid manufacturers, in part because of the costs associated with having the children of opioid dependents enter their foster care systems.⁹

A large literature has explored the characteristics of parents and children that are associated with the likelihood of a child's removal from their home.^{10–17} When children are removed because of parental drug abuse, their stay periods away from home are longer,¹⁸ and the removal is less likely to result in reunification with the parent,^{19–21} compared to removals for other reasons. An analysis of data for 1995–99 found that use of

methamphetamines caused an increase in the number of children placed in foster care.²² However, despite numerous press reports of state foster systems being strained by children of opioid dependents,²³⁻²⁵ no known studies have directly examined the relationship between parental opioid abuse and child removal from home.

This study investigates the relationship between the number of children removed from their homes and the rate of opioid use. While our analysis was limited to prescription rates and did not measure illicit opioids, prescription rates are closely related to illicit opioid use.¹ We employed county-level data for Florida for the period 2012–15. While our results are based on Florida, the state is in many ways representative of the US. It is the third-largest state, and its racial and demographic profile is roughly similar to that of the country as a whole. In 2012 the average opioid pain reliever prescription rate in Florida was 72.7 per 100 residents, while the corresponding national average was 87.3.²⁶ In 2010 and 2011 the state implemented several policies regarding pain clinics and a prescription drug monitoring program. Although the policies led to decreases in prescription rates²⁷ and diversion cases,²⁸ the 2.5 percent decrease in opioid volume²⁹ was arguably modest.

We analyzed not only all removals, but also removals for the two most common reasons nationally: parental drug abuse and parental neglect.³⁰ In addition to the opioid prescription rate, we controlled for prescription rates of benzodiazepines and stimulants as well as demographic and economic factors associated with the risk of removal. We took steps to address potential estimation bias due to differences across counties and to account for statewide changes over time.

Study Data And Methods

DATA The sample was a panel based on county-years and reflects all sixty-seven Florida counties in the period 2012–15. The outcomes of interest were child removal rates and were calculated as the ratio of the number of children removed from their home and the population in thousands ages 0–19. The number of removals was obtained from data submitted by the state to the federal government's Adoption and Foster Care Analysis and Reporting System and reported by Fostering Court Improvement.³¹ We obtained the number of total removals, as well as the number of removals where parental drug abuse, neglect, or both were listed as causes. When an investigation of child maltreatment takes place, child protective investigators are required to collect evidence to prove each type of maltreatment they report. If

a child is removed from the home, any specific maltreatment the investigator identified is listed as a cause for removal. Thus, multiple causes can be indicated for a given removal. Population data were obtained from the Census Bureau.³²

Prescription rates were measured as the number of prescriptions per 100 population and were obtained from the Florida Drug-Related Outcomes Surveillance and Tracking System.³³ Rates were available for opioids, benzodiazepines, and stimulants. Additional variables were obtained to reflect factors thought to be associated with removal risk, with the caveat that they were required to vary by year and within a county, given the empirical specification employed. Demographic factors were accounted for by the inclusion of the proportion of the population by sex, race, and ethnicity.³² The poverty rate controlled for economic factors related to child removal and was obtained from the Census Bureau's Small Area Income and Poverty Estimates.³⁴

STATISTICAL ANALYSIS The empirical relationships were estimated via ordinary least squares regression, in which separate regressions were estimated for the three removal categories (all causes, parental drug abuse, and parental neglect). County fixed effects were included to control for any county-level factors that did not vary over the sample period, such as geographic or cultural characteristics. Also employed were year fixed effects, which controlled for any statewide effects specific to a given year. For instance, in 2014 a state law was signed that was viewed as encouraging a greater number of child removals.³⁵ The year fixed effects captured any statewide changes resulting from this law.

The inclusion of county fixed effects implies that the estimated coefficients measured the within-county relationship between removal rates and control variables. Thus, unlike a cross-sectional analysis in which the coefficients measure differences across counties, the estimates below reflect the predicted changes within a given county over time. This approach means that only variables that vary over time within counties can be employed as explanatory variables. Furthermore, coefficient estimates for variables that vary relatively little within counties during the sample period will tend toward zero.

To investigate potential racial variation in the relationship between removals and prescription rates, we repeated our analysis on quartiles by percentage white population in 2012. The resulting quartile breaks were 77.6 percent, 83.2 percent, 87.6 percent, and 93.6 percent.

