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RESEARCH ARTICLE

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The effect of evictions on accidental drug and alcohol mortality

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Abstract

Objective: To assess the relationship between county-level eviction rates and drug and alcohol mortality rates.

Data Sources: Eviction rates from 2003 to 2016 provided by the Princeton University Eviction Lab were merged with Multiple Cause-of-Death Mortality Files and aggregated to the county-year level.

Study Design: All opioid (prescription and heroin), cocaine, psychostimulant, benzodiazepine, antidepressant, and alcohol poisoning–related deaths per 100 000 people, eviction rates, and socioeconomic indicators were merged at the county-year level from 2003 to 2016. We estimated a series of mortality rate models with county and year fixed effects and used a control function (2SRI) method to adjust for the endogeneity of eviction rates.

Data Collection/Extraction Methods: We matched retrospectively collected datasets.

Principal Findings: Higher levels of eviction rates were consistently associated with higher rates of mortality across six of nine substance categories studied when all counties were combined. Subanalysis by USDA population density measures indicated this positive association was almost entirely driven by urban counties; few systematic associations between the eviction rate levels and mortality were observed for suburban or rural counties.

Conclusions: Risk of eviction appears to exacerbate the current "deaths of despair" crisis associated with substance use. Proposed changes to Housing and Urban Development policy that are expected to substantially increase the risk of eviction may worsen an already-acute mortality crisis.

KEYWORDS

deaths of despair, evictions, substance use, substance use mortality

1 | INTRODUCTION

On April 25, 2018, acting Housing and Urban Development (HUD) Secretary Ben Carson proposed the "Making Affordable Housing Work 8 Act of 2018." This initiative, if implemented, would triple the cost of the minimum rent paid for federally subsidized housing by nonelderly and nondisabled low-income Americans, and would make this policy change mandatory for all housing agencies in the United States. While this proposed act is being promoted as a way to "encourage work and self-sufficiency," an analysis by the Center on Budget and Policy Priorities (CBPP) using data from HUD found that this policy would put around 1.7 million people (including 970 000 children) in danger of eviction and homelessness.[1,2] This policy initiative was followed in early 2019 with a proposal to purge undocumented residents from public housing, which some estimates would result in more than 55 000 children who are legal residents

or citizens being evicted (along with their parents or caregivers).[3] According to the Eviction Lab, a Princeton University research group led by Matthew Desmond, the number of total evictions in the United States around 2006 with 1 019 600 evictions, and had declined to 898 479 evictions by 2016.[4] Thus, if the estimates from CBPP and the media are accurate, we may see the number of evictions increase far beyond what they were at their maximum point in 2006.

Whether these specific policies are put in place or not, it is remarkable that relatively little research exists on the impact of evictions on public health outcomes. Given the "increasing disadvantage" framework that Case and Deaton used to understand what they labeled as "deaths of despair," there is reason to worry that outcomes like substance abuse mortality rates may be negatively affected by traumatic life events such as eviction.[5,6] We will provide the first evidence regarding the association between evictions and substance-related accidental deaths in the United States. We will assess this in the context of substances tracked by the CDC[7,8] (opioids, including heroin, benzodiazepines, psychostimulants, cocaine, antidepressants, and alcohol poisoning), which are broadly contributing to mortality highlighted in the "deaths of despair" literature.[6]

As has been widely discussed, the United States is in the midst of the deadliest drug mortality crisis in its history surrounding the use of licit and illicit opioids.[9] Drug overdose deaths involving prescription opioids quintupled between 1999 and 2016. In 2016 alone, over 64 000 Americans died from drug overdoses, with 42 249 being attributed to any opioid and 34 097 of those being attributed to prescription opioids.[10] This trend is devastating parts of the United States, particularly areas with higher rates of poverty and unemployment.[11] The total number of opioid prescriptions being filled at pharmacies peaked in 2012 (with a prescribing rate of 81.3 prescriptions per 100 persons) and has since fallen (with a prescribing rate of 66.5 prescriptions per 100 persons in 2016).[12] The dosage volume of opioids (as measured by morphine milligram equivalents [MMEs]) fell from 782 to 640 MME per capita between 2010 and 2015, though the number of days supplied per prescription, and the number of prescriptions with more than a 30-day supply, continued to rise.[13] While opioid mortality has received the greatest level of research and media attention in recent years, poisoning from other substances—including cocaine, benzodiazepines, and the other substances listed above—remain stubbornly high and are constantly tracked by the CDC.

