THE ASSOCIATION BETWEEN RESIDENTIAL RELOCATION AND REINCARCERATION AMONG DRUG DEPENDENT FORMER PRISONERS

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ABSTRACT

Aims: To determine if residential relocation to a different county by drug dependent former prisoners lowers their likelihood of reincarceration.

Design: This study uses Hurricane Katrina as a natural experiment to determine whether residential relocation induced by the hurricane affected the likelihood of reincarceration among drug dependent former prisoners. The study draws upon data provided by the Louisiana Department of Public Safety and Corrections, including information on place of residence, participation in treatment programs, and reincarceration.

Setting: New Orleans metropolitan area

Cases: The pre-Katrina cohort is comprised of individuals released from Louisiana prisons from September 2003 to February 2004 with a history of drug abuse, as determined by the Louisiana Risk/Needs Assessment (N = 796). The post-Katrina cohort is comprised of releases from a Louisiana prison immediately after the hurricane, from September 2005 to February 2006 (N = 677).

Measurements: Reincarceration, the dependent variable, refers to a return to a Louisiana prison for a new criminal conviction or a parole violation within one year of prison release. Residential relocation is measured as a change in parish of residence from the location immediately prior to imprisonment to the location immediately upon release from prison.

Findings: Instrumental variables probit analysis reveals that the probability of reincarceration is 0.10 lower for individuals who relocated to a new parish upon their exit from prison relative to individuals who returned to their home parish, with a 95 percent confidence interval ranging from -0.192 to -0.011. An estimated 10 percent of parolees who moved were reincarcerated within one year of their release from prison versus 20 percent of the stayers.

Conclusions: Residential relocation by drug dependent former prisoners significantly reduces their likelihood of reincarceration. Relocation is consequential because it separates individuals from opportunities for drug use, criminal peers, and environmental cues associated with prior drug use.

Key Words: residential relocation, migration, Hurricane Katrina, recidivism, incarceration, crime, drugs, substance abuse, addiction, cue reactivity

INTRODUCTION

More than 70,000 people died from drug overdoses in the United States in 2017, which represents a 10 percent increase over the previous year and nearly a 50 percent increase over the past three years [1]. Unintentional poisoning, of which drug overdoses account for the vast majority, is the leading cause of death among 25 to 44-year-olds [2, 3].

Additional consequences of drug abuse beyond overdose and death include crime and imprisonment. Nearly 60 percent of state prisoners nationally have some form of drug dependence or a history of abuse and 72 percent were regular users of drugs at the time of their imprisonment [4]. More than half of released prisoners are reimprisoned for new crimes or parole violations within just three years, and drug abuse is widely regarded to be one of the most consequential of the dynamic risk factors of reoffending [5, 6, 7].

A likely contributor to the cycle of recidivism as well as drug relapse is the fact that many released prisoners return home to the same environment with the same criminal peers and opportunities for drug use that proved so detrimental to their behavior in the past [8]. Returning to old neighborhoods may be particularly problematic for former prisoners with substance use disorders. Through a process of conditioning, persons addicted to drugs come to associate certain stimuli, called cues, with the use of a drug. Cues are commonly categorized as either substance-specific cues such as seeing drug paraphernalia or personal cues specific to an individual such as a seeing a person with whom a substance was used in the past or a place where it was used. Given the influence of personal cues, individuals may be more likely to relapse in environments associated with prior drug use [9, 10]. In the presence of familiar stimuli, individuals with an addiction may encounter a physiological reaction including an intense craving for drugs, and this reaction may still occur even after long periods of abstinence [11]. Research reveals that individuals may not even consciously notice a visual cue associated with prior drug use, but their brains may still react to the cue [12].

If relapse into drug use is influenced by exposure to familiar social environments associated with prior use, then residential relocation to an area far removed from such environments may decrease the likelihood of relapse and associated behaviors such as crime. One compelling study consistent with this assertion is Lee Robins's landmark study of desistance from heroin and opiate use among Vietnam veterans [13, 14]. Robins found that only five percent of veterans who had become addicted to heroin while in Vietnam had relapsed into active addiction through one year after their return. Just 12 percent of the prior heroin addicts had relapsed into active addiction at any point in the first three years after returning to the United States [14]. Robins concluded that participation in drug treatment did not explain the findings; the vast majority of individuals who recovered from heroin addiction did not participate in drug treatment. Robins argued that the pervasive use of narcotics in Vietnam was a function of the wide availability and low price of opiates along with the absence of social controls such as disapproving family members and friends [14]. She concluded that many addicts spontaneously recovered when these conditions changed upon leaving Vietnam, and she argued that spontaneous recovery was common because heroin addiction is not as interminable as widely assumed [14].

Several subsequent studies of individuals addicted to opiates, opioids, and injectable drugs have found evidence of a beneficial effect of residential change on abstinence and desistance from

drug use [15, 16, 17]. For instance, in a study of opioid dependent individuals originally from San Antonio, authors found that the frequency of abstinence from opioid use lasting at least one-year was more than three times greater among individuals who had moved away from San Antonio (17 percent) than in instances where sample members had instead received treatment or been incarcerated (six percent) [18]. In another study, of a sample of injection drug users originally from Vancouver, individuals who subsequently moved out of the Greater Vancouver area were significantly less likely to use heroin and cocaine during the post-move follow-up period relative to the pre-move period whereas a control group of non-movers demonstrated no significant change in the frequency of heroin or cocaine use [19]. Hence, based on extant research, residential relocation of a sufficient distance outside of an origin location appears to promote abstinence and recovery from drug abuse.

