Supplementary Appendix

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This appendix has been provided by the authors to give readers additional information about the work.

Appendix: Racial Inequality in Medications for Opioid Use Disorder

Michael L Barnett MD MS, Ellen Meara PhD, Terri Lewinson PhD, Brianna Hardy BS, Deanna Chyn MPH, Moraa Onsando MD MPH, Haiden A. Huskamp PhD, Ateev Mehrotra MD MPH, Nancy E Morden MD MPH

Supplement Methods

Data and Cohort

The sample restrictions used to form the study cohort are illustrated in Figure S1, a flowchart showing the number of beneficiaries excluded for each exclusion criterion. We used Medicare data for a national, random 40% sample of fee-for service beneficiaries eligible for Medicare due to disability with an opioid use disorder (OUD) related index event, (overdose, rehabilitation/detoxification, or injection-related infection) (see Table S1) from July 1, 2016-June 30, 2019. In a small number of cases, a beneficiary qualified with more than one index event type occurring on the same index date. Beneficiaries needed to be fully enrolled in Parts A (inpatient), B (physician services and outpatient), and D (prescription) and not enrolled in Medicare Advantage from 180 days before their index event through the 30 days following their index event.

We excluded beneficiaries who did not have a Research Triangle Institute code of Black (or African American), Non-Hispanic White, or Hispanic (unknown race for 554 beneficiaries with 883 events in the final study sample).[1,2] We excluded other race groups because of misclassification risk and small sample sizes. To enable inclusion of state (due to the importance of state policies on controlled substances, Medicaid eligibility, and other factors that could influence buprenorphine access),we limited the cohort to beneficiaries with a valid U.S. ZIP code. We excluded hospice patients using the "hos_stays" variable in the Cost and Utilization Segment of the Master Beneficiary Summary File.[3] We excluded beneficiaries who did not survive at least 30 days post their index event due to an insufficient follow-up observation period. A beneficiary could only contribute one event in a 12-month rolling period; subsequent index events within that 12-month period were removed. We excluded long-term opioid recipients, defined as beneficiaries with 90 or more days supply of opioid in 180 days prior to the index event.

Statistical Analysis

The unit of analysis for all models was at the beneficiary index event-level. If a beneficiary lost eligibility or died they were treated as censored and set to missing in the regression analyses. This resulted in 2,804 events and 2,531 beneficiaries being censored in our analyses. Thus, estimates of any medication receipt, any ambulatory visit, overdose event, and number of emergency department visits or admissions within 180 days following an index event included 25,904 events experienced by 23,370 beneficiaries in our cohort.

Our primary models estimated receipt of medication for opioid use disorder (MOUD). We estimated the percent of beneficiaries receiving a medication within 180 days of an index event. To do this, for each medication (buprenorphine, naloxone, naltrexone), we fit logistic regression models of the following form:

$$h\big(E(Y_{iks})\big) = \beta_0 + \beta_1 Black_i + \beta_2 Hispanic_i + \beta_3' State_s + \beta_4' Covariates_{ik} \quad (1)$$

where Y indicates whether individual i residing in state filled a prescription (e.g. for buprenorphine) in the 180 days following index event k, and *Black* indicates the individual is non-Hispanic and Black, *Hispanic* indicates the individual is of Hispanic or Latino ethnicity, $State_s$ is a vector of 50 indicators for state of residence (California is reference state), and $Covariates_{ik}$ is a vector of covariates that may vary at the individual index event level.

Covariates include a continuous measure of age in years, female sex (male reference), chronic condition count out of 60 Chronic Condition Warehouse (CCW) conditions from the base CCW file and the "Other Chronic and Disabling Conditions" file (categorized as 0, 1-2, 3-5, and 6+, with 0 as reference), three indicators for index event type (inpatient detoxification or rehabilitation center, opioid overdose, or opioid related infection). Because some individuals met criteria for more than one index event type, we include all three index types in the models. We used parameter estimates from these models to present adjusted rates (and 95% confidence intervals) of MOUD receipt within each racial and ethnic group, and to estimate pairwise differences (Black-White, Black-Hispanic, Hispanic-Black) adjusted for age, sex, comorbidity count, and state of residence. Reported 95% confidence intervals reflect Huber-White adjusted standard errors to account for the correlation of observations within state of residence. For continuous outcomes, we used a linear regression model with the same covariates shown in equation (1). We calculated adjusted means for each outcome separately for Black, White, and Hispanic beneficiaries, and we calculated adjusted mean differences of Black-White, Black-Hispanic, and Hispanic-White beneficiaries. For each of these models, we compare estimates with and without controlling for state of residence to compare mean rates of MOUD receipt (and differences by race and ethnicity) when we compare beneficiary MOUD receipt within a state, since Medicaid and other regulations governing the prescription and dispensing of controlled substances vary at the state level. The results of models estimating MOUD appear in the manuscript in Table 2.

Medication Receipt Measures (Table 2) All evaluated in the 180 days following the index event	**Health Care Utilization Measures (Tables 3, S11) All evaluated in the 180 days following the index event**
Logistic (Binary Outcomes)	**Logistic (Binary Outcomes)**
Buprenorphine fill	Any E&M visit
Buprenorphine Days supply greater than or equal to 150	Any PCP E&M visit
Naloxone fill	Any E&M visit for addiction treatment
Naltrexone fill	Any E&M visit for behavioral health treatment
Opioid Analgesic fill	Any ED visit
Benzodiazepine fill	Any Acute care admission
Linear (Continuous Outcomes)	Any overdose event
Buprenorphine Days supply received	**Linear (Continuous Outcomes)**
Naloxone Days Supply	Number of E&M visits
Naltrexone Days Supply	Number of PCP E&M visits
Opioid Analgesic Days Supply	Number of EM visits for addiction treatment
Benzodiazepine Days Supply	Number of ED visits
	Number of Acute care admissions
	Number of overdose events
E & M is evaluation and management visit. PCP is primary care provider. ED is emergency department.	

Secondary Analyses
We conducted a series of secondary analyses in the paper to understand differences by sex in MOUD receipt, fills for risky prescriptions (opioid analgesics and benzodiazepines) and health care utilization measures as shown in the table of outcomes above.

1) **Outcomes by race and sex differences (Table S7)**
We estimate models like those in equation (1), but we added two terms for Black*female and Hispanic*female to the model to permit estimates of adjusted rates of MOUD and differences in MOUD by sex and race and ethnicity. These models were estimated for each outcome below.

Outcomes
- Any buprenorphine fill receipt in the 180 days post index event
- Any naloxone fill receipt in the 180 days post index event
- Any naltrexone fill receipt in the 180 days post index event
- Any opioid analgesic receipt in the 180 days post index event
- Any benzodiazepine receipt in the 180 days post index event

1) **Outcomes according to receipt of MOUD prior to index event (Table S8)**
In Table S8, we estimated models of MOUD receipt within 180 days of index event like those described in equation (1), but we stratified the sample according to whether a beneficiary received had received buprenorphine in the 90 days prior to the index event.

2) **MOUD receipt over time (Table S10)** displays the exact quarterly rate of MOUD receipt for Black and, separately, for White beneficiaries in each quarter from 2016 Q2 through 2019 Q2.

3) **Health care utilization and health outcomes (Tables 3 and S11)** present estimates from models like those in equation (1) but changing the dependent variable for utilization outcomes (evaluation and management visits, ED visits, inpatient admissions, opioid overdose) described in Table S4.