Housing instability in general has been shown to be negatively associated with access to health services, mental health, and quality of life.[14-17] Predictably, interventions that have been targeted at reducing housing instability have been associated with improvements in health and reductions in emergency department services.[18] Evictions, a specific and very acute form of housing instability, have substantial and far-reaching consequences. They often lead tenants to be unable to find new housing, which can then trigger homelessness as it can take years to be approved for affordable housing programs in some parts of the country.[19] Even if tenants are able to find new housing following an eviction, it is likely that it will be in a poorer neighborhood with fewer economic opportunities and higher rates of crime.[20]

What This Study Adds

What is currently known?

- Deaths plausibly associated with adverse economic conditions ("Deaths of Despair") have been rising in the U.S.
- Evictions are associated with many adverse economic outcomes.

What this study adds

- Higher eviction rates are associated with higher rates of substance-use related deaths, consistent with the "Deaths of Despair" literature.
- The association between eviction and substance-use-related deaths was observed for urban, but not suburban or rural, counties.

There is a relatively small but growing literature that indicates evictions are also related to a variety of individual health outcomes. An analysis conducted by Vásquez-Vera and coauthors reviewed the limited literature and noted that there is evidence that even just the threat of eviction is associated with depression, anxiety, and psychological distress as well as worse reported physical health, higher blood pressure, and the mistreatment of children.[21] In addition, Fowler and colleagues studied the relationship between the housing crisis of 2006 and suicides, and found that eviction-related suicides doubled between 2005 and 2010.[22]

These individual health implications of eviction appear to have differential effects by sex and race. Desmond (2012) found that evictions are disproportionately applied to women, particularly Black and Hispanic women.[19] Between 2003 and 2007, 60 percent of overall tenants who were evicted were women. However, in predominantly White neighborhoods evictions are shared equally between men and women, while in Black and Hispanic neighborhoods women were twice as likely to be evicted compared with their male counterparts.[19] Desmond and Kimbro[23] found that low-income urban mothers who were evicted experienced more maternal hardship, were more likely to report health issues for themselves and for their children, and were more likely to experience depression than their low-income urban mother counterparts who were not evicted. Evidence from a 2018 study, using data from two separate cohort studies, suggests that evictions are associated with drug use relapse and the initiation of methamphetamine use.[24] One other recent study found that current heroin users who had been recently evicted were more likely to engage in the dangerous practice of sharing needles in order to inject the drug.[25]

Although there seems to be a clear conceptual link between the economic and life stresses associated with eviction and the likelihood that drug abuse worsens to the point that death becomes more likely, surprisingly little research has been done to investigate the link. In this study, we used county-level eviction

data from Evictions Lab, as well as mortality data from the Centers for Disease Control and Prevention (CDC) National Center for Health Statistics' National Vital Statistics System Multiple Cause-of-Death Mortality Files. We employed a series of 2SLS regressions (to account for the endogeneity of the eviction rate in the substance-related mortality rate models) to explore the degree to which eviction rates are associated with substance use–related mortality rates. Since prior research suggests that opioid mortality impacts communities of different population densities heterogeneously, we conducted subanalyses running these models separately across rural, suburban, and urban counties.[26,27]