Whereas there is promising evidence about the importance of residential relocation for cessation of drug use and a decline in associated criminal behavior, extant research suffers from the problem of selection bias. Existing studies tend to compare movers to non-movers, either without any statistical controls or with a limited number of controls. However, estimating the causal effect of place of residence on the likelihood of relapse or criminal recidivism is complicated by selection bias — the possibility that some unmeasured characteristic of individuals influences both where they live and their drug-related behavior, and may therefore account for any relation between residential relocation and both relapse and recidivism. People who move away from former places of residence may be fundamentally different in unobserved ways than individuals who remained embedded in familiar residential settings, and these unobserved characteristics may explain the decline in drug use rather than the relocation to a new physical and social environment.

Natural Experiment

In this study, I use Hurricane Katrina as a natural experiment for estimating the effect of residential relocation on the likelihood of reincarceration among drug dependent individuals released from prison in Louisiana. In August 2005, Hurricane Katrina ravaged the Louisiana Gulf Coast, damaging a vast majority of the housing stock in the New Orleans metropolitan area. In Orleans Parish, 71.5 percent of housing units suffered some damage, with 56 percent of housing units significantly damaged (note: parishes in Louisiana are equivalent to counties in other states) [20]. The extent of housing destruction was similar in the adjacent parishes that make-up the wider New Orleans metropolitan area.

One consequence of the property destruction from Hurricane Katrina was a dispersion post-Katrina of Louisiana parolees away from select New Orleans metropolitan neighborhoods to other residential locations throughout the state (parolees are required to remain in-state, unless they are granted a special transfer). For instance, Figure 1 draws on raw data from the Louisiana Department of Public Safety and Corrections (DPS&C), and provides a snapshot pre- and post-Katrina indicating whether newly released prisoners returned to their home parish upon release from prison or moved to a different parish. Prior to Hurricane Katrina, just over 23 percent of parolees with a history of drug dependence moved away from their pre-prison parish. Post-Katrina, this distribution doubled, with 46 percent of exiting prisoners migrating to a different parish. Thus, Hurricane Katrina fundamentally altered prevailing geographic patterns of residence for released prisoners in Louisiana, at least during the first year after the hurricane. For

prisoners released soon after Hurricane Katrina, their residential choices were significantly different than if they had been released prior to the hurricane, resulting in some measure of geographic displacement. This exogenously induced change in the residential patterns of former prisoners provides me analytic leverage for investigating the causal effect of residential relocation on the likelihood of reincarceration.

[FIGURE 1 HERE]

METHODS

Data and Sample

The analysis draws on data on parolees from the DPS&C, including information on the residential addresses of parolees and whether parolees were reincarcerated within one year of their release from prison (i.e., the outcome variable). The research design and hypothesis of the study were pre-registered on Open Science Framework (https://osf.io/dnxm2/). Roughly 90 percent of prisoners released from Louisiana prisons during the years of observation were released onto parole supervision (in contrast to unconditional releases, which do not require post-incarceration supervision). Because my interest is in residential displacement due to Hurricane Katrina, I restrict analyses to those prisoners who resided in affected metropolitan areas prior to incarceration. Accordingly, the analytic sample only includes ex-prisoners who were originally committed to prison from Orleans Parish or the four parishes adjacent to Orleans which make-up the wider New Orleans metropolitan area (Jefferson, Plaquemines, St. Bernard, and St. Tammany). Additionally, because my interest is in the post-release behavior of individuals with a history of drug dependence, I restrict the sample to individuals assessed as having a history of drug abuse as measured by the Louisiana Risk/Needs Assessment (LARNA). The LARNA risk score is also based on static and dynamic risk factors including, among others, criminal history, mental health problems, and current and past employment.

The analytic sample is drawn from prisoners released from Louisiana correctional facilities in two separate time periods, pre and post-Katrina. The pre-Katrina cohort is comprised of all releases from a Louisiana prison to parole supervision anytime from September 2003 to February 2004 who had a history of drug abuse. The post-Katrina cohort is comprised of releases from a Louisiana prison to parole supervision immediately after the hurricane, from September 2005 to February 2006. Nearly 66 percent of all individuals released to parole supervision in the pre-Katrina period were assessed as having a history of drug abuse (N = 796 of 1,211 who completed the LARNA assessment). The figure for the post-Katrina cohort is 61.9 percent (N = 677 of 1,094). These rates are comparable to national estimates [4]. The combined 1,473 cases (796 pre-Katrina and 677 post-Katrina) in my analytic sample are complete cases with no missing data. The remaining 832 cases completed the LARNA assessment and did not report a history of drug abuse. Therefore they are excluded from the analytic sample given my focus on drug dependence.

There were another 796 individuals released from Louisiana prisons during the same time periods (24 percent of all releases) who did not complete the LARNA assessment of substance abuse, and are therefore excluded from the analysis because I am unable to determine if they

have a history of substance abuse. Missing LARNA information typically results because the prison system was unable to administer the assessment to an individual prior to his or her release, as opposed to missing data from non-response. Hence, missing LARNA information is more common among individuals imprisoned on short sentences. Moreover, because the LARNA instrument was not adopted by DPS&C until 2003, missing LARNA information is more common in the pre-Katrina period when DPS&C staff were busily assessing both current and newly admitted prisoners. See Table S1 in the online supplement for an assessment of potential differences in the characteristics of the analytic sample versus excluded cases.

Finally, given the nature of their offense, sex offenders face a number of constraints on their residency choices upon release from prison. Because of this, I opt to exclude these individuals from the study.