4) **Stratifying medication receipt according to attribution to a Medicare Shared Savings Plan (Table S12)**
To assess whether beneficiaries receiving primary care from an accountable care organization were more likely to receive MOUD, and to assess whether MOUD receipt was more common or more equitable by race and ethnicity among ACO attributed beneficiaries, we stratified the sample by attribution status in a Medicare Shared Savings Program in the year of the index event and computed rates of MOUD receipt. Attribution to a Medicare Shared Savings Program is drawn from the Centers for Medicare and Medicaid Medicare Shared Savings Program Accountable Care Organizations (ACO) Beneficiary-level file. Receipt of Medication was measured within 180 days before (pre-event drug receipt) and up to 180 days following a qualifying index event. All measures come from the Medicare Part D Prescription Drug Event file. Beneficiaries in a Medicare Shared Savings Program were no more likely to receive MOUD, and racial and ethnic differences in MOUD receipt were similar in magnitude comparing beneficiaries who were and were not attributed to an MSSP.

Sensitivity Analyses

1) **Accounting for potential benefit design differences across Part D prescription drug plans (Table S13)**
To assess whether enrollment in different Part D prescription drug plans across race and ethnicity groups could explain differences in buprenorphine receipt, we estimated models in which we controlled for the Part D Plan in which a beneficiary was enrolled. These "Plan" fixed effects replaced the "state of residence" fixed effects that were in equation (1), so that we estimated:

$$h\left(E\left(Y_{ikj}\right)\right) = \beta_0 + \beta_1 Black_i + \beta_2 Hispanic_i + \beta_3' PartDPlan_j + \beta_4' Covariates_{ik} \quad (2)$$

In these models, 95% confidence intervals reflected Huber-White standard errors adjusted for correlation of observations within the Part D Plan Contract.

Outcomes
- Any buprenorphine fill receipt in the 180 days post index event
- Any naloxone fill receipt in the 180 days post index event
- Any naltrexone fill receipt in the 180 days post index event
- Any opioid analgesic receipt in the 180 days post index event
- Any benzodiazepine receipt in the 180 days post index event

2) **Mortality within 180 days of index event (Table S14)** presents the mortality rate for each race and ethnicity group within 180 days of an index event. These calculations include individuals who died within 30 days of the index event, otherwise excluded from the main analyses presented in the paper Tables 1-3 and Figure 1.

3) **Testing results including beneficiaries who died within 30 days (Table S15).**
To be sure that decedents did not bias our estimates of buprenorphine receipt by race, we relaxed the requirement that beneficiaries survive 30 days after an OUD-related index event and computed crude rates of receipt by race and ethnicity and adjusted two-way differences for measures of any medication receipt within 180 days. We used the same methods described above to estimate equation (1). For each medication (buprenorphine, naltrexone, naloxone), decedents were assigned a value of 1 for "any buprenorphine receipt in 180 days" if they had a fill after the index event and 0 otherwise.

4) **Sensitivity of results to missing methadone receipt** (**Table S16**).
Although Medicare did not reimburse methadone during our study period, the program started to reimburse methadone dispensed at licensed Opioid Treatment Programs starting January 1, 2020. Using an independent 20% sample of fee for service claims, we created a cohort of index events (overdose, rehabilitation/detoxification, or injection-related infection), applying the same methods described above and in Figure S1 and Tables S1 for index events from 2020-2021. As defined above, we created measures of Part D fills for buprenorphine and replicated estimates of any buprenorphine receipt within 180 days like those presented in Table 2 of the manuscript and Table S9 of the appendix, but for this 2020-2021 sample. We added to this measures of methadone administered or dispensed by licensed Opioid Treatment Programs and, a measure of any buprenorphine or methadone receipt within 180 days which included pharmacy fills for

buprenorphine administered or dispensed by a licensed Opioid Treatment Program based on procedure codes listed in Table S3.

In this sample of beneficiaries with 2020 or 2021 index events, we computed three outcomes by race and ethnicity: any buprenorphine pharmacy fill within 180 days of index event, any methadone claim from an opioid treatment program within 180 days of index event, and any buprenorphine or methadone receipt from a pharmacy or opioid treatment program within 180 days of index event. The first three columns of Table S16 present crude means for each of these outcomes by race and ethnicity. The second three columns of Table S16 present adjusted mean differences (Black-White), (Hispanic-White), (Black-Hispanic) in each outcome based on logistic regression models adjusted for age, sex, index event, and state of residence, with clustered standard errors at the state level.