2 | METHODS

2.1 | Data sources

We extracted data for this study from a variety of sources for the years 2004-2016. Our key independent variable is the county-level eviction rate, defined as the number of evictions divided by the number of renter-occupied houses (expressed in whole units, such that an eviction rate ranges between 0 and 100). These data were collected by the Eviction Lab, based at Princeton University.[4] This Eviction Lab provides the first (and largest) longitudinal dataset designed to track eviction rates in the United States. It is comprised of data for nearly all counties in 46 states and the District of Columbia and includes a variety of information such as: county eviction court filings; completed eviction rates; and a number of related socioeconomic measures at the county level (eg, poverty rate, median rental costs, median rental burden, and race and ethnicity measures). Four states (Alaska, Arkansas, North Dakota, and South Dakota) did not have consistent eviction data and were not included in this study. (See Table S2, including the table notes, for a discussion of how we determined that there is no substantial selection bias introduced by the exclusion of these states.) The Eviction Lab collected the data from court records, web scraping, text parsing, and through partnerships with record collecting companies. Estimates were validated through comparing overlapping data sources.[28]

Our dependent variables of interest were the rates of poisoning from nine categories of substances that are tracked by the CDC, and generally implicated in the "deaths of despair" literature. Data on these various types of substance-related deaths were collected from the Centers for Disease Control and Prevention (CDC) National Center for Health Statistics National Vital Statistic System and identified following CDC methods.[29] Causes were classified by the CDC using the standard International Classification of Diseases, Tenth Revision (ICD–10) underlying cause of death codes in any of the 20-underlying cause of death fields: overall opioid use (T40.0-T40.4, T40.6); prescription opioids (T40.2-T40.3); synthetic opioids, such as fentanyl (T40.4); heroin (T40.1); cocaine (T40.5); stimulants with abuse potential including methamphetamine—hereafter, "stimulants" (T43.6); benzodiazepines (T42.4); antidepressants (T43.0-T43.2); and alcohol (X45, Y15). Note, that for the latter category, we are only capturing accidental alcohol poisonings and are not attempting to control for the many other alcohol-related deaths that are tracked, such as liver disease and cancer.

Our measures of substance-related mortality capture the number of deaths where the substance was listed as one of perhaps multiple underlying causes of death. Many deaths involve multiple substances (eg, opioid and benzodiazepine together), so one could not add the number of deaths in the data to arrive at a total number of substance deaths due to double-counting. Since our goal was to

TABLE 1 Variable means and standard deviations, observations with observed eviction rates

	(1) Urban Counties Mean	(2) Suburban Counties Mean	(3) Rural Counties Mean
Opioid mortality rate	6.90	6.18	4.67
Prescription opioid mortality rate	4.35	4.46	3.56
Synthetic opioid mortality rate	1.46	1.36	1.01
Heroin mortality rate	1.42	0.61	0.19
Cocaine mortality rate	1.30	0.74	0.33
Stimulant mortality rate	0.68	0.80	0.49
Benzodiazepine mortality rate	1.93	1.92	1.45
Antidepressant mortality rate	1.22	1.18	0.94
Alcohol poisoning mortality rate	1.58	1.52	1.17
Observations	11 606	13 359	6082

Note: Data on all counties with measured eviction rates from 2004 to 2016.

understand how housing instability is associated with the implication of each substance in mortality, we did not attempt to define, for example, opioid-only, cocaine-only, or antidepressant-only deaths. We measured mortality rates by aggregating deaths to the county-year level and weighting this measure of county-level deaths by county population (per 100 000 residents). Average mortality rates for each of the tracked substances are presented in Table 1 for all, urban, suburban, and rural counties.

As mentioned above, subanalyses were conducted for three different categories of counties based on population density. Counties were categorized using the United States Department of Agriculture (USDA) Rural-Urban Continuum Codes (RUCC) based on the degree of urbanization and the adjacency to an urban area. Counties were classified as urban counties (continuum codes 1, 2, and 3), suburban counties (continuum codes 4, 5, 6, and 7), and rural counties (continuum codes 8 and 9).[30]