Measures

Data utilized in this study cover three domains: (a) individual-level data on parolees from DPS&C, (b) parish-level socioeconomic characteristics from the U.S. Department of Housing and Urban Development, the Louisiana Department of Labor, and ESRI [21], and (c) criminal justice system data from the Supreme Court of Louisiana, DPS&C, the Division of Probation and Parole, and the Uniform Crime Reports. The dependent variable, reincarceration, and the main independent variable, residential relocation, derive from the DPS&C data. Reincarceration refers to a return to a Louisiana prison for a new criminal conviction or a parole violation within one year of prison release. Residential relocation is measured as a change in parish of residence from the location immediately prior to imprisonment to the location immediately upon release from prison (= 1; termed “movers”). Individuals who did not change parish of residence have a value of zero (hereafter termed “stayers”). The unadjusted proportional difference in reincarceration between the movers (0.147) and stayers (0.205) equals 0.058.

The analyses statistically adjust for differences between movers and stayers in individual characteristics including race, gender, marital status, age at release, time served in prison, incarceration history, and the LARNA risk score. I also control for socioeconomic conditions measured at the parish-level (segregation, income inequality, the unemployment rate, average weekly wages, and fair market rents), as well as various indicators of criminal justice system operations (judge caseloads, the likelihood of arrest following the commission of a crime, average parole contacts per parole officer, and the reincarceration rate in the parolee’s parole district during the six months prior to when he or she was released from prison). The use of statistical controls further enhances my ability to isolate the specific effect of residential relocation on reincarceration.

Analytic Strategy

Conceptually, I seek to examine what would happen to the behavior of the same individual under two different circumstances: he or she moved to a new parish upon release from prison or stayed in the same parish. Yet, it is only possible to observe one of these two potential outcomes for an individual at a given point in time (i.e., either the individual moved or did not). If, instead, one simply compares outcomes for movers and stayers, the estimate of the effect of residential relocation may be biased because of omitted confounding variables related to the reasons why an

individual moves. One solution to this problem of omitted variables is the use of instrumental variables (IV).

One key assumption of the IV framework is that the instruments and the outcome variable are unrelated except through the treatment condition [22, 23]. However, we can have confidence that the instrument and outcome are related only through the treatment if the instrument derives from a random force of nature like a hurricane.

In the IV analyses below, I use a two-stage estimation process and in the first stage I use the timing of release from prison — i.e., pre-Katrina (= 0) or post-Katrina (= 1) — to predict the treatment condition (i.e., whether the individual moved to a new parish). In the second stage, I then use a probit model to regress the outcome variable — reincarceration within one year — on the *predicted* treatment measure. Conceptually, this approach removes the spurious correlation between the treatment variable and unobserved characteristics, in this case unobservable characteristics of parolees. I implemented this two-stage IV analysis in Stata with the *ivprobit* command. For the analysis, I adjust model standard errors to account for the clustering (i.e., interdependence) of parolees within parishes. Postestimation I used the *margins* command in Stata to calculate the marginal effect of residential relocation on the probability of reincarceration, computed with the values of all control variables held at their means. The marginal effect indicates the effect of the discrete change from 0 to 1 in the residential relocation variable.

RESULTS

Presented in Figure 2 are the predicted probabilities of reincarceration based on coefficient estimates from an instrumental variables probit model (see Table S2 in the online supplement for the full table of results). Results show that those individuals who moved to a different parish from where they resided in the past were significantly and substantially *less* likely to be reincarcerated. With respect to the marginal effect, the probability of reincarceration is 0.10 lower for movers relative to stayers (p-value for the marginal effect = 0.028). Accordingly, an estimated 10 percent of parolees who moved were reincarcerated within one year of their release from prison versus 20 percent of stayers. The 95 percent confidence interval of the marginal effect ranges from -0.192 to -0.011.

[FIGURE 2 HERE]

It is pertinent to consider whether the apparent effect of residential relocation on reincarceration depends upon whether individuals have received recent treatment for their substance abuse and/or other conditions such as mental illness. Accordingly, for the analysis presented in Figure 3, I subset the sample to compare drug dependent individuals who completed recommended treatment during incarceration or for which treatment was deemed unnecessary versus individuals who needed treatment but either were unsuccessfully terminated from treatment or were unable to participate because of a lack of institutional capacity. The predicted probabilities of reincarceration displayed in Figure 3 are based on coefficient estimates from the instrumental variables probit results found in Table S3. Among those who completed recommended treatment during incarceration or for which treatment was deemed unnecessary, the probability of

reincarceration is 0.08 lower for movers relative to stayers ($p = 0.117$), with a 95 percent confidence interval ranging from -0.190 to 0.021. Among individuals who did not complete a necessary treatment program, the probability of reincarceration is 0.22 lower for movers relative to stayers ($p = 0.083$), with a 95 percent confidence interval ranging from -0.470 to 0.029. These results provide some suggestive evidence that individuals in need of treatment who did not get it may actually benefit the most from residential relocation.

[FIGURE 3 HERE]

DISCUSSION

Using Hurricane Katrina as an exogenous source of variation that fundamentally influenced where exiting prisoners resided in the period right after the hurricane, in this study I was able to more thoroughly resolve the issue of selection bias than many prior studies of the effects of residential relocation. IV analysis revealed that the probability of reincarceration is 0.10 lower for individuals who relocated to a new parish upon their exit from prison relative to where they lived prior to incarceration. This finding is consistent with prior research on the effects of residential relocation among drug users and prisoners more generally [8, 13 – 19, 24 – 25].