Figure S1: Cohort Flow Diagram

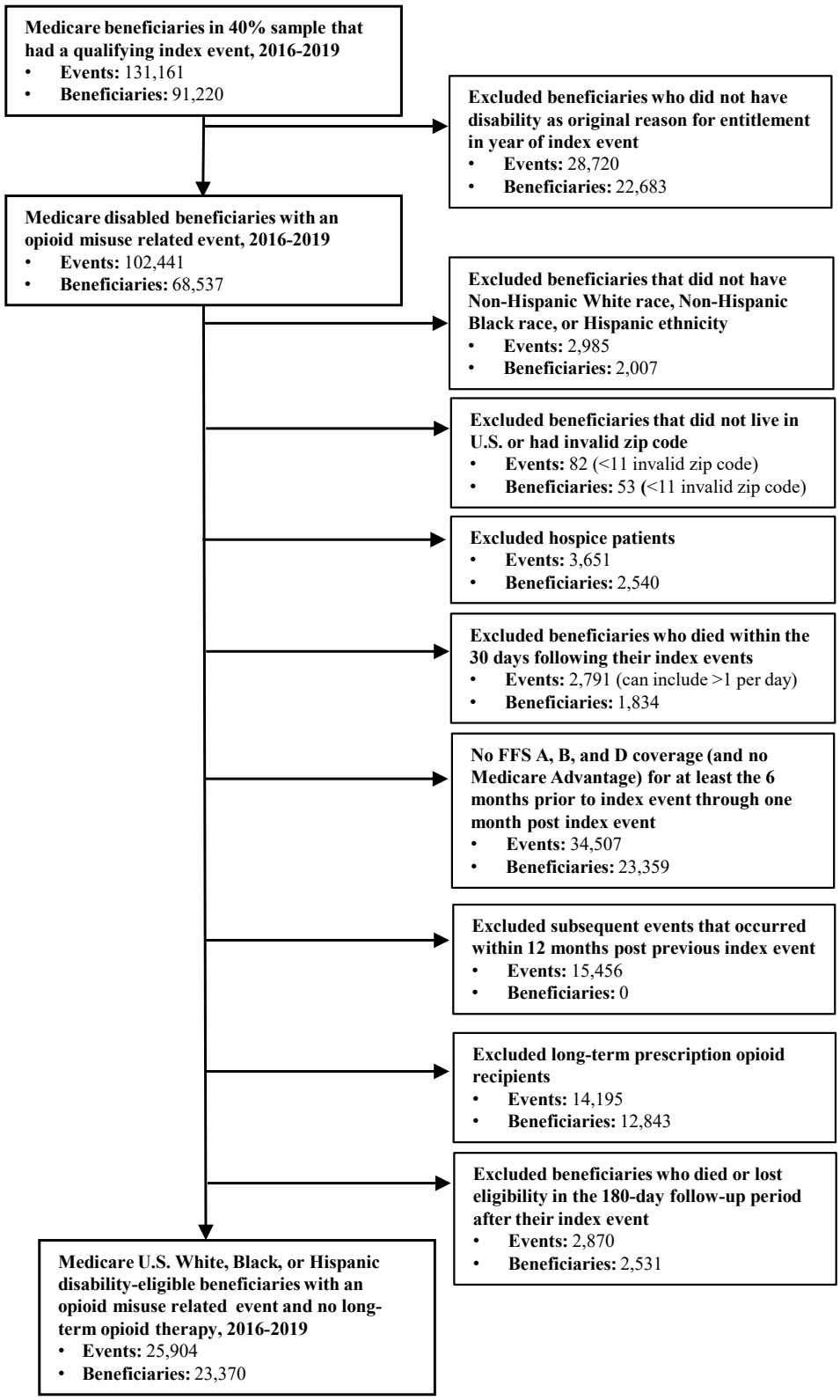

Table S1A-C: Definitions for OUD- Related Index Events

A. Non-Fatal Opioid Overdose	
ICD-10	T40.0X1A, T40.0X1D, T40.0X1S, T40.0X2A, T40.0X2D, T40.0X2S, T40.0X3A, T40.0X3D, T40.0X3S, T40.0X4A, T40.0X4D, T40.0X4S, T40.1X1A, T40.1X1D, T40.1X1S, T40.1X2A, T40.1X2D, T40.1X2S, T40.1X3A, T40.1X3D, T40.1X3S, T40.1X4A, T40.1X4D, T40.1X4S, T40.2X1A, T40.2X1D, T40.2X1S, T40.2X2A, T40.2X2D, T40.2X2S, T40.2X3A, T40.2X3D, T40.2X3S, T40.2X4A, T40.2X4D, T40.2X4S, T40.3X1A, T40.3X1D, T40.3X1S, T40.3X2A, T40.3X2D, T40.3X2S, T40.3X3A, T40.3X3D, T40.3X3S, T40.3X4A, T40.3X4D, T40.3X4S, T40.4X1A, T40.4X1D, T40.4X1S, T40.4X2A, T40.4X2D, T40.4X2S, T40.4X3A, T40.4X3D, T40.4X3S, T40.4X4A, T40.4X4D, T40.4X4S
Revenue	0450, 0451, 0452, 0456, 0459, 0981
Note: The patient needed to have an opioid overdose diagnosis in an inpatient setting or an opioid overdose diagnosis with a revenue center code for an emergency department visit to be included in cohort for non-fatal opioid overdose.	
B. Injection Drug-Use Related Infection	
Phlebitis	
ICD-10	I80.1*-I80.9*
Abscess and/or Cellulitis	
ICD-10	G06.1, G06.2, L02.01, L02.11, L02.12, L02.13, L02.211, L02.212, L02.213, L02.214, L02.215, L02.216, L02.219, L02.221, L02.222, L02.223, L02.224, L02.225, L02.226, L02.229, L02.231, L02.232, L02.233, L02.234, L02.235, L02.236, L02.239, L02.31, L02.32, L02.33, L02.411, L02.412, L02.413, L02.414, L02.415, L02.416, L02.419, L02.421, L02.422, L02.423, L02.424, L02.425, L02.426, L02.429, L02.431, L02.432, L02.433, L02.434, L02.435, L02.436, L02.439, L02.91, L03.011, L03.012, L03.019, L03.021, L03.022, L03.029, L03.031, L03.032, L03.039, L03.041, L03.042, L03.049, L03.111, L03.112, L03.113, L03.114, L03.115, L03.116, L03.119, L03.121, L03.122, L03.123, L03.124, L03.125, L03.126, L03.129, L03.212, L03.221, L03.222, L03.311, L03.312, L03.313, L03.314, L03.315, L03.316, L03.317, L03.319, L03.321, L03.322, L03.323, L03.324, L03.325, L03.327, L03.329, L03.811, L03.818, L03.891, L03.898, L03.390, L03.391, L98.3
Hepatitis C	
ICD-10	B17.1, B18.2, Z22.52
Infectious Athritis	
ICD-10	M00*
Infectious Endocarditis	
ICD-10	I33.0, I33.9, I38, I39
PLUS Emergency Department Visit Revenue Code for Outpatient Setting	
Revenue	0450-0452, 0456, 0459, 0981
Note: The patient needed to have one of the above infections in an inpatient setting or an infection with a revenue center code for emergency department visit. The patient additionally needed to have a diagnosis	

for Opioid Use Disorder (ICD10: F11.1*) on service date or 30 days prior to be included in cohort for inpatient detox or rehabilitation.

C. Inpatient Detox/Rehabilitation Treatment Center	
≥1 of Following Revenue ICD-10 Procedure Codes	
Revenue Code	0116, 0126, 0136, 0146, 0156, 0118, 0128, 0138, 0158,
ICD-10	HZ*
PLUS ≥ 1 of Following ICD-10 Diagnosis Codes	
ICD-10	F11*

Note: Patient needed to additionally have a diagnosis for Opioid Use Disorder (ICD10: F11.1*) on service date or 30 days prior to be included in cohort for inpatient detox or rehabilitation.

Index events adapted definitions from Larochelle MR, Wakeman SE, Ameli O, Chaisson CE, McPheeters JT, Crown WH, Azocar F, Sanghavi DM. Relative Cost Differences of Initial Treatment Strategies for Newly Diagnosed Opioid Use Disorder: A Cohort Study. *Medical Care*. 2020 Oct;58(10):919-926.[4]

Table S2: List of Generic Ingredients to Define Drug Classes

Medication Class	Generic Ingredient
Opioid analgesic	alfentanil, butorphanol, codeine, dezocine, dihydrocodeine, fentanyl, hydrocodone, hydromorphone, levomethadyl, levorphanol, meperidine, methadone, morphine, nalbuphine, opium, oxycodone, oxymorphone, paregoric, pentazocine, propoxyphene, remifentanil, sufentanil, tapentadol, tramadol
Medications for opioid use disorder (MOUD)	buprenorphine, naloxone, naltrexone
Benzodiazepines	alprazolam, chlordiazepoxide, clobazam, clonazepam, clorazepate, diazepam, estazolam, flurazepam, halazepam, lorazepam, midazolam, oxazepam, quazepam, temazepam, triazolam

Table S3: Definitions for MOUD Received from Opioid Treatment Programs

Medication	CPT Codes
Methadone	G2067, G2078
Buprenorphine	G2068-G2072, G2079

Note: Medication Measures pulled from outpatient, carrier, inpatient, and skilled nursing facility Medicare claim files

Table S4A-H: Healthcare Utilization and Adverse Outcome Definitions

A. Evaluation & Management Visit	
CPT codes	99201-99205, 99211-99215, G0402, G0438, G0463
Note: In the 180 days following qualifying index event. An NPI could contribute one event per patient per day for visit counts.	

B. Evaluation & Management Visit with a Primary Care Provider	
CPT codes (E&M)	99201-99205, 99211-99215, G0402, G0438, G0463
PCP Provider Number	Used attending national provider identifier (NPI) and MD-PPAS files to identify, based on NPI whether provider specialty was family practice (08), general practice (01), internal medicine (11), or geriatric medicine (38).
Note: In the 180 days following qualifying event. NPI could contribute one event per patient per day for visit counts.	

