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Assessing the effectiveness of problem-solving courts on the reduction of overdose deaths in the United States: A difference-in-difference study

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ABSTRACT

Background: Criminal justice-involved populations are disproportionately more likely to have an active substance use disorder (SUD) and experience a fatal overdose. One way the criminal justice system connects individuals with SUDs to treatment is through problem-solving drug courts designed to divert offenders into treatment. The aim of this study is to assess the effect of drug court implementation on drug overdoses in U.S counties.

Methods: A difference-in-difference analysis of publicly available data on problem-solving courts and monthly, county-level overdose death data, was completed to understand the difference in number of overdose deaths per county per year for counties with a drug court and those without. The time frame was 2000–2012, which included 630 courts serving 221 counties.

Results: There was a significant effect of drug courts in reducing county overdose mortality by 2.924 (95% CI: -3.478 – -2.370), after controlling for annual trends. Additionally, having a higher number of outpatient SUD providers in the county (coefficient 0.092, 95% CI: 0.032 - 0.152), a higher proportion of uninsured population (coefficient 0.062, 95% CI: 0.052–0.072), and being in the Northeast region (coefficient 0.51, 95% CI: 0.313 - 0.707), was associated with higher county overdose mortality.

Conclusions: When considering responses to SUDs, our findings point towards drug courts as a useful component of a compendium of strategies to address opioid fatalities. Policymakers and local leaders who wish to engage the criminal justice system in efforts to address the opioid epidemic should be aware of this relationship.

1. Introduction

In 2018, a national SAMHSA survey found that of approximately 20.3 million people in the United States with a substance use disorder (SUD), only about 3.7 million people received any treatment (SAMHSA, 2019). The barriers individuals encounter when attempting to access SUD treatment have been well-documented; these include barriers related to cost, transportation, or a lack of SUD treatment providers and facilities in certain regions (Knudsen et al., 2011). The results of such undertreatment have been significant; for example, in 2020, nearly 100,000 people in the U.S. died from drug-related overdoses, representing the highest number ever recorded in the United States (Ahmad et al., 2021).

Criminal justice-involved populations are disproportionately more likely to both have an active SUD and experience a fatal overdose (Tsai et al., 2019; Waddell et al., 2020). The majority of individuals with an SUD have at least one episode of incarceration each year (Winkelman et al., 2018), and it is estimated that 65% percent of the U.S prison population has an active SUD (NIDA, 2020). However, the majority of U.S jails and prisons do not offer evidence-based treatments for SUDs (for example, medications for opioid use disorder, or MOUDs, such as buprenorphine or methadone) (Bauch et al., 2018; NIDA, 2020), and justice-involved individuals are significantly less likely to be referred to MOUD treatment either during or following incarceration (Krawczyk et al., 2017), contributing to high rates of overdose fatality among individuals following release (Ranapurwala et al., 2018).

In recent years, policy attention and funding has been devoted to improving access to SUD treatment for criminal-justice populations, including through the use of drug courts. Drug courts are specialized court docket programs designed to divert drug-involved offenders with less serious charges into treatment. In 2012, the Bureau of Justice Statistics' Census of Problem-Solving Courts reported 1330 drug courts and 183 hybrid DWI/drug courts operating in all 50 states (Strong et al., 2012; BJS, 2016). While this Census has not yet been repeated, figures from the National Drug Court Resource Center note that as of 2021, this number increased to over 3800 drug court programs, including both drug treatment and hybrid courts (NDRC, 2021). Drug courts play a critical role in serving populations disproportionately impacted by the opioid

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epidemic and deliver substance use treatment to over 120,000 people annually across the United States, providing access to many who otherwise would be unable to afford or obtain this care (ONDCP, 2011). Though drug courts vary in services offered, program design and population served, in general, drug courts operate by offering individuals charged with or convicted of criminal offenses and who meet eligibility requirements the opportunity to enter SUD treatment either prior to pleading a charge (deferred prosecution model) or following a plea (post-adjudication model) (NDRC, 20,121). Services offered may include detoxification, outpatient treatment, support group meetings such as Alcoholics Anonymous (AA) or Narcotics Anonymous (NA), inpatient drug treatment, behavioral therapies, and medication for opioid use disorder (MOUD) such as buprenorphine or methadone (Friedrich et al., 2021; Franco et al., 2010).