I'll highlight two potential limitations of the study. First, the LARNA risk assessment used to determine substance abuse history began roll-out in 2003 and was not administered to some prisoners prior to their release from prison. Table S1 in the online supplement does reveal some differences in terms of control variables between the analytic sample and those cases excluded because they did not take the LARNA assessment. Importantly though, I did not find any differences in terms of the dependent variable (reincarceration) or the main independent variable (residential relocation). Additionally, I examined whether the raw difference in the proportions reincarcerated by movers versus stayers was similar in the analytic sample and excluded cases. In both groups movers are less likely to be reincarcerated than the stayers, although the magnitude of the difference is slightly greater in the analytic sample (0.147 for movers versus 0.205 for stayers in the analytic sample; 0.178 for movers versus 0.223 for stayers for excluded cases). The fact that movers have lower rates of reincarceration in both groups leads me to conclude that even if the excluded cases had been included in my analysis, I would likely find a significant association between residential relocation and reincarceration.

The second potential limitation is generalizability. The devastation from Hurricane Katrina provided a unique opportunity to examine the consequences of forced relocation, but further work is necessary to determine the generalizability of the findings presented in this study. An important avenue for future research would be to investigate the effect of residential relocation for drug-related behavior in a randomized experiment in order to provide an even more rigorous test of the causal effects of residential relocation. This could be done through an experimental housing mobility program, with the control group receiving subsidized housing back in a home county and a treatment group receiving subsidized housing in a different county. There is already some precedent for such an intervention in Maryland [24].

While further research is warranted, the findings from this study have significant policy implications. For instance, in some states, with Louisiana as one of the exceptions, prisoners

released onto parole supervision are legally required to return to their county of last residence, contributing to a return to old neighborhoods [26, 27]. Hence, criminal justice policies in some states are designed to return prisoners, including those with drug dependencies, to the same familiar surroundings where they used drugs and got into trouble with the law in the past. Yet there are tangible actions parole authorities could take to facilitate residential relocation, including revising parolee residency restrictions.

Residential relocation could also be fostered by the development of government-funded housing programs specifically designed to encourage residential moves [24]. Such housing programs could be combined with out-patient drug treatment as well as other support services. Given that it costs nearly $100/day to imprison someone in the United States, a housing program combined with out-patient treatment could conceivably be implemented at a lower cost per person than the cost of imprisonment [28].

In summary, the aim of this study has been to determine if residential relocation to a different county by drug dependent former prisoners lowers their likelihood of reincarceration. To the extent that the results can be validated in further research, programs and policies that provide greater access to housing assistance for individuals with a history of substance abuse, particularly housing opportunities located far away from former neighborhoods, may yield substantial individual-level and societal benefits in terms of reductions in overdoses, lower crime rates, and fewer tax dollars spent on emergency room visits, jails, and prisons. Of course, consistent with prior research on the effects of residential relocation among opioid users, residential change may be best conceived as a complement to medication-assisted treatment for drug dependency, not as a substitute [18].

DECLARATION OF INTERESTS

None.

DETAILS OF FUNDING

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FIGURES AND TABLES

Figure 1. The Percent of Louisiana Parolees who Moved to a Different Parish upon Release from Prison, Pre- versus Post-Katrina