To account for the potential for the error terms to be correlated within counties, the observations were clustered at the county level. The analysis was performed in Stata, version 14.0.

LIMITATIONS Our analysis had several limitations. First, using the prescription rate to measure opioid volumes is imperfect. While opioid prescriptions are correlated with illicit use, we could not precisely measure the relationship between illicit use and child removals. Second, we were unable to control for cross-county or cross-country movement of prescribed pills.³⁶ Third, our sample period was relatively short and coincided with changes in Florida law regarding child removal. However, our time fixed effects mitigated potential bias from the policy change.

Fourth, while the county fixed effects we employed controlled for time-invariant county-level factors, they did not capture factors within the county that varied during the sample period. Additionally, the county fixed effects did not control for the possibility of reverse causation in which changes in the removal rate could affect opioid prescription rates. Our estimates reflect associations and do not provide direct insight into causation. Fifth, our estimates are potentially limited because of an ecological fallacy, in that we used county-level data to make inferences about the behavior of individuals. However, to perform an individual-level analysis, we would have needed individual-level data for all children and parents in a county.

Study Results

DESCRIPTIVE ANALYSIS The statewide removal and prescription rates during the sample period are graphed in exhibit 1. The rates for all removals and removals due to parental drug abuse de-

creased in 2013 and were higher than their 2012 levels at the end of the period. By contrast, the parental neglect removal rate increased throughout the period, nearly doubling by 2015. The opioid prescription rate roughly followed the patterns of the rates for all removals and parental drug abuse removals.

Summary statistics for the sample employed are in exhibit 2. For the full sample, roughly half of all removals included parental drug abuse as a cause. There was significant variation in the underlying county averages (not shown). For instance, the removal rate for all causes varied from 1.2 to 11.1 per 1,000 children. The average opioid prescription rate was approximately 75 percent greater than the rate of benzodiazepines and over four times the rate of stimulants. The wide variation in county average opioid prescription rates found throughout the US¹ was also present within Florida. The Florida county averages during this period ranged from 30.5 to 146.8 (data not shown).

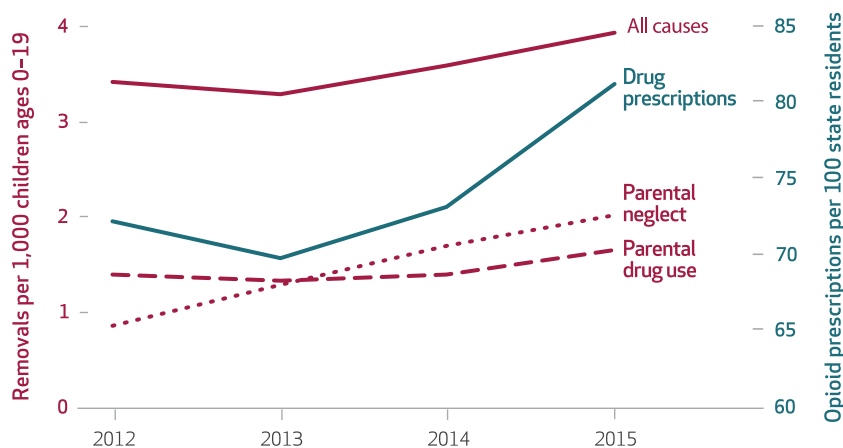
Exhibit 2 also describes the sample variables according to the percentage of the county population that was white, a characteristic explored in the analysis below. (The 2012 percentage was used.) Specifically, the middle pair of columns describes counties in the first quartile (where 42.8–77.6 percent of the population was white), and the last pair, those in the fourth quartile (where 87.6–93.6 percent of the population was white). The rates for all removals and parental drug abuse removals were much higher in the fourth quartile than in the first, while the opioid and benzodiazepine rates were also elevated in quartile 4 relative to quartile 1.

ANALYSIS OF FULL SAMPLE Exhibit 3 details the regression results using the full sample. Each column corresponds to a separate regression in which one of the three removal rates was the dependent variable. The point estimate for the opioid prescription rate coefficient was positive in all three regressions and significant in the parental neglect regression. A one-unit increase in the opioid prescription rate was associated with increases of 0.09 units ($p = 0.13$) in the rate for all removals and 0.07 ($p = 0.01$) units in the rate for parental neglect removal.