Previous research on drug courts in the U.S have evaluated their impact on recidivism rates among criminal justice involved populations, public costs, and engagement in treatment and time spent sober upon entry into the prison system and following release. This research has shown that drug courts are effective at reducing the number of times an individual was incarcerated (Csete, 2020; Matusow et al., 2013), have lower costs compared with traditional criminal justice processes, and that participants in drug courts spend significantly more time in recovery from their substance use disorders compared with non-participants (Sacco et al., 2018) Other studies have evaluated the impact of drug court referrals to MOUD treatment specifically, such as naltrexone or buprenorphine, finding that justice-involved individuals receiving MOUD have higher rates of drug court graduation and treatment retention compared with participants who received other forms of treatment (Gallagher et al., 2018; Westreich et al., 2019; Dugosh and Festinger, 2017).

However, much less evidence exists examining the role of drug courts in reducing overdose deaths. Some studies have assessed the impact of specific drug courts in single cities across the U.S. For example, an evaluation of public health interventions that included a drug court in Burlington, Vermont found a 50% reduction in overdose deaths compared with the rest of the state (Del Pozo, 2021). Yet, less than 10% of drug courts reported or assessed measures related to drug overdose and mortality in their evaluations (Joudrey et al., 2021), and to date there is no evidence exploring the relationship between implementation of problem-solving courts and a reduction in overdose deaths across counties in the United States.

The principal aim of this study is to assess the effect of drug court implementation on overdose deaths in the U.S. To do so, we utilized the most recent, publicly-available data on problem-solving courts as well as monthly, county-level overdose death data from the National Centers for Health Statistics to assess differences in the incidence of overdose deaths in the years following the implementation of a drug court. Given the recent surge in opioid deaths across the U.S, understanding the potential of drug courts to reduce fatalities is critical as they represent a key point of access to treatment for the most vulnerable populations. Findings from this study can inform policies surrounding the use and design of drug court programs to ensure that they are adopted in areas of highest need, and that they are responsive to the needs of the patients and communities they serve.

2. METHODS

2.1. Data source

Drug courts are a subset of specialized problem-solving courts designed to divert drug-involved offenders with less serious charges into treatment. In 2013, the Bureau of Justice Statistics (BJS) published a dataset that contains an exhaustive list of problem-solving courts that were operational in 2012 in the United States with their key characteristics (BJS, 2016). It was the first attempt to develop accurate and reliable national statistics regarding problem-solving courts and to introduce a standard definition of problem-solving courts based on six key components, and remains the most up-to-date, publicly-available version of this data. The dataset contains information on 3633 problem-solving courts operational as of 2012, among which 2793 were considered 'in-scope' to be qualified as the problem-solving court according to the BJS criteria (Strong et al., 2012). Specifically, these criteria included courts that used therapeutic methods to reduce recidivism, operated within the judiciary, was led by a judicial officer, had an exclusive docket, and indicated that it was operational in 2012 (Strong et al., 2012). For this study, we focused on the subset of the dataset that includes only the problem-solving courts that were classified as 'drug courts' or 'hybrid/DWI problem-solving courts,' and excluded courts that were classified solely as 'mental health courts,' 'family problem-solving courts,' youth Specialty courts,' 'domestic violence courts,' 'veteran courts,' 'tribal wellness courts,' and 'Other' courts, which may include gambling, gun, prostitution, elder abuse, and other specialty courts (Strong et al., 2012).

In order to accurately match the drug courts to its operating geographical scope, we limited our scope further to the drug courts that operate on county levels. Lastly, in order to ensure all county-level drug courts have at least one year post the launch of its operation, we excluded drug courts that were established in the year 2012. As a result, a total of 630 county-level drug courts were included in our study. The inclusion/exclusion criteria and the stepwise diagram of the data selection process is described in Fig. 1.