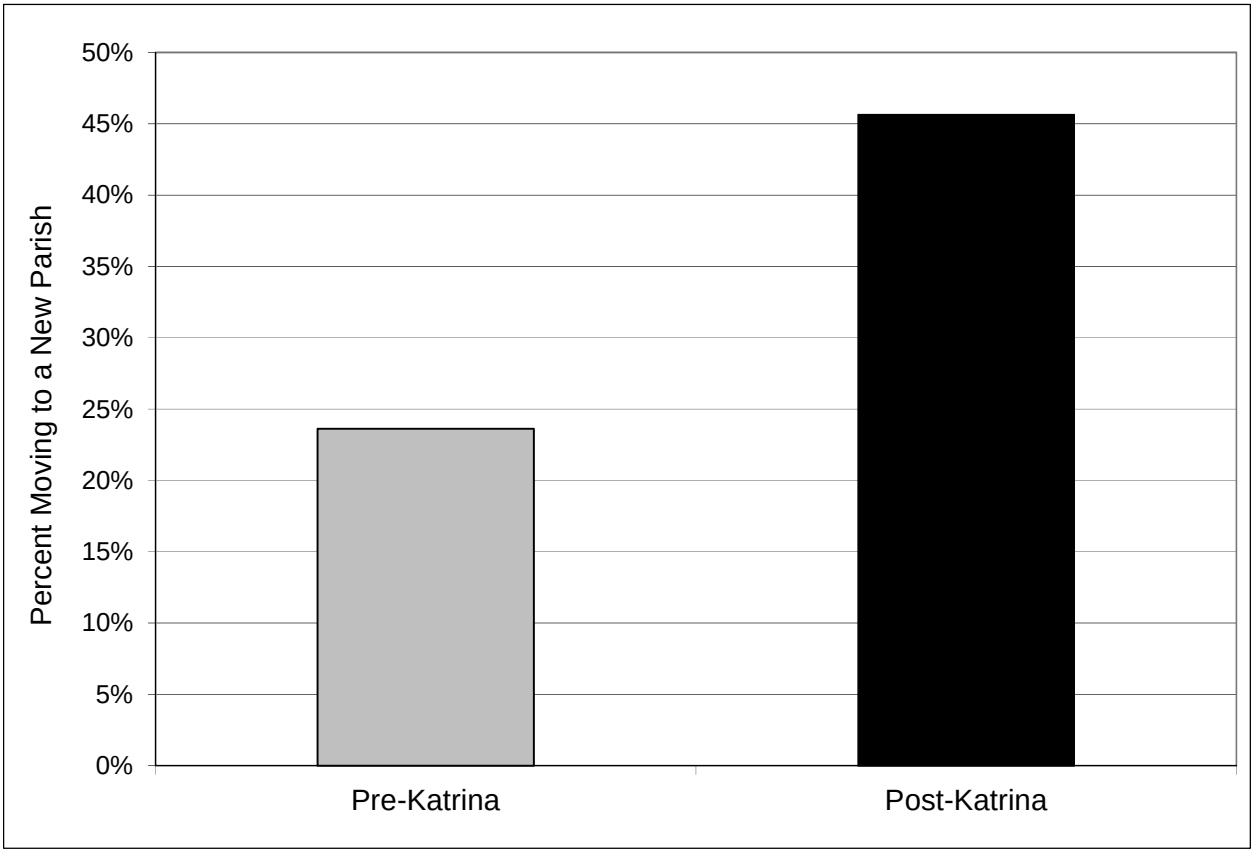

Figure 2. The Predicted Probability of Reincarceration within One Year of Release, Stayers vs. Movers

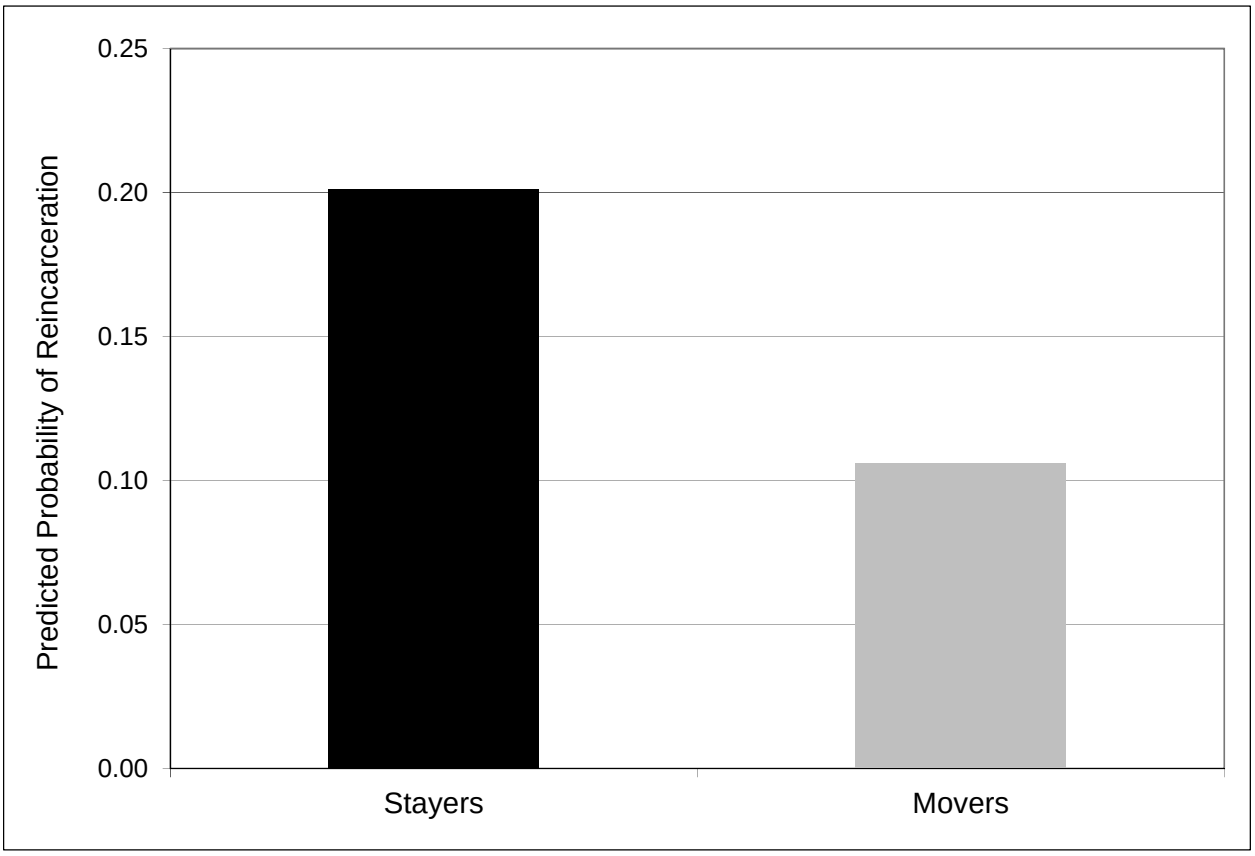

Figure 3. The Predicted Probability of Reincarceration within One Year of Release, Stayers vs. Movers by Drug Treatment Status while Incarcerated