Given that our analysis was based on within-county variation, the average of the within-county standard deviations of the opioid prescription rate (6.7) was used to estimate the typical variation in the opioid rate. (The standard deviation across the entire sample reflected variation across counties and would thus have overestimated the expected within-county variation of the rate.) An increase in the opioid rate by this amount was associated with a 32 percent increase in the removal rate for parental neglect,

EXHIBIT 1

Annual statewide rates of child removal and drug prescription in Florida, 2012–15



SOURCE Authors' analysis of removal data from the Adoption and Foster Care Analysis and Reporting System (see note 31 in text), prescription data from the Florida Drug-Related Outcomes Surveillance and Tracking System (see note 33 in text), and population data from the Census Bureau (see note 32 in text).

EXHIBIT 2

Rates of child removal and drug prescription in all Florida counties (full sample) and for the first and fourth quartiles of counties by white percentage of the population, 2012-15

	Full sample		Quartile 1 (lowest)		Quartile 4 (highest)	
	Mean	SD	Mean	SD	Mean	SD
REMOVALS PER 1,000 CHILDREN (AGES 0-19)						
All causes	4.3	0.21	3.4	0.15	5.2	0.27
Parental drug abuse	2.1	0.14	1.4	0.12	2.8	0.19
Parental neglect	1.4	0.11	1.4	0.10	1.6	0.12
PRESCRIPTIONS PER 100 PEOPLE (ALL AGES)						
Opioids	93.4	25.7	78.3	24.6	99.5	24.3
Benzodiazepines	53.2	12.5	45.9	10.8	59.2	13.4
Stimulants	21.5	6.3	21.1	6.4	20.6	5.1

SOURCES Authors' analysis of removal data from the Adoption and Foster Care Analysis and Reporting System (see note 31 in text), prescription data from the Florida Drug-Related Outcomes Surveillance and Tracking System (see note 33 in text), and population data from the Census Bureau (see note 32 in text). **NOTES** Quartiles of white population are defined in the text. SD is standard deviation.

when evaluated at the sample mean. In each of the regressions, the point estimates for the benzodiazepine prescription rate were negative in all of the regressions, but not significant.

ANALYSIS OF SAMPLE BY QUARTILE OF WHITE PERCENTAGE OF THE POPULATION The coefficient estimates for the prescription rates when the sample was limited to the first and fourth quartiles of white percentage of the population are shown in exhibit 4. The opioid rate coefficients differed across quartiles. The point estimates for the fourth quartile were generally twice as large, or larger, compared to the first quartile. For counties in the fourth quartile, a one-standard-deviation increase in the opioid rate was associated with a 70 percent increase in the parental drug abuse removal rate, evaluated at its sample mean. Across the regressions, the benzodiazepine coefficients were negative and significant. An increase in the benzodiazepine prescription rate by the average of the within-county standard deviations (1.4) was associated with a roughly 10 percent decrease in the rate for all removals for counties in the fourth quartile.

SENSITIVITY ANALYSES We performed several sensitivity analyses. One approach was to analyze removal causes not expected to be related to the opioid prescription rates. If regressions using those removal rates indicated a relationship between the removal rate and the prescription rate, it would suggest that an unmeasured factor was driving our estimates. The appendix³⁷ contains the results for regressions employing the following removal causes as dependent variables: parental physical abuse, parental sexual abuse, and child behavior. The small, nonsignificant findings suggest that our estimates captured the true relationship between removals and opioid prescription rates.

Other potential causes for concern are that our results were specific to our primary model and that the estimates were not robust to alternative specifications. The appendix³⁷ contains tables that demonstrate that the relationship was relatively robust to the inclusion of explanatory variables. The estimates became especially pronounced when county fixed effects were included, which points to the importance of controlling for time-invariant differences across counties.

We also extended our primary model by including county linear time trends. While these trends significantly reduced the variation in the data, the opioid rate point estimates in the “all removals” and “parental drug abuse removals” regressions were largely consistent with our primary model but less significant. In the “parental neglect removals” regression, the opioid point estimate was roughly one-third of the estimate in the primary model and not significant.