Demographic control variables were also included in this study, measured at the county and year level. Controls were selected to capture relevant characteristics of the local market. Control variable that represents the impact of the local economy in the likelihood of opioid abuse include the following: county median income, percent of the county population living in poverty, and county average unemployment rate. Other controls captured characteristics of the county populations (independent of economic activity) that are commonly found to be important in studies of population-level drug use or mortality; these include percent of the county population that is male; percent of the county population aged 20-64; percent of the county population that is Caucasian; and indicator variables for whether the county is classified as rural or suburban (urban counties were the excluded category) using the RUCC. We also included a set of variables that reflect the availability of health care services, and so access to prescription drugs: percent of the county population with no health insurance; and the number of active Medical Doctors per 1000 population. Since past research has indicated that state-level "must-access" electronic prescription drug monitoring programs have statistically significant effects on opioid use, we also include an indicator variable for that state policy.[31]

TABLE 2 Variable means and standard deviations, analysis sample (all counties)

	Mean	Standard deviation
Opioid mortality rate	6.16	11.2
Prescription opioid mortality rate	4.26	9.71
Synthetic opioid mortality rate	1.33	3.68
Heroin mortality rate	0.82	2.60
Cocaine mortality rate	0.84	2.29
Stimulant mortality rate	0.71	2.45
Benzodiazepine mortality rate	1.83	5.12
Antidepressant mortality rate	1.14	3.22
Alcohol poisoning mortality rate	1.52	7.29
Eviction rate	1.72	1.99
Total county population (in 100 000 s)	1.01	3.32
Percent population that is male	50.0	2.21
Percent population aged 20-64	57.6	3.31
Percent population white only	79.2	19.1
County median income (in $10 000 s)	4.36	1.12
Percent population in poverty in county	16.0	6.15
Percent population in county with no health insurance	16.6	6.13
Unemployment rate	6.67	2.82
Active physicians per 1000 persons in county	1.18	1.55
State has must-access PDMP	0.067	0.25
Census RUCC rural county	0.21	0.41
Census RUCC suburban county	0.43	0.49
Census RUCC urban county	0.36	0.48
Limit on deposit—number of months rent	0.64	0.86
State limits late fees	0.24	0.43
Mandated grace period for rent	0.14	0.34
Evictions in small claims court allowed	0.43	0.49
Laws prohibit landlord retaliation	0.79	0.40
Observations	32 269	

Note: Data on all counties with measured eviction rates from 2004 to 2016.

Finally, all models include year indicator variables and county fixed effects. The mean values and standard deviations for these explanatory variables are presented in Table 2.

2.2 | Modeling framework

We estimated models of county-level substance-related mortality rates (deaths per 100 000 residents) for all counties with observed eviction rates over the 2004-2016 time period. Our estimation strategy was designed to accommodate two important characteristics of the model data. First, the underlying relationship between the dependent variables and the eviction rates was nonlinear. Second, the key explanatory variable of interest, the eviction rate, was very likely to be endogenous. Unobservable characteristics of the county that drive substance-related mortality were likely also correlated with the eviction rate, which would cause classic endogeneity bias if left unaddressed. (For example, the unobservable rate of substance use disorders is certainly a driver of substance-related mortality and also very likely a factor contributing to eviction.)

In order to assess the nature of the relationship between the various substance use mortality rates and the local eviction rate, we created a series of eviction rate quartile indicators: 0th-24th percentile (eviction rate from 0 percent to 0.35 percent), 25th-49th percentile (eviction rate from 0.36 percent to 1.16 percent), 50th-74th percentile (eviction rate from 1.17 percent to 2.35 percent), and 75th percentile and higher (eviction rate from 2.36 percent to 24.16 percent). We then compared the raw county average mortality rates across each of the eviction rate quartiles (see Figures S1-S9). The rates of mortality were higher for the higher eviction rate groups than they were for the lowest (and often two lowest). These mortality rate differences were statistically significant at the 5 percent level or better for all opioids, prescription opioids, synthetic opioids, heroin, cocaine, benzodiazepines, antidepressants, and alcohol. Often, though not always, the differences between the 50th-74th percentile and the 75th percentile and higher counties were statistically significant as well. Thus, we conclude that the underlying relationship between substance use mortality and eviction rates is not only a positive one, but also a nonlinear one.