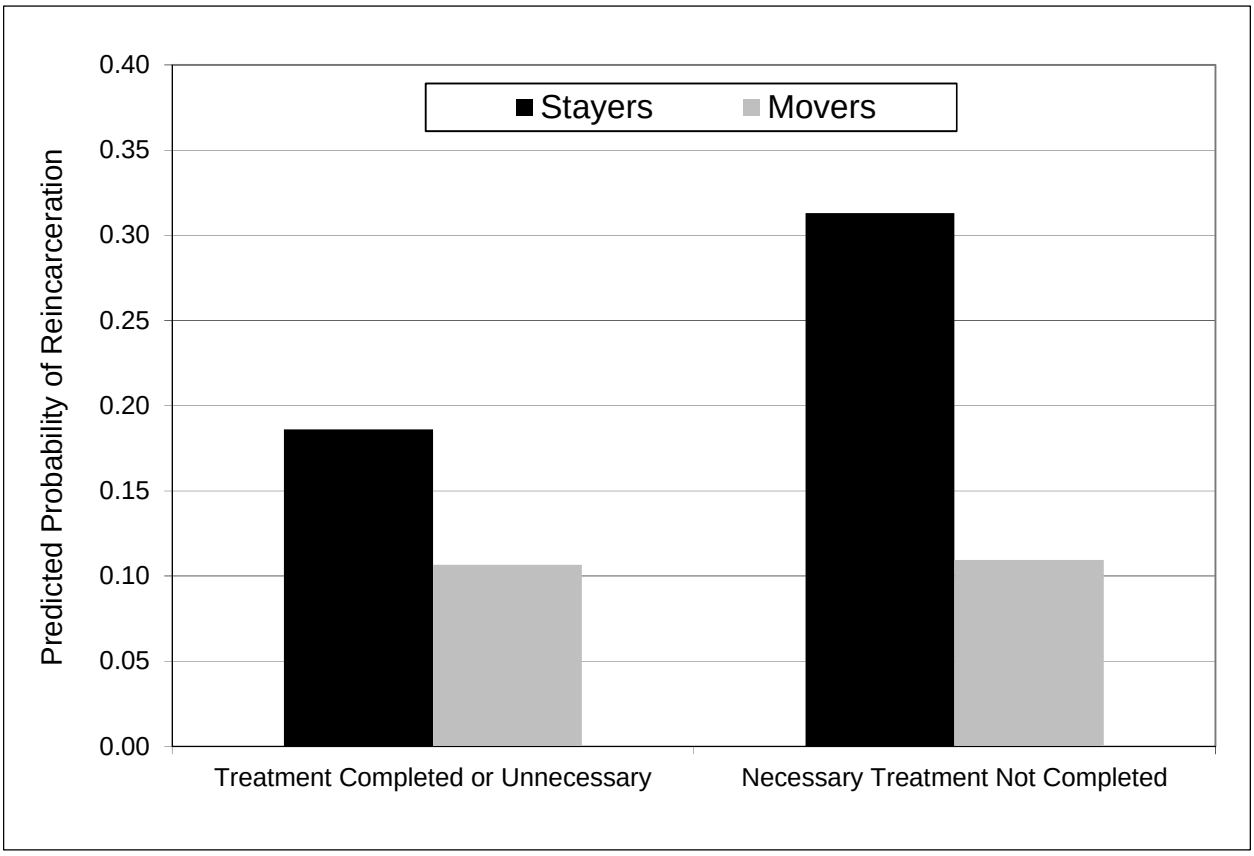

Table S1. Comparison of Analytic Sample vs. Excluded Cases

	Analytic Sample		Excluded: Did Not Complete LARNA		Hypothesis Test of Difference	
	Mean/ Proportion	SD	Mean/ Proportion	SD	Z or T Statistic	P-Value
Re-incarceration	0.185	0.389	0.209	0.407	1.336	0.182
Residential Relocation	0.337	0.473	0.330	0.471	-0.337	0.736
Individual-Level						
Black	0.714	0.452	0.769	0.422	2.810	0.005
Male	0.874	0.332	0.845	0.362	-1.920	0.055
Married	0.090	0.286	0.082	0.274	-0.642	0.521
Age at Release	33.322	9.980	33.347	9.919	0.057	0.955
Time Served	2.022	2.526	1.681	2.487	-3.101	0.002
First Release	0.685	0.465	0.626	0.484	-2.858	0.004
Context and Crim. Justice System						
Jefferson Parish	0.356	0.479	0.382	0.486	1.204	0.229
Plaquemines Parish	0.022	0.146	0.004	0.061	-3.312	0.001
St. Bernard Parish	0.029	0.168	0.031	0.175	0.295	0.768
St. Tammany Parish	0.169	0.375	0.090	0.287	-5.126	0.000
Socioeconomic Conditions	0.166	1.099	0.082	0.977	-1.873	0.061
Criminal Justice Operations	0.008	1.155	-0.140	0.961	-3.242	0.001
N	1473		796		1473 + 796	

Notes: A Z-test of proportions was used to test for differences in binary variables.
A t-test was used to test for differences in continuous variables.

Table S2. Instrumental Variable Probit Estimates of Reincarceration

	Coef.	Robust Std. Err.		95% CI		Marginal Effect
Residential Relocation	-0.410	(0.187)	*	-0.777	-0.042	-0.10
Individual-Level						
Black	-0.085	(0.089)		-0.260	0.090	-0.02
Male	-0.109	(0.118)		-0.341	0.122	-0.03
Married	-0.220	(0.204)		-0.620	0.180	-0.05
Age at Release	-0.004	(0.002)		-0.009	0.001	0.00
Time Served	-0.034	(0.020)		-0.073	0.004	-0.01
First Release	-0.142	(0.084)		-0.307	0.024	-0.04
LARNA Risk Score	0.079	(0.012)	***	0.055	0.103	0.02
Context and Crim. Justice System						
Jefferson Parish	-0.337	(0.111)	**	-0.554	-0.120	-0.08
Plaquemines Parish	-0.632	(0.271)	*	-1.162	-0.102	-0.16
St. Bernard Parish	-0.113	(0.125)		-0.358	0.133	-0.03
St. Tammany Parish	-0.308	(0.096)	***	-0.497	-0.119	-0.08
Socioeconomic Conditions	-0.102	(0.026)	***	-0.154	-0.050	-0.03
Criminal Justice Operations	-0.023	(0.028)		-0.078	0.033	-0.01
Intercept	-0.922	(0.271)	***	-1.454	-0.390	

