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Changes In Health Services Use After Receipt Of Medications For Opioid Use Disorder In A Statewide Correctional System

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ABSTRACT To decrease opioid overdose mortality, prisons and jails in the US are increasingly offering medications for opioid use disorder (OUD) to incarcerated people. It is unknown how receipt of these medications in a correctional setting affects health services use after release. In this article we analyze changes in postrelease health care use after the implementation of a statewide medications for OUD program in the unified jail and prison system of the Rhode Island Department of Corrections. Using Medicaid claims data, we examined individual health care use in the community before and after receipt of medications for OUD while incarcerated. We found that inpatient admissions did not change, emergency department visits decreased, and both nonacute outpatient services and pharmacy claims increased after people received medications for OUD while incarcerated. There was no change in total health care costs paid by Medicaid. Our findings provide evidence that people's use of health care services paid for by Medicaid did not increase after they started medications for OUD in correctional settings. Given the frequent interaction of people with OUD with the criminal justice system, offering evidence-based treatment of OUD in correctional settings is an important opportunity to initiate addiction treatment.

The US is currently experiencing an opioid overdose epidemic. Opioid-related overdose deaths have risen dramatically in the past two decades, and in 2018, opioid overdoses claimed more than 46,000 lives.[1] Of the more than two million people in the US with opioid use disorder (OUD),[2] most will have contact with the criminal justice system at some point in their lives.[3–7] After a person's release from incarceration, the risk for a fatal overdose is at least ten times higher than it is in the general population, and people released from prisons and jails make up a disproportionate number of overdose deaths.[8–10]

The Food and Drug Administration (FDA) has approved three medications for the treatment of OUD: methadone, buprenorphine, and naltrexone.[11] There is ample evidence that medications for OUD improve clinical outcomes in patients with OUD and that, in general, patients derive superior benefits from methadone or buprenorphine compared with naltrexone.[11,12]

The vast majority of prisons and jails in the US do not initiate or continue medications for OUD for incarcerated people, although the number of correctional systems with programs providing these medications has increased during the past several years.[13–15]

In 2016 the General Assembly of the State of Rhode Island allocated $2 million to implement the first comprehensive statewide prison and jail

OUD treatment program in the US.[16] The Rhode Island Department of Corrections (RIDOC) is a unified prison-jail system and incarcerates people who are pending arraignment; those awaiting trial, conviction, or sentencing; and all people after sentencing, regardless of sentence length. In the medications for OUD program, all incarcerated people are screened for OUD and offered their choice of the three FDA-approved medications. People in the program include those continuing medications for OUD (if they had been prescribed these medications in the community at the time of incarceration) and others newly initiated on medications for OUD during their incarceration.

Discharge planning for program participants nearing release includes linkage to an addiction provider after release who will continue prescribing medications for OUD via either a scheduled appointment with a community provider of medications for OUD or a planned return to the participant's previous provider. After release, participants can also receive medications for OUD at the community location of the vendor that provides these medications to RIDOC until they are enrolled with a provider. All participants are given a contact number for that vendor if they have difficulty with their reentry plan.[16] Discharge planning also includes enrollment in Medicaid, for which the majority of incarcerated people are eligible after Medicaid expansion.[16,17] Preliminary evidence has shown a reduction in overdose deaths postrelease in the first year after the program's implementation.[18] However, concerns around the cost of continuing such a program remain, especially costs billed to Medicaid for continued addiction treatment and increased nonaddiction health care use after release.

Health care use among people with OUD has risen in tandem with rising overdoses.[19–21] Nationally, from 2005 to 2014 opioid-related inpatient admissions increased by 64 percent.[22] From 2001 to 2012 total inpatient costs associated with hospital admission for heroin and prescription opioid overdose rose by $178 million and $727 million per year, respectively.[23] Many of the health care costs related to OUD are paid by Medicaid, especially in states that expanded Medicaid coverage.[24]

Although it is unknown what proportion of those health care costs are driven by people released from prisons and jails, providing medications for OUD for the incarcerated population may increase postrelease health system costs and Medicaid expenditures.[25–27] Increased costs could come from the continuation of medications for OUD in the community after release and increased access to treatment for previously undiagnosed conditions such as hepatitis C. There have been no studies to date of the impact on community health care spending of a medications for OUD program in a statewide correctional system. In this study we aimed to examine the change in community health care costs associated with starting a medications for OUD treatment program in a correctional setting.