To deal with the nonlinearity of this relationship, we specified our main models using levels of the substance-related mortality (weighted by county population in 100 000s) and included the indicator variables for the highest three eviction rate percentile groups as our key explanatory variables. We used a linear model with county fixed effects as our main specification because this estimator fits the data better than alternatives that directly address skewness in the dependent variable. (The estimated elasticities for our key eviction rate variables were often somewhat smaller in magnitude when we used fixed-effects Poisson models, though the sign patterns were identical and the levels of statistical significance were similar; those results are available on request.)

We dealt with the endogeneity of the eviction rate in our mortality rate models using a control function (2SRI) approach. Estimation of 2SRI models required an identifying set of instruments: variables that were correlated with the eviction rate but which could be excluded from the main equation of interest because they were not directly predictive of substance-related mortality rates (conditional on the other variables in the mortality rate models). We created a set of indicator variables for various state laws governing landlord-tenant relationships using various editions of *Every Landlord's Legal Guide* and *Every Tenant's Legal Guide* from 2000 through 2017.[32,33] We included policies that change the ease at which tenants may move to another rental home or apartment or change the ease with which they can be evicted. Our instruments were indicator variables for state policies dictating: the number of months rent that landlords can charge as a deposit; any limits on allowable fees for late rent; whether a grace period was required after a late rent payment before eviction proceedings can begin; whether evictions through small claims court were permitted; and whether there were limits on landlord retaliation once a tenant reported any legal violation. The theoretical justification of the identifying restrictions was that state policies are set without consideration of the likelihood of an individual suffering a substance use–related death (at least, conditional on the other variables included in the estimating equation of interest).

TABLE 3 First-stage partial *F*-statistics and partial adjusted R^2 for instruments

	Partial *F*-statistic	Partial adjusted R^2
All counties	347.5897	.0376808
Urban counties	186.4047	.0588988
Suburban counties	126.5392	.0363985
Rural counties	75.07607	.0427958

Note: First-stage models with eviction rate as the dependent variable to test instruments. All models estimated using OLS. The instruments were as follows: limit on deposit; evictions in small claims court allowed; mandated grace period for rent; state limits late fees; laws prohibit landlord retaliation. All first-stage models also included: second-stage explanatory variables and time fixed effects.

In order to be useful as instruments, these variables must be both excludable from the mortality equations on theoretical grounds and also be adequate predictors of the eviction rate. The usual test for adequacy of the instrument strength is to estimate first-stage regressions of the endogenous variable (the eviction rate in this case) including all the exogenous variables from the second stage (2) and the full set of instruments, and then conduct an ex post *F* test on the joint hypothesis that all of the instruments could be excluded from the first stage (known as first-stage partial *F*-statistics). The usual rule of thumb is that the first-stage partial *F*-statistics should be >10. Table 3 presents the partial *F*-statistics from first-stage models of all counties and then separately for urban, suburban, and rural counties. We found partial *F*-statistics were substantially greater than 10. In addition, the instruments themselves independently explain between 3.6 percent and 5.9 percent of the variation in the eviction rate as seen in the second column of Table 3 (the difference between the adjusted R^2 of

the full first-stage model and the adjusted R^2 from the first stage without the instruments). Thus, we concluded that our instruments being theoretically justified and empirically strong were valid (except for the models of rural counties, which we will not therefore interpret). For comparison purposes, we also presented models for all counties assuming exogenous eviction rate indicators (Table S8) and using lagged eviction rate indicators (Table S9). Estimated coefficients for those sensitivity test models were somewhat smaller for some of the opioids and approximately the same magnitude and significance for stimulants and benzodiazepines.

In order to implement the control function approach to 2SLS (2SRI), we recovered the residuals from the first-stage regressions of the eviction rate, $\hat{e}_{it}$, which were then included as a regressor in our mortality rate equations. As discussed above, $\hat{e}_{it}$ captures the unobservables associated with local eviction rates that would lead to endogeneity bias in the estimated parameters for our eviction rate indicators. Since $\hat{e}_{it}$ is a predicted variable, we estimated the covariance matrix using a bootstrap.