Several datasets were merged for the purpose of this study. First, we obtained the key outcome variable, county overdose mortality rates per county per year, from the National Centers for Health Statistics (NCHS) to be used as an outcome variable for the years 2000–2012 (CDC, 2020). Specifically, we used the model-based age-adjusted annual overdose mortality estimate per county between year 2000 - 2012 provided by NCHS without further transformation.

To account for potential confounders, we also added both time-invariant and time-fixed covariates that have previously been found to be associated with overdose rates. For time-invariant covariates, we included the urban/rural classification of counties by the US Department of Agriculture Economic Research Service (USDA, 2021), a dichotomous variable that indicates counties in the Northeast region (USCB, 2021a), and the proportion of uninsured population per county based on US Census Bureau's Small Area Health Insurance Estimates (SAHIE) (USCB, 2021b). While the proportion of uninsured population may vary between years, due to the limited data availability for the years included in our analysis, we handled this as a time-invariant covariate using the estimates from 2012. To ensure its validity, we checked the proportion of uninsured population per country between the years 2006 and 2012 and confirmed that the estimates did not change significantly over time.

For time-fixed covariates, we included the estimated number of outpatient providers (OTP) for SUD per county (2003–2012), year of state Medicaid expansion, and the county-level returns for presidential election (2000–2012). To estimate the number of OTP per county, we used the number of outpatient providers for SUD per ZIP code by matching the ZIP code with the county FIPS code (Policy Development and Research (PD&R), 2021). For ZIP codes that belong to more than one county, we matched the ZIP code to the county that covers the largest proportion of the population under the ZIP code. For 8 states that experienced the state Medicaid expansion during our study period, namely Connecticut, Delaware, Maine, Maryland, Washington, D.C. (expanded 2010), Washington, New Jersey (expanded 2011), Colorado, and Missouri (expanded 2012), we marked the expansion year and onwards as 1 and previous years as 0. For other states, this variable was all coded as 0. County-level returns for four presidential elections between year 2000 and 2012 was coded as "Democrat", "Republican", and "Other" based on the data from the MIT Election Data and Science Lab (MEDSL) (Harvard Dataverse, 2021). All data merges were done using the county FIPS code and the calendar year in R software (ver.3.6.3).