Study Data And Methods

We conducted a retrospective cohort analysis of Medicaid beneficiaries who received medications for OUD while incarcerated by RIDOC. Using administrative claims data, we evaluated the use of and payments for health care services across inpatient and outpatient settings both before and after exposure to the correctional system's medications for OUD program.

DATA SOURCES Our analysis included linked data from two primary sources: Data on people who received medications for OUD while incarcerated came from RIDOC, and data on paid Medicaid claims came from the Rhode Island Executive Office for Health and Human Services. Data from RIDOC included demographics and dates of any commitments and releases from January 1, 2014, to December 31, 2018, of people who participated in the medications for OUD program while incarcerated. Information on the type of medications for OUD received was obtained from RIDOC. Data from the Rhode Island Executive Office for Health and Human Services contained information on paid Medicaid claims, including the dollar amount. The two data sources were linked using matching at the individual level, based on unique identifiers of name, date of birth, and Social Security number. The data were linked by the Rhode Island Executive Office for Health and Human Services and deidentified before being provided to the research team for analysis. The Rhode Island Department of Health provided information on overdose deaths among participants in the RIDOC medications for OUD program.

STUDY SAMPLE People were included in the cohort if they met the following conditions: received medications for OUD while incarcerated by RIDOC from November 2016, when the comprehensive medications for OUD program began, through December 2018; had been incarcerated by RIDOC at least once after January 2014 and before the incarceration event when they received medications for OUD; and were enrolled in Rhode Island Medicaid at any point from January 1, 2014, to December 31, 2018. Our inclusion criteria were structured to include people who had a release after receiving medications for OUD while incarcerated by RIDOC and who had a prior release from RIDOC when

they had not received medications for OUD, which we could use as a comparison. To reflect the high rate of churning of people in and out of the correctional system, leading to frequent episodes of Medicaid suspension, we included participants with any Medicaid enrollment. Participants were excluded if they had spent fewer than ninety days in the community in either the period before or the period after being exposed to the medications for OUD program.

STUDY VARIABLES Demographics, including sex, age, race/ethnicity, type of medications for OUD received, and incarceration history (days incarcerated, number of times committed, and days in the community), were obtained from RIDOC. Medicaid enrollment information was obtained from the Rhode Island Executive Office for Health and Human Services.

OUTCOMES Study outcomes included measures of health care use and associated costs. We measured acute health care use (inpatient medical admissions, inpatient addiction treatment, and emergency department [ED] visits), use of nonacute outpatient services, and pharmacy use.

We separated inpatient claims into two groups: claims from facilities that provide inpatient care for acute medical care and claims from facilities that provide inpatient services for primarily addiction services (such as substance use detoxification or rehabilitation). We defined inpatient claims for addiction services as those that had a billing code for those services (that is, Healthcare Common Procedure Coding System codes H0004, H0008–14, H0017–19, or T2048) or were billed by a facility that exclusively provides addiction services. We counted length-of-stay in days between admission and discharge. All professional claims during the admission were assumed to be associated with services provided during the inpatient stay.

ED use was determined from both professional and facility claims, using billing codes associated with these services (that is, Healthcare Common Procedure Coding System codes 99281–5). To avoid double counting ED visits, we assumed that all professional and facility claims from the same day were associated with a single visit. This method is consistent with other work using administrative claims to identify ED use.[28]

Nonacute outpatient services were defined as professional services claims not associated with a claim for acute health care services as defined above. Pharmacy use was defined as outpatient pharmacy claims and was further categorized into the following groups: medications for OUD (buprenorphine and naltrexone), hepatitis C antivirals, HIV antivirals, cancer chemotherapeutics, controlled substances (opioids and benzodiazepines), and psychiatric medications (for example, antipsychotics, antidepressants, and mood stabilizers). Of note, methadone prescribed via an outpatient opioid treatment program was not included, as it is not billed as a pharmacy claim.