C. Evaluation & Management Visit for Addiction Treatment (Primary Diagnosis of Drug, Alcohol or Opioid Use Disorder)	
CPT codes (E&M)	99201-99205, 99211-99215, G0402, G0438, G0463
ICD-10 (Drug Use Disorder)	F11.10, F11.120, F11.121, F11.122, F11.129, F11.14, F11.150, F11.151, F11.159, F11.181, F11.182, F11.188, F11.19, F11.20, F11.220, F11.221, F11.222, F11.229, F11.23, F11.24, F11.250, F11.251, F11.259, F11.281, F11.282, F11.288, F11.29, F11.90, F11.920, F11.921, F11.922, F11.929, F11.93, F11.94, F11.950, F11.951, F11.959, F11.981, F11.982, F11.988, F11.99, F12.10, F12.120, F12.121, F12.122, F12.129, F12.150, F12.151, F12.159, F12.180, F12.188, F12.19, F12.20, F12.220, F12.221, F12.222, F12.229, F12.250, F12.251, F12.259, F12.280, F12.288, F12.29, F12.90, F12.920, F12.921, F12.922, F12.929, F12.950, F12.951, F12.959, F12.980, F12.988, F12.99, F13.10, F13.120, F13.121, F13.129, F13.14, F13.150, F13.151, F13.159, F13.180, F13.181, F13.182, F13.188, F13.19, F13.20, F13.220, F13.221, F13.229, F13.230, F13.231, F13.232, F13.239, F13.24, F13.250, F13.251, F13.259, F13.26, F13.27, F13.280, F13.281, F13.282, F13.288, F13.29, F13.90, F13.920, F13.921, F13.929, F13.930, F13.931, F13.932, F13.939, F13.94, F13.950, F13.951, F13.959, F13.96, F13.97, F13.980, F13.981, F13.982, F13.988, F13.99, F14.10, F14.120, F14.121, F14.122, F14.129, F14.14, F14.150, F14.151, F14.159, F14.180, F14.181, F14.182, F14.188, F14.19, F14.20, F14.220, F14.221, F14.222, F14.229, F14.23, F14.24, F14.250, F14.251, F14.259, F14.280, F14.281, F14.282, F14.288, F14.29, F14.90, F14.920, F14.921, F14.922, F14.929, F14.94, F14.950, F14.951, F14.959, F14.980, F14.981, F14.982, F14.988, F14.99, F15.10, F15.120, F15.121, F15.122, F15.129, F15.14, F15.150, F15.151, F15.159, F15.180, F15.181, F15.182, F15.188, F15.19, F15.20, F15.220, F15.221, F15.222, F15.229, F15.23, F15.24, F15.250, F15.251, F15.259, F15.280, F15.281, F15.282, F15.288, F15.29, F15.90, F15.920, F15.921, F15.922, F15.929, F15.93, F15.94, F15.950, F15.951, F15.959, F15.980, F15.981, F15.982, F15.988, F15.99, F16.10, F16.120, F16.121, F16.122, F16.129, F16.14, F16.150, F16.151, F16.159, F16.180, F16.183, F16.188, F16.19, F16.20, F16.220, F16.221, F16.229, F16.24, F16.250, F16.251, F16.259, F16.280, F16.283, F16.288, F16.29, F16.90, F16.920, F16.921, F16.929, F16.94, F16.950,

	F16.951, F16.959, F16.980, F16.983, F16.988, F16.99, F17.203, F17.208, F17.209, F17.213, F17.218, F17.219, F17.223, F17.228, F17.229, F17.293, F17.298, F17.299, F18.10, F18.120, F18.121, F18.129, F18.14, F18.150, F18.151, F18.159, F18.17, F18.180, F18.188, F18.19, F18.20, F18.220, F18.221, F18.229, F18.24, F18.250, F18.251, F18.259, F18.27, F18.280, F18.288, F18.29, F18.90, F18.920, F18.921, F18.929, F18.94, F18.950, F18.951, F18.959, F18.97, F18.980, F18.988, F18.99, F19.10, F19.120, F19.121, F19.122, F19.129, F19.14, F19.150, F19.151, F19.159, F19.16, F19.17, F19.180, F19.181, F19.182, F19.188, F19.19, F19.20, F19.220, F19.221, F19.222, F19.229, F19.230, F19.231, F19.232, F19.239, F19.24, F19.250, F19.251, F19.259, F19.26, F19.27, F19.280, F19.281, F19.282, F19.288, F19.29, F19.90, F19.920, F19.921, F19.922, F19.929, F19.930, F19.931, F19.932, F19.939, F19.94, F19.950, F19.951, F19.959, F19.96, F19.97, F19.980, F19.981, F19.982, F19.988, F19.99, F55.0, F55.1, F55.2, F55.3, F55.4, F55.8, O35.5XX0, O35.5XX1, O35.5XX2, O35.5XX3, O35.5XX4, O35.5XX5, O35.5XX9, T40.691A, T40.692A, T40.693A, T40.694A, O99.320, O99.321, O99.322, O99.323, O99.324, O99.325, P04.41, P04.49, P96.1, P96.2, T40.0X1A, T40.0X2A, T40.0X3A, T40.0X4A, T40.0X5A, T40.0X5S, T40.1X1A, T40.1X2A, T40.1X3A, T40.1X4A, T40.2X1A, T40.2X2A, T40.2X3A, T40.2X4A, T40.3X1A, T40.3X2A, T40.3X3A, T40.3X4A, T40.3X5A, T40.3X5S, T40.4X1A, T40.4X2A, T40.4X3A, T40.4X4A, T40.7X1A, T40.8X1A, T40.601A, T40.602A, T40.603A, T40.604A, T40.691A, T40.692A, T40.693A, T40.694A, T40.901A, T40.991A, Z71.41, Z71.42, Z71.51, Z71.52, Z71.6
ICD-10 (Alcohol Use Disorder)	F10.10, F10.120, F10.121, F10.129, F10.14, F10.150, F10.151, F10.159, F10.180, F10.181, F10.182, F10.188, F10.19, F10.20, F10.220, F10.221, F10.229, F10.230, F10.231, F10.232, F10.239, F10.24, F10.250, F10.251, F10.259, F10.26, F10.27, F10.280, F10.281, F10.282, F10.288, F10.29, F10.920, F10.921, F10.929, F10.94, F10.950, F10.951, F10.959, F10.96, F10.97, F10.980, F10.981, F10.982, F10.988, F10.99, G62.1, I42.6, K29.20, K29.21, K70.0, K70.10, K70.11, K70.2, K70.30, K70.31, K70.40, K70.41, K70.9, P04.3, Q86.0, T51.0X1A, T51.0X2A, T51.0X3A, T51.0X4A, Z13.89, Z71.41, Z71.42, Z71.51, Z71.52, Z71.6
ICD-10 (Opioid Use Disorder)	F11.10, F11.11, F11.120, F11.121, F11.122, F11.129, F11.14, F11.150, F11.151, F11.159, F11.181, F11.182, F11.188, F11.19, F11.20, F11.21, F11.220, F11.221, F11.222, F11.229, F11.23, F11.24, F11.250, F11.251, F11.259, F11.281, F11.282, F11.288, F11.29, F11.90, F11.920, F11.921, F11.922, F11.929, F11.93 ,F11.94, F11.950, F11.951, F11.959, F11.981, F11.982, F11.988, F11.99

Note: In the 180 days following qualifying event. An NPI could contribute one event per patient per day for visit counts. Chronic Condition Warehouse ICD-10 definitions used for alcohol use disorder, drug use disorder and opioid use disorder.

D. Evaluation & Management Visit with a Mental Health Provider	
CPT codes (E&M)	99201-99205, 99211-99215, G0402, G0438, G0463
Mental Health Specialty Code	Used attending national provider identifier (NPI) and MD-PPAS files to identify whether provider specialty was psychiatry (26), geriatric psychiatry (27), or addiction medicine (79).

Note: Within 180 days following qualifying event. An NPI could contribute one event per patient per day for visit counts.

E. Community Mental Health Center Visit	
Provider Number code (digits 3 and 4)	**14**, **46**, **47**, **49** https://resdac.org/sites/datadocumentation.resdac.org/files/Provider Number Table.txt
Revenue	05*, 0900-0919
Note: In the 180 days following of qualifying event. Up to one event per patient per day for visit counts.	