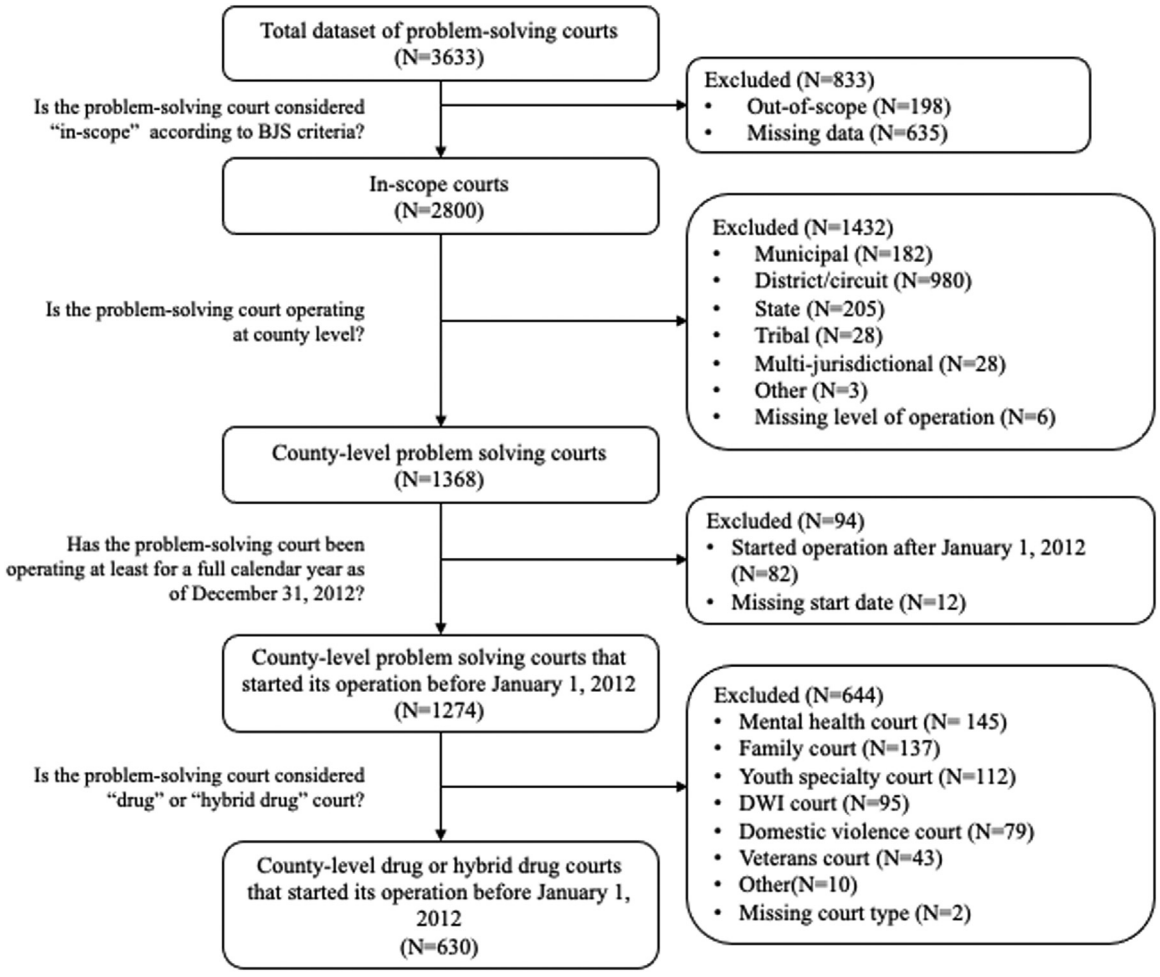

Fig. 1. Stepwise data inclusion/exclusion process.

2.2. Study design

We conducted a quasi-experimental difference-in-difference analysis to quantify the effect of the county-level drug courts on the number of overdose deaths. The year-by-year trend of the overdose mortality, derived from the NCHS model-based estimate and centered on the year each drug court started its operation, is plotted in Fig. 2.

Treatment vs. control group: Counties that had at least one eligible drug court actively operating during 2012 were coded as "treatment" group (Treatment = 1). Based on the BJS Census of Problem-solving Courts, we defined the drug court to be eligible if it meets all of the following criteria: 1) the court is classified as "in-scope" by BJS; 2) the type of court is classified as "drug" or "hybrid DWI/drug" court in the BJS Census data; 3) the court operates at the county level; and 4) the court accepted its first participant no later than December 2011. All the other counties that did not have the eligible drug court(s) were coded as a "control" group (Treatment = 0). Among them, we excluded counties that had drug or hybrid drug court(s) that operated at a smaller geographical level, for example, municipal or district level, within the counties.

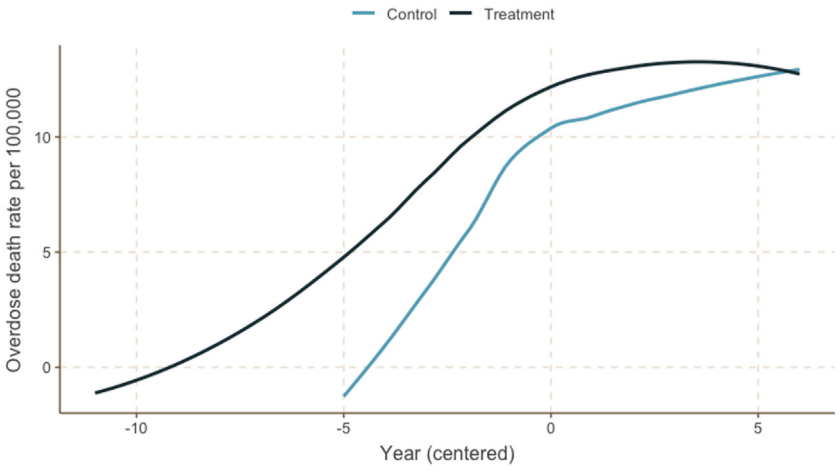

Fig. 2. Model-based overdose death rate per 100,000 by treatment group (Source: NCHS).