Notes: N = 1473; * p<=0.05 ** p<=0.01 *** p<=0.001

Table S3. IV Probit Estimates of Reincarceration, by Drug Treatment Status

	Completed Treatment or Treatment Unnecessary				Treatment Terminated or Unable to Attend			
	Coef.	Robust Std. Err.		95% CI	Coef.	Robust Std. Err.		95% CI
Residential Relocation	-0.352	(0.227)		-0.798 0.093	-0.743	(0.420)		-1.567 0.081
Individual-Level								
Black	-0.106	(0.071)		-0.245 0.032	0.070	(0.280)		-0.478 0.618
Male	-0.148	(0.171)		-0.483 0.186	0.142	(0.374)		-0.592 0.875
Married	-0.268	(0.204)		-0.669 0.132	0.050	(0.536)		-1.001 1.102
Age at Release	-0.004	(0.002)	*	-0.008 0.000	-0.010	(0.013)		-0.034 0.015
Time Served	-0.037	(0.020)		-0.077 0.003	-0.034	(0.023)		-0.079 0.012
First Release	-0.109	(0.090)		-0.286 0.067	-0.306	(0.265)		-0.825 0.213
LARNA Risk Score	0.087	(0.014)	***	0.060 0.114	0.083	(0.033)	*	0.019 0.148
Context and Crim. Justice System								
Jefferson Parish	-0.405	(0.092)	***	-0.585 -0.226	0.024	(0.452)		-0.862 0.909
Plaquemines Parish	-0.462	(0.358)		-1.164 0.239		(omitted)		
St. Bernard Parish	-0.126	(0.130)		-0.381 0.128	0.118	(0.409)		-0.682 0.919
St. Tammany Parish	-0.395	(0.105)	***	-0.601 -0.189	0.173	(0.360)		-0.534 0.879
Socioeconomic Conditions	-0.121	(0.034)	***	-0.187 -0.055	-0.007	(0.114)		-0.230 0.215
Criminal Justice Operations	-0.035	(0.027)		-0.087 0.017	0.080	(0.166)		-0.245 0.406
Intercept	-0.944	(0.350)	**	-1.630 -0.259	-1.239	(0.839)		-2.883 0.405
N	1283				183			

Notes: All observations from Plaquemines Parish (seven) in the right column analysis were dropped from the analysis because of a lack of variation. All seven cases had the same value for the dependent variable.
* p<=0.05 ** p<=0.01 *** p<=0.001

ONLINE SUPPLEMENT

CASES

As described in the main text, the sample includes parolees with a history of drug abuse who were originally committed to prison from Orleans Parish or the four parishes adjacent to Orleans which make-up the wider New Orleans metropolitan area (Jefferson, Plaquemines, St. Bernard, and St. Tammany). The pre-Katrina cohort is comprised of individuals released from Louisiana prisons from September 2003 to February 2004 who had a history of drug abuse. The post-Katrina cohort is comprised of releases from a Louisiana prison immediately after the hurricane, from September 2005 to February 2006.

From September 2003 to February 2004, 1,858 individuals originally convicted in the New Orleans metropolitan area were released from prison onto parole supervision. I excluded 127 sex offenders from the analytic sample, leaving 1,731 remaining. Of these, 1,211 completed the Louisiana Risks/Needs Assessment (LARNA), which identifies whether a prisoner has a history of drug abuse. Of this number, 796 individuals were assessed to have a history of substance abuse (65.7% of the individuals completing the LARNA assessment).

From September 2005 to February 2006, 1,469 individuals originally convicted in the New Orleans metropolitan area were released onto parole supervision. I excluded 99 sex offenders from the analytic sample, leaving 1,370 remaining. Of these, 1,094 completed the Louisiana Risks/Needs Assessment (LARNA), with 677 of the 1,094 assessed as having a history of substance abuse (61.9%).

As noted in the main text, 520 pre-Katrina individuals and 276 post-Katrina releases (24 percent of all prison releases) did not complete the LARNA assessment of substance abuse, and are therefore excluded from the analysis. In Table S1 below, I provide a comparison of the characteristics of analytic sample versus the excluded cases, using a Z-test to test for differences in proportions (for binary variables) and a t-test to assess differences in means (for continuous variables). I do not find any systematic differences between these two groups in terms of the dependent variable of the study (reincarceration) or the main independent variable (residential relocation). I do however find some differences between the groups in terms of the control variables. As noted in the Discussion section of the paper, I also examined whether the raw difference in the rate of reincarceration between movers and stayers was similar in the analytic sample and excluded cases. I find that in both groups, movers are less likely to be reincarcerated than the stayers, although the difference is slightly larger in the analytic sample (0.147 for movers versus 0.205 for stayers in the analytic sample; 0.178 for movers versus 0.223 for stayers in the excluded cases). Nevertheless, the lack of complete roll-out of the LARNA risk assessment and the resulting effect on the completeness of my sample is one potential limitation of the study.

[TABLE S1 HERE]

MEASURES

This study draws upon prison release and reincarceration data from the Louisiana Department of Public Safety and Corrections (DPS&C) to estimate the effect of residential relocation among drug dependent former prisoners on the likelihood of reincarceration.

Statistical analyses presented in the main body of the paper control for a variety of (1) individual characteristics, (2) socioeconomic conditions, and (3) the operation of the criminal justice system. Analyses include seven individual-level control variables designed to account for any baseline differences between movers and stayers: race, gender, marital status, age at time of release, time served in prison, incarceration history, and the LARNA risk score.