F. Emergency Department Visit	
Revenue	0450-0452, 0456, 0459, 0981
Note: Within 180 days following qualifying event.	

G. Acute Care Admission	
Provider Number ACH or CAH	
Provider Number (ACH)	**0***
Provider Number (CAH)	**13**
PLUS	
SSLSSNF (medpar)	Not equal to skilled nursing facility
Length of stay days	Less than or equal to 365 days
Special Unit	Not equal to null
OR Provider Number Indicates a Psychiatric Hospital	
Provider Number	**40**, **41**
Note: Within 180 days following qualifying event, MedPAR file used.	

H. Overdose Event

ICD-10	T40.0X1A, T40.0X1D, T40.0X1S, T40.0X2A, T40.0X2D, T40.0X2S, T40.0X3A, T40.0X3D, T40.0X3S, T40.0X4A, T40.0X4D, T40.0X4S, T40.1X1A, T40.1X1D, T40.1X1S, T40.1X2A, T40.1X2D, T40.1X2S, T40.1X3A, T40.1X3D, T40.1X3S, T40.1X4A, T40.1X4D, T40.1X4S, T40.2X1A, T40.2X1D, T40.2X1S, T40.2X2A, T40.2X2D, T40.2X2S, T40.2X3A, T40.2X3D, T40.2X3S, T40.2X4A, T40.2X4D, T40.2X4S, T40.3X1A, T40.3X1D, T40.3X1S, T40.3X2A, T40.3X2D, T40.3X2S, T40.3X3A, T40.3X3D, T40.3X3S, T40.3X4A, T40.3X4D, T40.3X4S, T40.4X1A, T40.4X1D, T40.4X1S, T40.4X2A, T40.4X2D, T40.4X2S, T40.4X3A, T40.4X3D, T40.4X3S, T40.4X4A, T40.4X4D, T40.4X4S
Revenue	0450, 0451, 0452, 0456, 0459, 0981

Note: The patient needed to have an opioid overdose diagnosis in an inpatient setting or during an emergency department visit. A patient could only contribute one opioid overdose event per day to avoid duplicate counts.

Table S5: Patient Characteristic Definitions and Data Sources

Patient Characteristic	Definition
Race and ethnicity	Research Triangle Institute definitions
Age	As of January 1st of Index Event Year
Sex	Female or Male
Low Income Subsidy	Any Part D low-income subsidy coverage in any month of study year
Dual Eligible	Any eligibility for Medicaid (partial or full benefits) during any month of the year
Long Term Care Resident	Pharmacy Service Type Code indicates Long-Term Care Pharmacy dispensed ≥50% of prescription fills in the six months prior to index-event.[7]
Comorbidities	Had chronic condition(s) at end of previous year
Prescription use in 6 months prior to index event (buprenorphine, naloxone, naltrexone, opioid analgesic, benzodiazepine)	Had at least one fill in the Prescription Drug Event file for one or more MOUD product in the six months prior to index event. See Table S2 drug list.

Note: All definitions are relative to the qualifying index event date. Comorbidities were measured using the 60 Chronic Conditions Warehouse Chronic condition categories, from 1999-2020 made available in the Master Beneficiary Summary file [5,6]

Table S6: Additional Patient Comorbidities by Race and Ethnicity

	Overall	Black	Hispanic	Non-Hispanic White
Beneficiaries (N)	23,370	3,524	1,858	17,988
Events (N)	25,904	3,937	2,105	19,862
Comorbidities				
Alzheimer's disease	0.79%	0.64%	1.14%	0.78%
Alzheimer's disease and related disorders or senile dementia	7.11%	7.26%	7.03%	7.08%
Anemia	29.04%	40.26%	29.36%	26.78%
Asthma	18.02%	22.56%	18.62%	17.05%
Atrial Fibrillation	3.39%	3.02%	2.09%	3.60%
Benign Prostatic Hyperplasia	4.30%	6.10%	4.80%	3.89%
Breast Cancer	1.03%	1.27%	0.57%	1.04%
Cataract	5.10%	5.36%	5.61%	4.99%
Chronic Kidney Disease	28.11%	39.12%	28.84%	25.85%
Chronic Obstructive Pulmonary Disease				
Colorectal Cancer	0.63%	0.84%	0.67%	0.58%
Diabetes	28.95%	39.01%	32.45%	26.58%
Endometrial Cancer	*	*	*	0.25%
Glaucoma	2.23%	3.71%	2.47%	1.91%
Heart Failure	16.75%	25.37%	15.72%	15.14%
Hip or pelvic fracture	*	0.43%	*	0.67%
Hyperlipidemia	29.90%	33.15%	26.22%	29.65%
Hypertension	52.93%	69.24%	48.17%	50.21%
Hypothyroidism	11.90%	7.21%	9.31%	13.11%
Ischemic Heart Disease	24.82%	32.16%	21.66%	23.70%
Lung Cancer	*	0.48%	*	0.59%
Osteoporosis	3.08%	1.75%	2.42%	3.42%
Prostate Cancer	*	1.30%	*	0.44%
Rheumatoid Arthritis	41.21%	44.25%	33.87%	41.38%
Stroke or Transient Ischemic Attack	3.86%	5.66%	3.42%	3.54%
ADHD, Conduct Disorders, and Hyperkinetic Syndrome	11.56%	4.50%	8.84%	13.25%
Anxiety Disorders	62.74%	47.45%	55.82%	66.51%
Autism Spectrum Disorders	*	*	*	0.32%
Traumatic Brain Injury and Nonpsychotic Mental Disorders due to Brain Damage	1.25%	0.53%	0.95%	1.42%
Cerebral Palsy	*	0.28%	*	0.31%
Cystic Fibrosis and Other Metabolic Developmental Disorders	1.82%	1.24%	2.38%	1.87%
Epilepsy	11.57%	8.94%	10.26%	12.23%
Sensory - Deafness and Hearing Impairment	2.56%	2.31%	2.28%	2.64%
Intellectual Disabilities and Related Conditions	1.00%	1.07%	0.86%	1.00%
Learning Disabilities	*	0.56%	*	0.46%
Leukemias and Lymphomas	1.08%	1.14%	0.90%	1.09%

Liver Disease Cirrhosis and Other Liver Conditions excluding Hepatitis	14.25%	13.36%	19.14%	13.91%
Migraine and other Chronic Headache	12.25%	7.82%	8.84%	13.48%
Mobility Impairments	4.81%	7.21%	5.23%	4.28%
Multiple Sclerosis and Transverse Myelitis	1.25%	1.04%	0.67%	1.35%
Muscular Dystrophy	*	*	*	0.15%
Obesity	27.89%	29.57%	28.03%	27.54%
Other Developmental Delays	*	0.30%	*	0.42%
Personality Disorders	12.70%	8.33%	10.64%	13.79%
Post-Traumatic Stress Disorder	17.76%	10.95%	16.77%	19.22%
Peripheral Vascular Disease	11.65%	17.27%	11.31%	10.58%
Sickle Cell Disease	*	1.91%	*	*
Spina Bifida and Other Congenital Anomalies of the Nervous System	*	*	*	0.44%
Spinal Cord Injury	1.56%	1.24%	1.76%	1.61%
Tobacco Use Disorders	63.33%	63.70%	57.77%	63.84%
Pressure Ulcers and Chronic Ulcers	9.59%	10.01%	9.60%	9.51%
Sensory - Blindness and Visual Impairment	1.19%	2.26%	1.43%	0.95%

*Denotes cells with ≤11 sample size, whose results must be suppressed per Medicare policy.