The general mortality rate model functional form was therefore:

$$y_{it} = \beta_1 + \sum_{k=2}^{4} \beta_k \mathbf{1}\,(k\text{th eviction rate quartile}) + \underline{\beta} X_{it} + \hat{e}_{it} + \tau_t + \mu_i + \varepsilon_{it} \quad (1)$$

where **1**(*k*th eviction rate quartile) were the three eviction rate percentile group indicator variables (the indicator for being in the 1st quartile was the excluded category), X_{it} were the time-varying county covariates listed at the end of the previous section, τ_t was a set of time fixed effects, μ_i were county fixed effects, and ε_{it} was an error. We also calculated implied average (arc) elasticities associated with each eviction rate indicator so that our results can be understood in the context of the usual literature.

Finally, because drug overdoses exhibit different trends across different levels of population density, we also conducted subanalyses by estimating the two mortality models separately for rural, suburban, and urban counties.

2.3 | Limitations

Our analysis did have several limitations. First, the Eviction Lab data were censored. They suppressed eviction rates for counties that have high variance in the estimated rates over time.[28] We assessed whether this censoring affected our models by estimating linear (OLS) and sample selection corrected versions of (2)—assuming exogenous continuous eviction rates—and comparing those results. As

TABLE 4 Coefficients from 2SLS substance-related mortality rate models, all counties

	All opioids	Prescription opioids	Synthetic opioids	Heroin	Cocaine
Eviction rate percentile coefficients					
25th-49th	0.186 (1.13)	0.059 (0.37)	0.133 (1.56)	0.156*** (3.25)	0.022 (0.50)
50th-75th	0.766*** (2.90)	0.530** (2.28)	0.295** (2.49)	0.337*** (4.46)	0.085 (1.51)
75th and up	1.296*** (3.12)	0.800** (2.44)	0.454*** (2.59)	0.596*** (5.04)	0.165* (1.89)
Eviction rate percentile implied elasticities					
25th-49th	0.028	0.013	0.095	0.175	0.023
50th-75th	0.183	0.184	0.331	0.596	0.143
75th and up	0.127	0.114	0.209	0.432	0.114
Observations	32 269	32 269	32 269	32 269	32 269

	Stimulants	Benzodiazepines	Antidepressants	Alcohol poisoning
Eviction rate percentile coefficients				
25th to 49th	0.028 (0.41)	0.009 (0.07)	−0.030 (−0.50)	0.026 (0.31)
50th to 75th	0.139* (1.84)	0.364** (2.24)	−0.028 (−0.38)	0.251*** (2.59)
75th and up	0.172* (1.91)	0.682*** (3.70)	0.070 (0.67)	0.340** (2.22)
Eviction rate percentile implied elasticities				
25th to 49th	0.037	0.005	−0.025	0.016
50th to 75th	0.285	0.296	−0.036	0.244
75th and up	0.145	0.227	0.037	0.135
Observations	32 269	32 269	32 269	32 269

Note: Models of the rate of substance-related deaths weighted per 100 000 population. Coefficients are from 2SRI models. *T*-statistics are in parentheses using bootstrapped standard errors. Explanatory variables included in all models but not shown are count of population (in 100 000 s); percent county population that is male; percent county population between ages 20 and 64; percent of county population Caucasian; median household income in county; percent of county living in poverty; percent of county population without health insurance; county unemployment rate; MDs per capita in county; indicator variable for state having must-access PDMP; suburban and rural indicator variables. All models also included time and county fixed effects. Instruments are listed in the footnote to Table 3 above.

*$P < .10$.