Time frame: Given that the Census of Problem-Solving Courts only guarantees the active operation of each court by December 2012, we restricted the temporal scope of analysis to be between 2000 and 2012. To avoid overfitting, the year variable was centered on the calendar year that each drug court accepted its first participant for the counties in the treatment group. For counties in the control group, this variable was arbitrarily centered on the calendar year 2006.

Pre vs. post: The BJS Census of Problem-Solving Court data includes the year-month when the first participant was accepted to each eligible problem-solving court. We used this variable to center each county's overdose deaths data so that the subsequent years after accepting the first participant is coded as "Post" (Prepost = 1). The year the drug court accepted its first participant and the preceding years were coded as "Pre" (Prepost = 0). We also introduced the second Prepost variable which coded the "Post" years as (calendar year – the year the drug court accepted its first participant). For example, if a drug court accepted its first participant during the calendar year 2009, the year 2010 was coded as 1, 2011 as 2, and 2012 as 3 (Prepost2 = 1, 2, 3). The "Pre" years were all coded as 0 (Prepost2 = 0).

2.3. Statistical analysis

We used a generalized linear mixed model (GLM) to quantify the effect of the drug courts on reducing overdose mortality. The GLM using Gaussian family with the identity link function allowed the regression to be controlled for the fixed effects across the county and the county-level random effects, and to quantify robust standard error. In the equation below, the coefficient for the interaction term between Treatment and Prepost variable (β_4) represents the difference-in-difference effect of the drug courts. To account for potential confounders, we introduced a set of covariates (represented by the vector Z in the equation) into the regression. These covariates include the county- or state-level time-invariant confounders (rural-urban specification, Northeast region, proportion of uninsured population) and the time-varying confounders (number of outpatient providers for SUD per year, county presidential voting return per election, state Medicaid expansion timing).

$$(Overdose\ mortality) = \beta_0 + \beta_1 * Year + \beta_2 * Treatment + \beta_3 * Prepost + \beta_4 * Treatment * Prepost + Z + \in$$

3. Results

Data on 630 drug courts serving 221 counties were analyzed. Table 1 summarizes the number of counties included in our sample with their key characteristics. 221 out of 1843 counties reported to have at least one county-level drug court operating as of 2012. The mean number of overdose deaths per 100,000 population were 12.9 deaths in counties without a drug court, and 14.0 deaths for counties with a drug court. About 63.0% of the counties with operating drug court(s) were classified as metropolitan. Among counties without drug courts, only 34.5% were classified as metropolitan, while 26.0% were rural. The proportion of the uninsured population was significantly higher in the counties without drug courts (two-sided T-test p-value < 0.001), and the availability of the OTP for SUD was significantly higher in the counties with at least one drug court (chi-square test p-value < 0.001). In addition, significantly higher proportion of counties with drug court(s) were located in the Northeast region (13.1% *vs.* 7.6%, p-value < 0.001) and voted for Democratic candidate during the 2012 election (32.1% *vs.* 20.5%, p-value < 0.001).

Table 2 summarizes the characteristics of county-level drug courts included in our study. Average years of drug court operation, as of 2012, was 8.9 years (range 1 – 23 years), and the average duration of the drug court program was 272 days (range 9 - 1095 days). Majority of the drug courts were classified as adult drug courts (59.2%), followed by juvenile drug courts (26.1%) and hybrid DWI and drug courts (14.1%). More than 60.0% of the drug courts did not specify the major entry point (61.2%). The source of funding varied among drug courts in our sample, and included fees and fines (30.6%), state grants (23.0%), federal grants (21.2%), and state budgets (32.7%). All drug courts identified more than one funding source.