Table S7: Receipt of Medications after OUD-Related Event by Patient Race and Ethnicity and Sex

	Male				Female			
	Overall	**Black**	**Hispanic**	**White**	**Overall**	**Black**	**Hispanic**	**White**
Events (n)	13,821	2,284	1,323	10,214	12,083	1,653	782	9,648
Buprenorphine								
Any in 180 days	3,033 (21.94%)	300 (13.13%)	263 (19.88%)	2,470 (24.18%)	2,488 (20.59%)	201 (12.00%)	130 (17.00%)	2,157 (22.00%)
Total days supply within 180 days, among recipients (M (SD))	115.05 (66.38)	93.72 (68.35)	111.05 (65.37)	118.08 (65.77)	115.90 (66.96)	94.67 (69.50)	113.12 (70.07)	118.05 (66.20)
Treatment retention (≥150 days supply among those with any Buprenorphine fill)	1,315 (43.36%)	92 (30.67%)	105 (39.92%)	1,118 (45.26%)	1,069 (42.97%)	59 (29.00%)	55 (42.00%)	955 (44.00%)
Naloxone								
Any in 180 days	3,074 (22.24%)	345 (15.11%)	292 (22.07%)	2,437 (23.86%)	2,475 (20.48%)	223 (13.00%)	143 (18.00%)	2,109 (22.00%)
Naltrexone								
Any in 180 days	473 (3.42%)	76 (3.33%)	45 (3.40%)	352 (3.45%)	371 (3.07%)	34 (2.00%)	25 (3.00%)	312 (3.00%)
Total days supply within 180 days, among recipients (M (SD))	52.59 (45.78)	53.78 (42.80)	46.51 (45.32)	53.11 (46.52)	58.53 (50.70)	64.59 (62.46)	44.88 (38.97)	58.96 (50.08)
Opioid analgesic								
Any in 180 days	2,954 (21.37%)	462 (20.23%)	268 (20.26%)	2,224 (21.77%)	3,097 (25.63%)	459 (28.00%)	206 (26.00%)	2,432 (25.00%)
Benzodiazepine								
Any in 180 days	3,927 (28.41%)	397 (17.38%)	307 (23.20%)	3,223 (31.55%)	4,976 (41.18%)	524 (32.00%)	316 (40.00%)	4,136 (43.00%)

Table S8: Receipt of Medication after OUD-Related Event by Patient Race and Ethnicity and Prior Use

	180-Day Post-Event Among Beneficiaries with No Prior Use				180-Day Post-Event Among Beneficiaries with Prior Use			
	Overall	**Black**	**Hispanic**	**White**	**Overall**	**Black**	**Hispanic**	**White**
Buprenorphine								
Events	**21,199**	3,574	1,768	15,857	**4,705**	363	337	4,005
Any in 180 days	1,835 (8.66%)	238 (6.66%)	135 (7.64%)	1,462 (9.22%)	3,686 (78.34%)	263 (72.45%)	258 (76.56%)	3,165 (79.03%)
Total days supply within 180 days, among recipients (M (SD))	76.70 (61.05)	70.20 (61.12)	69.40 (56.49)	78.44 (61.36)	134.64 (60.68)	115.73 (68.20)	133.72 (61.08)	136.29 (59.73)
Treatment retention (≥150 days supply among those with any Buprenorphine fill)	327 (17.82%)	38 (15.97%)	18 (13.33%)	271 (18.54%)	2,057 (55.81%)	113 (42.97%)	142 (55.04%)	1,802 (56.94%)
Naloxone								
Events	**21,387**	3,541	1,755	16,091	**4,517**	396	350	3,771
Any in 180 days	2,191 (10.24%)	297 (8.39%)	187 (10.66%)	1,707 (10.61%)	3,358 (74.34%)	271 (68.43%)	248 (70.86%)	2,839 (75.29%)
Naltrexone								
Events	**25,489**	3,887	2,074	19,528	*	50	*	334
Any in 180 days	715 (2.81%)	98 (2.52%)	62 (2.99%)	555 (2.84%)	* (*)	12 (24.00%)	*	109 (32.63%)
Total days supply within 180 days, among recipients (M (SD))	50.13 (43.96)	53.40 (47.00)	43.89 (41.23)	50.25 (43.71)	83.23 (59.14)	87.50 (61.96)	*	84.34 (59.36)
Opioid analgesic								
Events	**20,190**	3,095	1,709	15,386	**5,714**	842	396	4,476
Any in 180 days	3,138 (15.54%)	479 (15.48%)	271 (15.86%)	2,388 (15.52%)	2,913 (50.98%)	442 (52.49%)	203 (51.26%)	2,268 (50.67%)
Benzodiazepine								
Events	**16,128**	2,942	1,461	11,725	**9,776**	995	644	8,137
Any in 180 days	1,580 (9.80%)	195 (6.63%)	115 (7.87%)	1,270 (10.83%)	7,323 (74.91%)	726 (72.96%)	508 (78.88%)	6,089 (74.83%)

*Marks cells with ≤11 entries, whose values must be suppressed by Medicare data privacy regulations.

Note: Receipt of medication was measured in the 180 days before (pre-event drug receipt) and up to 180 days following a qualifying index event. All measures come from the Medicare Part D Prescription Drug Event file. The FirstDataBank database was used to identify opioid product details from National Drug Code in the Part D file. Prior use defined as having receipt of medication within 6 months prior to index event date.

Table S9: Adjusted Rates of Medication Use within 180 Days of OUD-Related Event by Race and Ethnicity

	Across State Model (Adjusted for Age, Sex, Chronic Condition Count, Index Event)			**Within State Model (Adjusted for State + Age, Sex, Chronic Condition Count, Index Event)**		
Use within 180 days of OUD-related event	Adjusted percentages	95% CI		Adjusted percentages	95% CI	
Buprenorphine						
White	23.0	20.4	25.6	22.9	22.3	23.4
Black	14.1	10.9	17.4	14.2	12.0	16.4
Hispanic	17.6	12.1	23.1	18.7	16.6	20.7
Naloxone						
White	22.6	19.4	25.8	22.6	22.0	23.1
Black	15.8	11.9	19.6	15.9	13.5	18.3
Hispanic	19.5	12.9	26.2	20.2	17.9	22.6
Naltrexone						
White	3.3	3.0	3.6	3.3	3.2	3.4
Black	2.9	2.2	3.7	3.2	2.7	3.8
Hispanic	3.3	2.0	4.6	3.4	2.5	4.3
Opioid Analgesic						
White	23.4	21.8	25.1	23.5	23.1	23.9
Black	23.4	20.8	25.9	22.8	21.1	24.4
Hispanic	23.6	20.6	26.6	23.6	21.6	25.6
Benzodiazepine						
White	36.8	34.2	39.4	37.2	36.7	37.6
Black	23.8	20.1	27.6	23.0	20.9	25.2
Hispanic	32.1	29.7	34.5	30.5	29.0	32.0

We used logistic regression to examine within-state vs. across-state differences by comparing estimated race and ethnicity differences in models that did and did not include state of residence indicator. State-level geography was used due to inadequate sample size in smaller geographic units and due to the importance of state policies on controlled substances, Medicaid eligibility, and other factors that could influence buprenorphine access. Chronic condition count (out of 60 conditions shown in Table 1 and Table S6) included in models was categorized as 0, 1-2, 3-5, and 6+. Reported 95% confidence intervals reflect Huber-White adjusted standard errors to account for the correlation of observations within state of residence. Index event type included in models were: A) a non-fatal opioid overdose treated in the emergency department (ED) or inpatient setting, B) hospitalization with an injection drug use-related infection or C) and inpatient or residential rehabilitation or detoxification stay with a primary diagnosis of opioid use disorder.