**$P < .05$.

***$P < .01$.

can be seen in Table S2, the estimated associations were extremely robust across all both approaches, suggesting that the censoring was not problematic. A second limitation involved the measurement of some of the substance-related mortality rates. Christopher Ruhm has recently presented evidence that the Vital Statistics microfiles may underestimate the number of accidental opioid overdose deaths, particularly for fentanyl, because of heterogeneity in the quality of the underlying death certificates.[35] Some counties rely on elected coroners rather than medical examiners to fill out the death certificates. We have not estimated versions of our opioid (any, prescription, synthetic, or heroin) models with data that imputes opioid deaths as he suggests, though that could be a productive line of inquiry in future research.

3 | RESULTS

We found consistent associations in six of our nine of our control function models of county-level eviction rates and substance-related mortality for all US counties (Table 4). In each case, we found evidence for a positive relationship between the eviction rate and the substance mortality rates. For six of the nine mortality rate models, the highest two eviction rate quartile indicators were positive and significant at the 5 percent level or better. We calculated elasticities at the implied percentage changes in the eviction rates across the upper and lower bounds of each eviction rate quartile of the data using (3) above; these are presented in the bottom panel of Table 4. Mortality rates were found to have inelastic responses to the eviction rate, with positive elasticities below one in eight of the nine mortality categories. There was substantial variation in magnitude, however. For the "all counties" estimates in Table 4, the statistically significant (at the 5 percent level or better) implied elasticities ranged from 0.114 (for counties in the 4th quartile of eviction rates in the prescription opioid model) to 0.596 (for counties in the 3rd quartile of eviction rates in the heroin mortality model). The implied elasticities related to the other substances were all similarly in the inelastic range (less than one).

We also found that economic factors play a significant role in the relationship between substance-related deaths and evictions

TABLE 5 Coefficients from 2SLS substance-related mortality rate models, urban counties

	All opioids	Prescription opioids	Synthetic opioids	Heroin	Cocaine
Eviction rate percentile coefficients					
25th-49th	0.254 (1.36)	0.177 (1.00)	0.151 (1.46)	0.138 (1.21)	0.100* (1.75)
50th-75th	0.803** (2.48)	0.472* (1.91)	0.336* (1.80)	0.344** (2.24)	0.120 (1.42)
75th and up	1.169** (2.23)	0.691 (1.62)	0.518** (2.22)	0.582** (2.37)	0.088 (0.65)
Eviction rate percentile implied elasticities					
25th-49th	0.053	0.059	0.152	0.146	0.112
50th-75th	0.221	0.205	0.443	0.475	0.175
75th and up	0.114	0.106	0.242	0.285	0.045
Observations	11 771	11 771	11 771	11 771	11 771
	Stimulants	**Benzodiazepines**	**Antidepressants**		**Alcohol poisoning**
Eviction rate percentile coefficients					
25th-49th	0.046 (0.63)	0.147 (1.01)	0.061 (0.77)		0.125 (1.32)
50th-75th	0.049 (0.56)	0.520** (2.55)	0.146 (1.17)		0.234** (2.10)
75th and up	0.237*** (2.58)	0.893*** (2.66)	0.179 (0.95)		0.358** (2.06)
Eviction rate percentile implied elasticities					
25th-49th	0.096	0.111	0.073		0.113
50th-75th	0.136	0.511	0.229		0.277
75th and up	0.232	0.311	0.099		0.150
Observations	11 771	11 771	11 771		11 771

Note: Models of the rate of substance-related deaths weighted per 100 000 population. Coefficients are from 2SRI models. *T*-statistics are in parentheses using bootstrapped standard errors. Explanatory variables included in all models but not shown are count of population (in 100 000 s); percent county population that is male; percent county population between ages 20 and 64; percent of county population Caucasian; median household income in county; percent of county living in poverty; percent of county population without health insurance; county unemployment rate; MDs per capita in county; indicator variable for state having must-access PDMP; suburban and rural indicator variables. All models also included time and county fixed effects. Instruments are listed in the footnote to Table 3 above.

*$P < .10$.