EXHIBIT 3

Associations between rates of child removal and drug prescriptions for all Florida counties, 2012-15

	All causes	Parental drug abuse	Parental neglect
Opioids	0.09	0.07*	0.07**
Benzodiazepines	-0.12	-0.09	-0.06
Stimulants	0.10	0.02	0.03

SOURCE Authors' analysis of removal data for 2012-15 from the Adoption and Foster Care Analysis and Reporting System (see note 31 in text), prescription data from the Florida Drug-Related Outcomes Surveillance and Tracking System (see note 33 in text), population data from the Census Bureau (see note 32 in text), and data from the Census Bureau's Small Area Income and Poverty Estimates program (see note 34 in text). **NOTES** The results are based on regression analysis. The dependent variable is the rate of child removals per 1,000 children ages 0-19 in a given Florida county. The prescription rate is calculated per 100 residents of all ages in a given Florida county. County and year fixed effects and county characteristics are included in all models. There are 268 observations, and observations are clustered by county. An unabridged version of this text is available in the online appendix (see note 37 in text). * $p < 0.10$ ** $p < 0.05$

EXHIBIT 4

Associations between child removal and prescription rates for the first and fourth quartiles of Florida counties by white percentage of the population, 2012–15

	All causes		Parental drug abuse		Parental neglect	
	Quartile 1	Quartile 4	Quartile 1	Quartile 4	Quartile 1	Quartile 4
Opioids	0.17**	0.32***	0.09	0.30***	0.05*	0.12***
Benzodiazepines	-0.32***	-0.38**	-0.25**	-0.31**	-0.13***	-0.14**
Stimulants	-0.16	0.12	-0.54*	0.13	0.08	0.02

SOURCES Authors' analysis of removal data for 2012–15 from the Adoption and Foster Care Analysis and Reporting System (see note 31 in text), prescription data from the Florida Drug-Related Outcomes Surveillance and Tracking System (see note 33 in text), population data from the Census Bureau (see note 32 in text), and data from the Census Bureau's Small Area Income and Poverty Estimates program (see note 34 in text). **NOTES** The results are based on regression analysis. The dependent variable and prescription rate are explained in the notes to exhibit 3. County and year fixed effects and county characteristics are included in all models. There are sixty-eight observations in the first quartile regressions and sixty-four observations in fourth quartile regressions. The observations are clustered by county. An unabridged version of this table is available in the online appendix (see note 37 in text). **p* < 0.10 ***p* < 0.05 ****p* < 0.01

Discussion

We report a generally positive association between the rate of child removals and the opioid prescription rate. The relationship was measured imprecisely for the rate for all removals, but it may reflect the inclusion in this rate of removal causes not associated with opioid dependence. Furthermore, given that neglect and parental drug abuse can co-occur yet were categorized separately as cause for removal, our estimates may underestimate the true associations. The connection between child removals and opioid prescriptions was particularly pronounced in counties that had a relatively high percentage of white residents, perhaps reflecting the opioid epidemic's inroads among whites.³⁸

The associations indicate very costly effects, in both human and financial terms. Based on the full sample estimates, a one-standard-deviation increase in the statewide opioid prescription rate was associated with over 2,000 additional Florida children being removed due to parental neglect. The resulting fiscal cost was roughly \$40 million, which did not include the psychological and physical effects and health care costs for affected children. For instance, neonatal ab-

stinence syndrome primarily affects infants exposed to opioids. The syndrome's incidence rate in Florida per 1,000 hospital births increased from 0.4 in 1999 to 6.3 in 2013;³⁹ nationwide, the syndrome was responsible for approximately \$1.5 billion in hospital charges in 2012.⁴⁰ Many of these children will require ongoing psychiatric and physical care, which compounds our cost estimates.⁵

Conclusion

While much attention has deservedly been paid to the direct costs of the opioid epidemic, less has been devoted to its indirect human and financial costs. Policy makers should consider these costs, even though they are difficult to measure, when determining the appropriate amount of resources to devote to addressing opioid dependence. Our estimates provide some insight into indirect costs due to parental incapacitation, but they reflect only the extreme result of child removal. The additional emotional, developmental, and financial costs associated with less stark but likely far more commonplace outcomes require measurement in future studies. ■

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