Table S10: Quarterly Buprenorphine or Naloxone Fills within 180-Days Post Index Event, Stratified by Race

Buprenorphine within 180 days of Index Date

	White			Black		
Quarter of Index Date	Any Fill	OUD Index Events	Rate	Any Fill	OUD Index Events	Rate
2016Q2	424	1,961	21.62 %	35	384	9.11 %
2016Q3	399	1,878	21.25 %	41	387	10.59 %
2016Q4	390	1,725	22.61 %	42	334	12.57 %
2017Q1	257	1,424	18.05 %	28	231	12.12 %
2017Q2	341	1,564	21.80 %	38	318	11.95 %
2017Q3	369	1,614	22.86 %	46	336	13.69 %
2017Q4	345	1,435	24.04 %	50	317	15.77 %
2018Q1	306	1,263	24.23 %	31	233	13.30 %
2018Q2	330	1,392	23.71 %	39	311	12.54 %
2018Q3	386	1,560	24.74 %	28	293	9.56 %
2018Q4	434	1,539	28.20 %	44	307	14.33 %
2019Q1	310	1,190	26.05 %	44	237	18.57 %
2019Q2	336	1,317	25.51 %	35	249	14.06 %

Naloxone within 180 days of Index Date

	White			Black		
Quarter of Index Date	Any Fill	OUD Index Events	Rate	Any Fill	OUD Index Events	Rate
2016Q2	387	1,961	19.73 %	36	384	9.38 %
2016Q3	376	1,878	20.02 %	40	387	10.34 %
2016Q4	359	1,725	20.81 %	42	334	12.57 %
2017Q1	247	1,424	17.35 %	31	231	13.42 %
2017Q2	322	1,564	20.59 %	43	318	13.52 %
2017Q3	356	1,614	22.06 %	45	336	13.39 %
2017Q4	330	1,435	23.00 %	54	317	17.03 %
2018Q1	300	1,263	23.75 %	34	233	14.59 %
2018Q2	328	1,392	23.56 %	48	311	15.43 %
2018Q3	410	1,560	26.28 %	38	293	12.97 %
2018Q4	437	1,539	28.40 %	54	307	17.59 %
2019Q1	340	1,190	28.57 %	59	237	24.89 %
2019Q2	354	1,317	26.88 %	44	249	17.67 %

Note: Exact values of "Figure 1" in manuscript. Left table shows the percent of Medicare beneficiaries with disability with any buprenorphine fill in the 180 days after an Opioid Use Disorder-related index event by quarter from the second quarter of 2016 through the second quarter of 2019. The right table shows the same for naloxone fills.

Table S11: Health Care Utilization and Adverse Outcomes Following OUD-Related Index Event by Race and Ethnicity

	Overall	Black	Hispanic	White	Adjusted Black-White Difference (CI)[a]	Adjusted Hispanic-White Difference (CI)[a]	Adjusted Hispanic-Black Difference (CI)[a]
Events (n)	25,904	3,937	2,105	19,862	n/a	n/a	n/a
Health Care Utilization							
All E&M visits							
1+ visit in 180 days (N (%))	22,501 (86.86%)	3,296 (83.72%)	1,745 (82.90%)	17,460 (87.91%)	-4.9 (-6.9, -2.9)	-2.59 (-4.4, -0.8)	2.3 (-0.2, 4.8)
Number of visits, mean (SD)	7.384 (7.16)	6.596 (6.653)	6.686 (7.27)	7.614 (7.23)	-0.9 (-1.3, -0.6)	-0.6 (-0.9, -0.3)	0.3 (-0.1, 0.8)
E&M visits with a PCP							
1+ visit in 180 days (N (%))	19,776 (76.34%)	2,783 (70.69%)	1,521 (72.26%)	15,472 (77.90%)	-7.67 (-10.3, -5.1)	-1.71 (-3.8, 0.4)	5.96 (3.1, 8.8)
Number of visits, mean (SD)	3.735 (4.284)	3.187 (4.003)	3.399 (4.142)	3.88 (4.341)	-0.6 (-0.8, -0.4)	-0.2 (-0.4, -0.05)	0.4 (0.1, 0.7)
E&M visits for addiction treatment							
1+ visit in 180 days (N (%))	5,608 (21.65%)	683 (17.35%)	416 (19.76%)	4,509 (22.70%)	-3.52 (-5.5, -1.6)	-3.38 (-4.9, -1.8)	0.14 (-1.5, 1.8)
Number of visits, mean (SD)	1.124 (3.328)	0.813 (2.621)	1.104 (3.915)	1.187 (3.381)	-0.2 (-0.3, 0)	-0.1 (-0.3, 0.1)	0.1 (-0.1, 0.3)
E&M visits for MH treatment							
1+ visit in 180 days (N (%))	5,364 (20.71%)	616 (15.65%)	357 (16.96%)	4,391 (22.11%)	-6.46 (-8.5, -4.4)	-4.71 (-6.4, -3)	1.75 (-0.7, 4.2)
Number of visits, mean (SD)	0.668 (2.032)	0.43 (1.374)	0.594 (2.796)	0.723 (2.042)	-0.3 (-0.3, -0.2)	-0.1 (-0.3, 0.05)	0.1 (-0.05, 0.3)
Adverse Outcomes							
ED visits							
1+ visit in 180 days (N (%))	17,550 (67.75%)	2,771 (70.38%)	1,437 (68.27%)	13,342 (67.17%)	4.93 (3.5, 6.3)	0.63 (-1.6, 2.9)	-4.3 (-6.5, -2.1)
Number of visits, mean (SD)	2.577 (4.714)	3.201 (6.821)	2.624 (5.00)	2.449 (4.125)	0.85 (0.52, 1.18)	0.02 (-0.17, 0.22)	-0.83 (-1.22, -0.43)
Acute care admissions							
1+ admissions in 180 days (N (%))	11,885 (45.88%)	1,903 (48.34%)	949 (45.08%)	9,033 (45.48%)	3.33 (1.1, 5.6)	-1.0 (-3.0, 1.0)	-4.33 (-7.2, -1.4)
Number of visits, mean (SD)	0.97 (1.588)	1.16 (1.94)	0.974 (1.575)	0.932 (1.508)	0.24 (0.14, 0.35)	-0.01 (-0.07, 0.06)	-0.25 (-0.34, -0.15)
Overdose event							
1+ event in 180 days (N (%))	1,732 (6.69%)	291 (7.39%)	153 (7.27%)	1,288 (6.48%)	0.56 (-0.7, 1.8)	0.28 (-0.7, 1.3)	-0.27 (-1.7, 1.1)
Number of events, mean (SD)	0.082 (0.346)	0.093 (0.372)	0.092 (0.375)	0.078 (0.337)	0.01 (-0.01, 0.03)	0.01 (-0.01, 0.02)	0.0 (-0.02, 0.02)

Note: Columns show adjusted percentage differences between rates for each possible combination of the 3 race and ethnicity groups. We estimated adjusted differences for all two-way combinations of groups (Black vs. White, Hispanic vs. White, Hispanic vs. Black) for each outcome using a set of indicator variables for race in linear regression models (or logistic regression for binary outcomes) controlling for age, sex, chronic condition count out of 60 conditions (categorized as 0, 1-2, 3-5, and 6+), index event type (inpatient detox or rehabilitation center, opioid overdose, or opioid related infection) and state of residence. Reported 95% confidence intervals reflect Huber-White adjusted standard errors to account for the correlation of observations within state of residence.