The results of the difference-in-difference analysis using a generalized linear mixed model (GLM) is summarized in Table 3. In the base model without the DiD term, the counties with drug courts reported 2.9 more overdose deaths per 100,000 population per year than the control group of counties without drug courts (95% CI: 2.639 – 3.169). The overdose mortality also increased every year (coefficient 1.2, 95% CI: 1.215 – 1.279), with a significant increase after the implementation of a drug court when controlling for treatment group and year (Coefficient 0.7, 95% CI: 0.498 – 0.932). In the DiD model, the significant increase by year (coefficient 1.2, 95% CI: 1.228 – 1.292), and in the treatment group (coefficient 3.8, 95% CI: 3.570 – 4.116) was still observed. In addition, there was a significant effect of drug court in reducing the overdose mortality by 2.9 (95% CI: −3.478 – −2.370), after controlling for annual trends. Counties' urban/rural classification and state Medicaid expansion was not significantly associated with the overdose mortality. However, higher numbers of outpatient providers for SUD in the county (coefficient 0.1, 95% CI: 0.032 - 0.152), counties in the Northeast region (coefficient 0.5, 95% CI: 0.313 - 0.707), and the higher proportion of uninsured population (coefficient 0.1, 95% CI: 0.052–0.072) was associated with higher overdose mortality in the county.

Table 1
Number of United States counties with/without drug court(s), 2012 (N = 1843).

	Without drug court(s)(N = 1622)	With drug court(s)(N = 221)	Overall(N = 1843)
Model-based overdose death rate per 100,000			
Mean (SD)	12.9 (6.16)	14.0 (6.06)	13.0 (6.16)
Urban/Rural classification			
Metropolitan	560 (34.5%)	139 (62.9%)	699 (37.9%)
Rural	421 (26.0%)	14 (6.3%)	435 (23.6%)
Urban	621 (38.3%)	68 (30.8%)	689 (37.4%)
Missing	20 (1.2%)	0 (0.0%)	20 (1.1%)
% of uninsured population			
Mean (SD)	17.3 (5.5)	16.4 (5.1)	17.2 (5.5)
Northeast region			
No	1499 (92.4%)	192 (86.9%)	1691 (91.8%)
Yes	123 (7.6%)	29 (13.1%)	152 (8.2%)
Outpatient provider (OTP) availability for SUD			
Not available	1441 (88.8%)	147 (66.5%)	1588 (86.2%)
At least one OTP for SUD in the county	181 (11.2%)	74 (33.5%)	255 (13.8%)
Presidential election return (2012 election)			
Democrat	332 (20.5%)	71 (32.1%)	403 (21.9%)
Republican	1191 (73.4%)	149 (67.4%)	1340 (72.7%)
Missing	99 (6.1%)	1 (0.5%)	100 (5.4%)

Table 2
Summary of the county-level drug court characteristics, 2012 (N = 630).

Characteristics	Summary
Average years operated	8.9(SD 4.6, Range 1.0 - 23.0)
Average duration of the court program (days)	272.0(SD 239.0, Range 0 - 1095.0)
Average number of full-time staff	2.8 (SD 4.2, Range 0, 48.0)
Average number of admitted participants in 2012	44.1 (SD 90.8, Range 0 – 1000.0)
Court type	
Adult drug	373 (59.2%)
DWI and drug	89 (14.1%)
Juvenile drug	165 (26.1%)
Others	1 (0.1%)
Re-entry drug	2 (0.3%)
Entry point	
No information available	386 (61.2%)
Post-conviction/pre-sentence/after order issued (temporary or final)	9 (1.4%)
Post-disposition/after adjudication of relief	26 (4.1%)
Post-plea/condition of sentence	69 (10.9%)
Post-plea/pre-disposition	18 (2.8%)
Post-plea/pre-sentence	51 (8.1%)
Post-sentence	22 (3.4%)
Pre-plea/upon filling or case initiation	46 (7.3%)
Upon probation violation/revocation	3 (0.4%)
Source of funding (not mutually exclusive)	
Federal grant	134 (21.2%)
State grant	145 (23.0%)
State budget	206 (32.7%)
Local grant	225 (35.7%)
Private budget	50 (7.9%)
In-kind	111 (17.6%)
Fees and fines	193 (30.6%)
Others	25 (3.9%)

Table 3
Base model (with no interaction term) and difference-in-difference (DID) model using the dichotomous pre-post variable on the effect of drug courts on overdose mortality in United States counties.