COSTS To calculate the costs paid by the Rhode Island Executive Office for Health and Human Services for Medicaid claims, we summed payments of all claims during the whole study period, in periods before and after exposure to the RIDOC medications for OUD program. We similarly summed payments for claims for inpatient services, ED visits, nonacute outpatient services, and pharmacy. Payments for claims for ED services that subsequently resulted in an inpatient admission were included in costs for the inpatient stay. As the focus of our study was on postrelease community health care use, any Medicaid claims paid for services provided when a person was in the custody of RIDOC were excluded from our analysis. We inflation-adjusted all dollar amounts to 2014 dollars, using the yearly average Consumer Price Index for All Urban Consumers for the year when the costs were incurred.[29]

ANALYSIS We limited our analysis to periods after release when people were in the community and not incarcerated. The total time in the community was split into two periods: a sum of all postrelease periods before first receipt of medications for OUD in RIDOC and a sum of all postrelease periods after first receipt of medications for OUD in RIDOC. We limited our analysis to days between releases and subsequent commitment in RIDOC, the person's death caused by overdose, or the end of the study period (December 31, 2018). If a person was incarcerated multiple times, all periods between incarcerations were included. To compare health care use after a similar exposure (that is, release from corrections), we excluded the time before the first incarceration in the study period. We did this to account for the fact that the rate of health care use in this population is not constant and is particularly high in the postrelease period.[30] To normalize health care use across individuals with different amounts of time in the community, all outcomes were analyzed as a per year rate.

We calculated individual per year service use and costs by dividing the summed Medicaid payments by the number of years in the community. Given the difference in time in the community between participants and to account for the period with particularly high health care use immediately after release,[30] we performed subsequent secondary analyses narrowing the time horizon of analysis to three months and twelve months after release from RIDOC custody. Finally, we performed a secondary analysis excluding people with fewer than 180 days of Medicaid enroll-

ment in either the pre or the post period.

We compared means in individual use per year using a paired *t*-test. Although the distributions of per year costs were non-normal and right-skewed, the approach of reporting the mean, and not the median, is in line with our goal of estimating per member costs for budgetary and policy-making decisions.[31] Given our sample size, the paired *t*-test will be robust to non-normal distribution of our outcomes. All statistical analyses were performed using Stata SE, version 15.2. A two-sided p value of <0.05 was considered statistically significant, and 95% confidence intervals were estimated using bootstrap techniques. The study protocol was approved by the Brown University Institutional Review Board and the RIDOC Medical Research Advisory Group.

LIMITATIONS Extrapolation of our findings around changes in Medicaid costs attributable to exposure to a correctional medications for OUD program is limited by the nature of our analysis. Randomization was neither ethically nor practically feasible. In addition, there was no systematic screening of people for OUD in RIDOC before the start of the medications for OUD program. Also, given the pre-post structure of our analysis, we could not account for secular trends in health care use. For these reasons, we cannot attribute causality to receipt of medications for OUD in a correctional setting for the changes in health care costs we observed.

When examining a person's health care costs as they age, we would expect, on average, costs to increase, although our study was limited to four years of claims and we would not expect this length of time to have a large effect.[32] Also, we could account only for overdose deaths and not all-cause deaths among included people, so the yearly rate of health care use may be an underestimation. We could not include health care use and costs paid for by entities other than Rhode Island Medicaid, although 89 percent of participants who otherwise met our inclusion criteria had medical services billed to Rhode Island Medicaid during the study period, reflecting high rates of Medicaid enrollment.

Despite these limitations, we believe that the trajectory of health care costs before and after exposure to a corrections-based medications for OUD program is relevant for policy makers. Our study design mirrors previous studies of initiation of these medications in noncorrectional settings.[26,27,33]

Study Results

DEMOGRAPHICS AND INCARCERATION PATTERNS We identified 930 people who met the criteria of being incarcerated by the Rhode Island Department of Corrections at least once before being exposed to its medications for OUD program and at least once after exposure to the program during the study period. Of these, we excluded seventy-nine people because they could not be matched with the Medicaid database and forty-four people because they did not have at least ninety days in the community before and after exposure to the medications for OUD program. Among the 930 people who met the incarceration criteria, there was no difference in age ($p = 0.51$) or race/ethnicity ($p = 0.37$) between those included and those excluded in the final sample, but those excluded were more likely to be men ($p = 0.04$). Our final sample included 807 people.