**$P < .05$.

***$P < .01$.

(presented in Table S4). For all opioids, synthetic opioids, heroin, cocaine, stimulants, and benzodiazepines states with must-access PDMPs actually had higher mortality rates. We found that counties with higher proportions of the population aged 20-64 years old had higher mortality rates for heroin and cocaine. Higher unemployment rates were associated with lower synthetic opioid, heroin and cocaine death rates, and higher antidepressant mortality rates. Holding all of the other variables constant (including the eviction rate), a greater proportion of the population represented by men was associated with lower rates of heroin mortality, which is contrary to one component of the "deaths of despair" narrative—though we are measuring the percent of the population that is male of any race, whereas much of the "deaths of despair" literature focuses on Caucasian men over age 45. The time fixed effects were very often statistically significant and appear to explain a great deal of the variation in mortality rates.

We explored this difference in associations between substance-related mortality by population density by running our control function models separately by county size. The results for urban counties are presented in Table 5 (and in Tables S5-S7 for urban, suburban, and rural counties). The primary, and striking, finding was that the strong net positive association between eviction rates and substance-related mortality was observed for urban counties (Table 5), but was not generally found for suburban counties (Table S6) or rural counties (Table S7). Prescription opioid mortality was the only one of the mortality types where we found statistically significant associations when estimated for all counties but did not find at least one statistically significant quartile effect for urban county-only models. Taken together, we conclude that there were statistically significant associations between the eviction rates and six of the nine measured substance-related mortality rates, but only for urban counties.

4 | COMMENT

The opioid abuse and mortality crisis has spread rapidly in the United States over the past decade and a half. Originally concentrated in economically challenged regions of Appalachia and the southwestern parts of the country, the epidemic has now reached into essentially every state and locality. The mortality associated with accidental opioid deaths has grown so large that it has, for the first time, driven life expectancy down for some segments of the US population.[36,37] While opioids have received the most attention in recent years, other substances such as cocaine, benzodiazepines, and alcohol are also a serious and continuing threat to life and life expectancy in the United States. This broad phenomenon has notably been labeled as a problem of "deaths of despair."[6] This label has been assigned largely because of the perceived connection between such deaths and lower levels of education, economic opportunity, and mental health-associated economic stressors.

One economic stressor that many families face is the risk of eviction. Evictions are common among renting populations, but vary substantially by geography, with eviction rates as high as 16.7 percent, 11.4 percent, and 10.5 percent in North Charleston SC, Richmond VA, and Hampton VA, respectively, in 2016.[38] While evictions have been associated with some adverse mental health outcomes in the past, including suicide,[22] to date there have been no studies that assess the association of evictions with substance-related mortality—a key component of the "deaths of despair." We examined data on the average annual eviction rate in nearly all counties in the United States from 2004 through 2016 and estimated the association with mortality related to nine categories of substances that are regularly monitored by the CDC using 2SRI analysis to control for the endogeneity between the eviction rate and mortality.

We found that an implied 1 percent increase in the eviction rate was associated with between 0.114 percent and 0.596 percent higher substance-related deaths per 100 000 population each year for the average county in the United States (when statistically significant). These associations were largest for heroin-related deaths. These estimates suggest a generally positive (though inelastic) relationship between the eviction rate and substance-related mortality—at least for urban counties. Note that a 1 percent increase in the eviction rate would represent about a half of a standard deviation. Thus, the potential impact of eviction on substance-related deaths is large.

These estimates are extremely concerning when one considers that national housing policies under current consideration could increase the eviction rate by substantially more than 1 percent overall. According to the most recent data available from the Eviction Lab, there were just under 900 000 evictions in the United States in 2016. New policies under consideration by the Department of Housing and Urban Development have the potential to increase the number of evictions by more than double that amount.[2] Our findings here suggest that significant worsening of the opioid and other substance mortality crisis could be expected to accompany such dramatic increases in evictions induced by federal government policy. Our research highlights the importance of devising policies that can help minimize evictions as part of a multipronged strategy of combating the scourge of opioid- and other drug-related overdose deaths.

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CONFLICT OF INTEREST

None.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

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