	Base model			DID model		
Variable	Coefficient	95% CI	Z-score	Coefficient	95% CI	Z-score
(Intercept)	6.1	(5.916, 6.402)	49.7	6.0	(5.787, 6.269)	49.0
Year Centered	1.2	(1.215, 1.279)	75.3	1.2	(1.228, 1.292)	76.8
Treatment	2.9	(2.649, 3.169)	21.9	3.8	(3.570, 4.116)	27.6
Pre/post	0.7	(0.498, 0.932)	6.4	0.9	(0.744, 1.178)	8.6
Treatment * Pre/post				−2.9	(−3.478, −2.370)	−10.3
Urban/rural classification						
Metropolitan	Ref			Ref		
Rural	−0.1	(−0.277, 0.075)	−1.1	−0.1	(−0.275, 0.077)	−1.1
Urban	0.0	(−0.172, 0.134)	−0.2	0.0	(−0.171, 0.135)	−0.2
Number of OTP	0.1	(0.019, 0.147)	2.5	0.1	(0.032, 0.152)	2.9
Medicaid expansion	−2.7	(−3.221, −2.211)	−10.5	−2.6	(−3.150, −2.144)	−10.3
Northeast region	0.5	(0.305, 0.703)	4.9	0.5	(0.313, 0.707)	5.0
Return of presidential voting						
Democrat	Ref			Ref		
Republican	0.9	(0.822, 1.144)	11.9	0.9	(0.781, 1.103)	11.4
Others	1.0	(0.679, 1.391)	5.6	1.1	(0.776, 1.478)	6.2
% of uninsured population	0.1	(0.051, 0.071)	11.8	0.1	(0.052, 0.072)	12.0

4. Discussion

Deaths due to drug overdose have risen dramatically in the U.S, placing a new urgency on the need for interventions and programs that reduce overdose fatalities. Given the high proportion of individuals in U.S jails and prisons with a substance use disorder (NIDA, 2020), the U.S criminal justice system is at the frontlines of the opioid epidemic. Drug courts, specialized court docket programs targeting criminal defendants and offenders with SUDs (NIJ, 2020), represent one of the primary means for the criminal justice system to connect individuals with SUDs to treatment. Individuals who have participated in drug court programs are retained in SUD treatment for longer (Worcel et al., 2008), have lower rates of recidivism (King and Pasquarella, 2016), and appear to reduce drug use (Lowenkamp et al., 2005). However, no prior study has examined the effect of drug courts on county-level overdose death rates on a national-level.

The difference-in differences model used in our analysis calculates the mean differences in overdose deaths between counties that implemented a drug court (Treatment group) and counties that did not implement a drug court (Control group). This model is distinguished by the inclusion of an interaction term representing how the average number of overdoses changed in Treatment counties compared with Control counties in the periods following drug court implementation. In this analysis, we found that overdose deaths decreased following the implementation

of a drug court, a finding which was not observed in the base model, which lacked the difference-in-differences interaction term. Our findings point toward drug courts as a potentially effective tool to tackle rising rates of SUDs and drug overdose deaths across counties by diverting individuals with SUDs into treatment. Previous research has emphasized the need for communities to adopt multi-pronged strategies to address overdose fatalities as well as that a wider continuum of social determinants of health (SDOHs), as singular interventions or those focusing narrowly on substance use may prove insufficient (Park et al., 2020; Haegerich et al., 2019; Robinson et al., 2019). Our study adds to this literature by demonstrating the importance of drug courts within a wider approach to reduce overdose deaths using a difference-in-differences model.