Among these people, the initial medications for OUD exposure in the RIDOC program was as follows: 444 people received methadone, 346 received buprenorphine, and 17 received injectable naltrexone. The demographics of people included in the population are in exhibit 1.

On average, our study population was incarcerated by RIDOC 5.9 times for a total of 313 days during the study period (exhibit 1). The average incarceration episode was 53 days, and of the 4,731 incarceration episodes that occurred in the study period, only 130 (2.8 percent) were longer than 365 days. On average, the incarceration episode when people first received medications for OUD in RIDOC was 91 days, with only 51 of the 807 (6.3 percent) participants being incarcerated longer than 365 days (data not shown). People had an average total of 1,233 days in the community after release from RIDOC, with an average of 716 days occurring before receipt of medications for OUD and an average of 518 days occurring after receipt of medications for OUD (exhibit 1). On average, people were enrolled in Medicaid for 921 days in the pre period and 649 days in the post period (exhibit 1). There were eleven fatal overdoses among included participants in the period after exposure to the medications for OUD program (data not shown).

INPATIENT USE AND EMERGENCY DEPARTMENT VISITS During the whole period, 70 percent of included participants had an inpatient stay after release from RIDOC, with 56 percent having an inpatient medical admission and 49 percent having an inpatient stay for addiction treatment (data not shown). There were an average of 11.6 inpatient days per year, with 3.6 days per year of inpatient medical care and 8.0 days per year of inpatient addiction treatment (exhibit 2).

We found no statistically significant change in per year inpatient days before and after exposure to the RIDOC medications for OUD program

EXHIBIT 1

Demographics and incarceration patterns of people who received medications for opioid use disorder (MOUD) and were previously incarcerated by the Rhode Island Department of Corrections, January 2014–December 2018

	Number	Percent or SD
DEMOGRAPHICS		
Sex		
Male	602	74.6%
Female	205	25.4%
Mean age, years	36.0	8.8
Race/ethnicity		
Black	50	6.2%
White	640	79.3%
Other	117	14.9%
MOUD modality[a]		
Methadone	444	55.0%
Buprenorphine	346	42.9%
Naltrexone	17	1.8%
Mean Medicaid enrollment		
Pre-MOUD enrollment days	921	427
Post-MOUD enrollment days	345	345
INCARCERATION PATTERNS		
Mean days incarcerated	313	276
Mean no. of incarcerations	5.9	3.0
Pre–MOUD program exposure	3.4	2.2
Post–MOUD program exposure	2.5	1.8
Mean days in the community	1,233	327
Pre–MOUD program exposure	716	327
Post–MOUD program exposure	518	213

SOURCE Authors' analysis of linked data from Rhode Island Department of Corrections (RIDOC) and Rhode Island Executive Office of Health and Human Services. **NOTES** $N = 807$. SD is standard deviation. [a]MOUD modality first used for a person while incarcerated by RIDOC.

(12.9 versus 11.0 days per year; $p = 0.13$). We also saw no difference in days per year for inpatient medical care (3.7 days per year in both time periods; $p = 0.99$) or in days per year for inpatient addiction treatment (9.2 versus 7.3 days per year; $p = 0.09$). People averaged 2.8 ED visits per year during the entire study period. ED use decreased from 3.3 visits per year before program exposure to 2.3 visits per year after ($p < 0.001$) (exhibit 2).

CHANGES IN MEDICAID COSTS Overall, Medicaid paid $43,787,541 for health care services provided to the 807 study participants during the study period: $23,891,525 before exposure to the RIDOC medications for OUD program and $19,896,016 after exposure (data not shown). Accounting for the time when they were in the community, people used $15,948 per year of Medicaid services during the study period. There was no statistically significant difference in individual per year costs between periods before the program ($15,780 per year) and those after the program ($17,316 per year; $p = 0.15$) (exhibit 2).