I measure parolee race with a binary variable (black equals one, otherwise zero). Black parolees compose 71.4 percent of the sample, with whites making up 28.6 percent. Males compose 87 percent of the sample, and nine percent of the sample were married at the time of release. On average, prisoners were 33 years old at the time of release. Averaged time served is two years, which partly reflects the fact that some individuals were serving time on shorter duration parole revocations. Controlling for time served is necessary to account for any differences between cohorts in the average severity of prior offending. I measure incarceration history as a binary variable labeled "first release" which indicates whether the parolee was released from his or her first term of incarceration (equals one) or from a second or greater term (zero). The LARNA risk score is calculated based on a total of 12 items measuring static and dynamic predictors of risk including a history of drug abuse, criminal history, a history of mental health problems, and current and past employment. Based on information from the individual LARNA item related to recent drug treatment (question 11 of the assessment), for the Figure 3 and Table S3 analysis I split the sample into individuals for which treatment was deemed unnecessary or necessary and successfully completed versus those individuals who were unsuccessfully terminated from treatment or were unable to attend a necessary treatment program (e.g., because of a lack of available spots).

For the purposes of estimating the effect of residential relocation on reincarceration net of the socioeconomic conditions of destination parishes, I include the following statistical controls, all measured at the parish level at the time point in which a given parolee was released from prison: segregation, income inequality, the unemployment rate, average weekly wages, and fair market rents. Measures of segregation (dissimilarity) and income inequality are drawn from annual sociodemographic estimates produced by ESRI [21]. I use 2004 estimates for the pre-Katrina cohort and 2006 estimates for the post-Katrina cohort. Data on unemployment and wages comes from the Louisiana Department of Labor, and are measured during the calendar-quarter in which the parolee was released from prison. From data compiled by the U.S. Department of Housing and Urban Development, I use estimates of fair market rents in 2004 for the pre-Katrina cohort and in 2006 for the post-Katrina cohort. Figures are adjusted to 2000 dollars. Because of sizable correlations between these various aspects of socioeconomic context, I combined these five measures into one variable (*socioeconomic status*) through principal components analysis.

The implications of Hurricane Katrina for changes in the criminal justice system in Louisiana are many [29, 30]. For instance, because of the depopulation of New Orleans and the geographic shift in where parolees fresh out of prison resided after Katrina, there was an increase in the ratio of parole officers to parolees in New Orleans [31, 32]. Arguably then, parolees in New Orleans

after Katrina faced greater scrutiny than their pre-Katrina counterparts. Given that increased scrutiny is associated with higher recidivism rates [33], the increased ratio of parole officers to parolees post-Katrina may have resulted in higher levels of reincarceration. Therefore, using parish-level data from the Supreme Court of Louisiana, the Uniform Crime Reports (UCR), the DPS&C, and the Division of Probation and Parole, I developed pre- and post-Katrina measures of judge caseloads (in 2004 and 2006 for the pre- and post-Katrina cohorts, respectively), the likelihood of arrest following the commission of a crime (UCR arrests divided by reported crimes, based on 2003 and 2005 data for the respective cohorts), average parole contacts per parole officer during the quarter in which a parolee was released from prison, and the reincarceration rate in the parolee's parole district during the 6 months prior to when he or she was released from prison. I combined these measures via principal components analysis and labeled the component *criminal justice operations*.

Finally, I also included binary variables representing the origin parish of respondents, with Orleans Parish omitted as the reference category.

ANALYTIC STRATEGY

Figures 2 and 3 in the main body of the paper were produced based on coefficients from the estimated results found in Tables S2 and S3 respectively. These models were estimated with an instrumental variables probit model, via the *ivprobit* command in Stata. An IV analysis helps remedy the issue of omitted variables by using only a portion of the variability in the treatment variable that is uncorrelated with omitted variables to estimate the causal relation between the treatment and the dependent variable. The *ivprobit* command estimates two structural equations as part of the two-stage estimation process with the IV technique. The first equation models the treatment variable — residential relocation — as a function of an instrumental variable which represents the release cohort (i.e., released pre-Katrina or released post-Katrina) and a vector of control variables as described above. The second-stage of the two-stage estimation process models the dependent variable, reincarceration within one-year of release, as a function of the predicted treatment variable (residential relocation) from the first equation. I use probit regression to model the binary dependent variable. In a probit model, the inverse standard normal distribution of the probability — in this case, the probability of reincarceration — is modeled as a linear combination of the predictors. After estimating the probit model with the *ivprobit* command, I used the *margins* command in Stata to calculate the marginal effect of residential relocation on the probability of reincarceration.

I used a binary treatment variable in this study — residential relocation equaled one if an individual moved to a different parish upon release from prison relative to where she or he resided prior to incarceration, and it equaled zero if she or he moved back to the same parish upon release. With a binary treatment variable, marginal effects measure a discrete change from zero to one — that is, how predicted probabilities change as the binary variable changes from zero to one, with the values of all control variables held at their means. In a probit model, the marginal effect of a binary variable is computed by:

$$\varphi(x\beta) * \beta_k$$

where φ is the probability density function for a standardized normal variable [34].

Presented in Tables S2 and S3 are the probit regression results, for the full analytic sample (Table S2) and then subset by drug treatment participation (Table S3). Figures 2 and 3 in the main text show the corresponding predicted probabilities of reincarceration based on the results found in these tables. For Figure 2, I computed the predicted probability twice based on coefficients in Table S2, once for movers and again for stayers. When computing these predicted probabilities, I held all variables other than the residential relocation measure at their mean values. I computed predicted probabilities similarly for Figure 3 from probit coefficients in Table S3.

[TABLES S2 AND S3 HERE]