The vast majority of counties included in our sample did not report the adoption of any type of drug court program. While the number of drug courts in the U.S have expanded since our study data has been compiled, many counties remain unserved (NDRC, 2021). The fact that implementation of a drug court was associated with a decrease in overdose deaths in a county suggests that counties who have been affected greatly by the opioid epidemic may have much to gain by adopting a drug court model.

Our data and findings have important limitations to consider. First, our analysis is based on the model-based estimate of annual overdose mortality per county, which is subject to inherent uncertainties and assumptions (Slavova et al., 2019). We attempted to use an alternative and more accurate data for the outcome variable from the CDC WONDER database (CDC, 2021), however were unable to acquire the restricted data that includes annual county-level mortality counts across the country. Publicly available data from the same source only includes overdose death that exceeds 10 per temporal unit (*i.e.*, year), which potentially leads to underestimation of the mortality. Second, the Bureau of Justice Statistics Census of Problem-Solving Courts, which we included in our analysis as the main source of information on drug court locations and models, was compiled in 2012, and is an underrepresentation of the number of active drug courts in the U.S in 2021. We also limited the scope of the included drug court to the ones operating at the county level for the purpose of clean matching with other covariates. This, in turn, resulted in exclusion of drug courts that operated in different geographical levels, including municipal and district level drug courts. Therefore, the findings from our study may not be generalizable outside the scope of included drug courts. Third, while our multivariate model controlled for a number of potential confounders, due to the unavailability of time-specific data it did not capture county-level differences in coverage for and availability of other SUD treatment, in particular the availability of buprenorphine-waivered practitioners. There were several potential confounders we considered to include, for example, the availability of licensed buprenorphine providers by county and Medicaid enrollment by county, that we simply could not include due to the unavailability of the adequate data. Fourth, the timeframe of our analysis (2000–2012) coincides with a number of advancements that supported SUD recovery; this includes increased availability of naloxone and MOUD (Maxwell et al., 2006; Kim et al., 2009; Worthington et al., 2006), as well as the passing of policies such as the Mental Health Parity and Addiction Act (MHPAEA) in 2008 (HHS, 2022), which mandated that health insurance plans must provide mental health and SUD treatment benefits at an equal level to medical/surgical benefits, and the Affordable Care Act of 2010, which enabled many previously uninsured adults, including a large proportion of individuals with SUDs, to gain health insurance coverage (Collins et al., 2012). Lastly, the difference-in-differences methodology used in this study is insufficient to establish causal relationships between the establishment of a drug court and the subsequent decrease in overdose deaths. Future research should seek to establish causality between the existence of a drug court and county-level overdose rates using updated data, controlling for additional SUD treatment variables and policy advancements, and using methodology appropriate for establishing causality.

5. Conclusions

The opioid epidemic is an ongoing public health crisis that requires sustained, coordinated efforts from across the healthcare system and criminal justice system to reduce overdose fatalities. The response of the criminal justice system to this crisis has become particularly critical as the rate of incarcerated individuals with substance use disorders remains high, and the number of deaths due to drug overdoses continues to surge. When considering responses to SUDs, our findings point towards drug courts as a useful component of a compendium of strategies to address overdose fatalities in a community, and to a role in mitigating treatment access gaps leading to such high overdose rates among criminal justice involved populations. Policymakers and local leaders who wish to engage the criminal justice system in efforts to address the opioid epidemic should be aware of this relationship. However, the opioid epidemic will not be averted solely by the implementation of one type of intervention, nor with a focus on substance use treatment alone. Instead, diverse portfolios of policies are required, including those that offer health coverage, patient-centered care and trauma-informed care to individuals with SUDs, as well as social supports such as housing and transportation services.

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Declaration of Competing Interest

No conflict declared.

CRediT authorship contribution statement

Zoe Lindenfeld: Conceptualization, Methodology, Software, Formal analysis, Writing – original draft, Writing – review & editing, Supervision. **Sooyoung Kim:** Methodology, Software, Formal analysis, Data curation, Visualization, Writing – original draft, Writing – review & editing. **Ji Eun Chang:** Supervision, Methodology, Writing – review & editing.

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