Costs associated with inpatient admissions also did not change between periods before exposure to the medications for OUD program ($6,796 per year) and periods after program exposure ($7,076 per year; $p = 0.68$). This remained true when we looked at costs associated with inpatient medical admissions ($p = 0.54$) or inpatient addiction treatment ($p = 0.74$). However, costs associated with ED visits decreased from $1,898 per year before to $1,356 per year

EXHIBIT 2

Individual per year health care use and costs paid by Rhode Island Medicaid for people who received medications for opioid use disorder (MOUD) and were previously incarcerated by the Rhode Island Department of Corrections, January 2014–December 2018

	Overall (mean)	Before exposure to MOUD program (mean)	After exposure to MOUD program (mean)[a]
HEALTH CARE USE			
Inpatient admissions			
All admissions, days	11.6	12.9	11.0
Inpatient medical admissions, days	3.6	3.7	3.7
Inpatient addiction treatment, days[b]	8.0	9.2	7.3*
Emergency department visits[c]	2.8	3.3	2.3***
HEALTH CARE COSTS PAID BY MEDICAID			
All costs	$15,948	$15,780	$17,316
All inpatient costs	6,729	6,795	7,075
Inpatient medical admissions	4,344	4,335	4,716
Inpatient addiction treatment[b]	2,385	2,460	2,359
Emergency department[c]	1,631	1,898	1,356***
Nonacute outpatient services	3,556	3,265	3,878***
Pharmacy	1,968	1,560	2,508***

SOURCE Authors' analysis of linked data from Rhode Island Department of Corrections and Rhode Island Executive Office of Health and Human Services. **NOTES** Sample size is in exhibit 1. Costs are inflation-adjusted to 2014 dollars. [a]Significance reflects a paired *t*-test comparing individual rates between pre-MOUD periods and post-MOUD periods. [b]Limited to inpatient substance use detoxification or rehabilitation services. [c]Does not include costs or visits that resulted in inpatient hospitalizations. *$p < 0.10$ ***$p < 0.01$

after exposure to the medications for OUD program ($p < 0.001$) (exhibit 2).

Medicaid costs for nonacute outpatient services increased from $3,265 per year to $3,878 per year after exposure to the program ($p < 0.001$), and Medicaid costs for pharmacy claims increased from $1,560 per year before to $2,508 per year after exposure ($p = 0.002$) (exhibit 2). There was no change in the rate of pharmacy claims ($p = 0.26$), and when we analyzed claims by pharmaceutical categories, we found an increase in pharmacy claims for medications for OUD ($p = 0.01$) and hepatitis C antivirals ($p = 0.004$); a decrease in pharmacy claims for controlled substances ($p < 0.001$); and no change in pharmacy claims for HIV antivirals ($p = 0.73$), cancer chemotherapeutics ($p = 0.22$), or psychiatric medications ($p = 0.11$) (data not shown).

We conducted several secondary analyses. First, we limited our analysis to periods in the three-month window after release and to periods in the twelve-month window after release (exhibit 3). As in our primary analysis, inpatient days per year did not change before and after exposure to the medications for OUD program within the three-month ($p = 0.29$) or twelve-month ($p = 0.32$) window, and ED visits per year decreased within both the three-month ($p = 0.006$) and twelve-month ($p < 0.001$) windows.

Compared with the periods before exposure, overall costs per year increased in the period after exposure to the medications for OUD program in the three-month ($p = 0.02$) and twelve-month ($p = 0.05$) windows. This increase was driven by increases in nonacute outpatient services ($p < 0.001$) and pharmacy claims ($p = 0.006$). Costs for inpatient admissions did not change in the three-month ($p = 0.11$) or twelve-month ($p = 0.48$) window, and costs for ED visits decreased in the three-month ($p < 0.001$) and twelve-month ($p < 0.001$) windows.

There was no difference in our findings when we excluded people with fewer than 180 days of Medicaid coverage in the pre or post periods, as shown in the online appendix.[34]

Discussion

In our analysis of Medicaid claims before and after receipt of medications for OUD in the statewide correctional system in Rhode Island, we found that overall per year costs for health services after release to the community did not change. When we examined individual service types, the use of ED services decreased, the use of inpatient services did not change, and the use of nonacute outpatient services and pharmacy claims increased. Our findings provide additional context for the previously reported decrease in statewide opioid overdose mortality

EXHIBIT 3

Secondary analyses of individual per year health care use and costs paid by Rhode Island Medicaid for people who received medications for opioid use disorder (MOUD) and were previously incarcerated by the Rhode Island Department of Corrections, limited to first 3 and 12 months postrelease, January 2014–December 2018

	3-month window (n = 807)		12-month window (n = 477)	
	Pre-MOUD (mean)	Post-MOUD (mean)	Pre-MOUD (mean)	Post-MOUD (mean)
HEALTH CARE USE				
Inpatient admissions				
All admissions, days	16.4	18.8	13.2	11.9
Inpatient medical admissions, days	3.9	4.9	3.6	3.9
Inpatient addiction treatment, days[a]	12.6	13.9	9.5	8.0
Emergency department visits[b]	3.6	2.9***	3.4	2.4***
HEALTH CARE COSTS PAID BY MEDICAID				
All costs	$17,928	$22,140**	$16,200	$18,612**
All inpatient costs	7,693	9,584	6,914	7,429
Inpatient medical admissions	4,522	5,930	4,346	4,862
Inpatient addiction treatment[a]	3,171	3,654	2,568	2,567
Emergency department[b]	3,551	2,440***	1,896	1,392***
Nonacute outpatient services	1,075	1,551***	2,651	3,424***
Pharmacy	1,356	2,100*	1,608	2,580***

SOURCE Authors' analysis of linked data from Rhode Island Department of Corrections and Rhode Island Executive Office of Health and Human Services. **NOTES** "Pre-MOUD" refers to periods prior to MOUD program exposure; "post-MOUD" refers to periods following MOUD program exposure. Costs are inflation-adjusted to 2014 dollars. [a]Limited to inpatient substance use detoxification or rehabilitation services. [b]Does not include costs or visits that resulted in inpatient hospitalizations. *$p < 0.10$ **$p < 0.05$ ***$p < 0.01$

seen after the start of the Rhode Island medications for OUD program.[16,18]

Although there was no change in overall health services costs before and after exposure to the medications for OUD program, the shift from ED services to outpatient services and pharmacy claims is notable. First, the increase in pharmacy claims for medications for OUD may reflect increased engagement in community OUD treatment, which could partly explain the observed decrease in fatal overdoses.[18,35] Second, connection to outpatient services can lead to improved detection and treatment of chronic disease. Increased outpatient treatment may lead to short-term increased costs associated with treatment of diseases such as hepatitis C,[36] as we observed in our data.

Our data are relevant to jurisdictions planning to follow Rhode Island's example in expanding access to medications for OUD in correctional settings. Although Rhode Island's unified correctional system is different than those of most states, most of our study participants had shorter incarcerations similar to "jail" populations in other states. The total cost of a starting a correctional medications for OUD program on state budgets will include changes in costs for community health care use. Even our observed modest, non–statistically significant increase in costs was associated with a beneficial shift away from use of ED services to outpatient and pharmacy services.

Our findings are similar to those of other studies that analyzed changes in health care costs before and after exposure to medications for OUD in noncorrectional settings.[26,33] The individual costs we observed were similar to the costs in the period after medications for OUD initiation in noncorrectional settings, which ranged from $13,621 to $32,372 per year.[26,27,33] Also, similar to our study, these studies saw a shift of health care costs after medications for OUD initiation away from claims associated with acute services (hospitalizations or ED visits) toward claims associated with outpatient and pharmacy services. In those studies, the cost shifting after initiation of medications for OUD led to either no change in overall costs,[33] as in our study, or an increase in costs.[26] It is also worth noting that in studies that followed people with OUD who did not receive medications for OUD, such people have higher health care costs than those initiated on medications for OUD.[25,26,33]

Our results highlight how correctional systems and the health care services they provide are part of the larger treatment system for OUD. Although we selected a particularly high-risk group, it is notable that, on average, they were incarcerated almost six different times during the four years covered by our study. Given their frequent interaction with the criminal justice system, offering evidence-based treatment of OUD in correctional settings serves as an important opportunity to initiate addiction treatment. ■

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