Table S12: Receipt of Medication Following OUD-Related Event by Medicare Shared Savings Program (MSSP) Attribution

	Not Attributed to MSSP in Index Year			Attributed to MSSP in Index Year		
	Black	**Hispanic**	**White**	**Black**	**Hispanic**	**White**
Events (n)	2,866	1,566	13,681	1,071	539	6,181
Buprenorphine						
Any in 180 days	383 (13.36%)	277 (17.69%)	3,237 (23.66%)	118 (11.02%)	116 (21.52%)	1,390 (22.49%)
Total days supply within 180 days, among recipients (M (SD))	92.43 (67.68)	112.04 (67.69)	116.88 (66.25)	99.53 (72.11)	110.98 (65.14)	120.82 (65.22)
Treatment retention (≥150 days supply among those with any Buprenorphine fill)	108 (28.20%)	112 (40.43%)	1,420 (43.87%)	43 (36.44%)	48 (41.38%)	653 (46.98%)
Naloxone						
Any in 180 days	431 (15.04%)	313 (19.99%)	3,170 (23.17%)	137 (12.79%)	122 (22.63%)	1,376 (22.26%)
Naltrexone						
Any in 180 days	76 (2.65%)	51 (3.26%)	466 (3.41%)	34 (3.17%)	19 (3.53%)	198 (3.20%)
Total days supply within 180 days, among recipients (M (SD))	52.33 (46.25)	49.14 (47.48)	56.38 (48.77)	67.82 (55.82)	37.32 (26.06)	54.62 (47.19)
Opioid analgesic						
Any in 180 days	627 (21.88%)	339 (21.65%)	3053 (22.32%)	294 (27.45%)	135 (25.05%)	1,603 (25.93%)
Benzodiazepine						
Any in 180 days	657 (22.92%)	447 (28.54%)	4,889 (35.74%)	264 (24.65%)	176 (32.65%)	2,470 (39.96%)

Note: Attributed to a Medicare Shared Savings Program in CMS Medicare Shared Savings Program Accountable Care Organizations (ACO) Beneficiary-level RIF. Receipt of Medication was measured within 180 days before (pre-event drug receipt) and up to 180 days following a qualifying index event. All measures come from the Medicare Part D Prescription Drug Event file. The FirstDataBank database was used to identify opioid product details from National Drug Code in the Part D Event file.

Table S13: Sensitivity Analysis Controlling for Part D Plan Identifier

	Original Model - Adjusted for State, Age, Sex, Chronic Condition Count, Index Event			**Adjusted for Plan Contract, Age, Sex, Chronic Condition Count, Index Event**		
Receipt within 180 days of OUD-related event	Adjusted percentages	95% CI		Adjusted percentages	95% CI	
Buprenorphine						
White	22.9	22.3	23.4	23.3	23.0	23.7
Black	14.2	12.0	16.4	14.5	13.8	15.2
Hispanic	18.7	16.6	20.7	19.1	16.6	21.7
Naloxone						
White	22.6	22.0	23.1	23.0	22.7	23.3
Black	15.9	13.5	18.3	16.2	15.5	16.9
Hispanic	20.2	17.9	22.6	20.8	18.3	23.3
Naltrexone						
White	3.3	3.2	3.4	3.4	3.3	3.5
Black	3.2	2.7	3.8	3.3	2.9	3.8
Hispanic	3.4	2.5	4.3	3.6	3.0	4.1
Opioid Analgesic						
White	23.5	23.1	23.9	23.9	23.7	24.2
Black	22.8	21.1	24.4	23.4	22.4	24.5
Hispanic	23.6	21.6	25.6	24.2	22.4	25.9
Benzodiazepine						
White	37.2	36.7	37.6	37.7	37.4	38.0
Black	23.0	20.9	25.2	23.7	22.8	24.6
Hispanic	30.5	29.0	32.0	30.9	29.4	32.5

Note: We used logistic regression adjusted for state, age at index event, chronic condition range, inpatient detox or rehabilitation index event, opioid overdose index event, opioid related infection index event, and race. Chronic condition count out of 60 comorbid conditions included in models was categorized as 0, 1-2, 3-5, and 6+. Reported 95% confidence intervals reflect Huber-White adjusted standard errors to account for the correlation of observations within state of residence in left of table and Part D plan identifier in right panel of table.

Table S14: 180-Day Post Index Event Mortality by Race and Ethnicity

	Black	Hispanic	White
Events	4,527	2,362	22,069
Died within 180 days of index event (n, %)	223 (4.93%)	89 (3.77%)	992 (4.50%)

Note: The exclusion that beneficiaries were required to survive 30 days post their index-date was lifted for the purposes of this analysis

Table S15: Receipt of Medication within 180-days Post-Index Event Including Beneficiaries Who Died within the Period

	Black	Hispanic	White	Adjusted Black-White Difference (CI)	Adjusted Hispanic-White Difference (CI)	Adjusted Hispanic-Black Difference (CI)
Events (n)	4,158	2,194	4,738			
Buprenorphine						
Any in 180 days	516 (12.41%)	399 (18.19%)	4,738 (22.72%)	-8.53 (-11.1, -6)	-4.2 (-6.7, -1.7)	4.33 (1.9, 6.8)
Naloxone						
Any in 180 days	585 (14.07%)	445 (20.28%)	4,662 (22.36%)	-6.62 (-9.4, -3.9)	-2.23 (-5.0, 0.6)	4.39 (1.6, 7.1)
Naltrexone						
Any in 180 days	112 (2.69%)	70 (3.19%)	679 (3.26%)	-0.09 (-0.7, 0.5)	0.05 (-0.9, 1.1)	0.14 (-0.7, 1)
Opioid analgesic						
Any in 180 days	979 (23.54%)	495 (22.56%)	4,902 (23.51%)	-0.73 (-2.8, 1.3)	-0.02 (-2.2, 2.1)	0.71 (-2, 3.4)
Benzodiazepine						
Any in 180 days	962 (23.14%)	639 (29.12%)	7,724 (37.04%)	-14.45 (-17, -11.9)	-7.35 (-8.8, -5.9)	7.1 (4.3, 9.9)

Note: The exclusion that a beneficiary had to survive the 30-day period post-index event and censorship if they died within 31-180 days was lifted for the purposes of this analysis to capture their fill receipts that happened prior to their death. Eligibility until their death date was still required. All measures come from the Medicare Part D Prescription Drug Event file. The FirstDataBank database was used to identify opioid product details from the National Drug Code in the Part D file.

Table S16: Receipt of Methadone or Buprenorphine in the 180 Days Following Opioid Use Disorder-Related Event by Patient Race and Ethnicity, 2020 and 2021

	Black	Hispanic	White	Adjusted Black-White Difference (CI)[a]	Adjusted Hispanic-White Difference (CI)[a]	Adjusted Hispanic-Black Difference (CI)[a]
Events (n)	652	436	3,705			
Buprenorphine pharmacy fill within 180 days of index event	106 (16.3%)	76 (17.4%)	943 (25.5%)	-7.7 (-9.8, -5.6)	-5.8 (-8.8, -2.7)	-1.9 (-5.3, 1.5)
Methadone claim from OTP within 180 days of index event	54 (8.3%)	49 (11.2%)	319 (8.6%)	0.8 (-1.8, 3.4)	0.9 (-1.9, 3.6)	-0.1 (-3.1, 3.0)
Buprenorphine OR Methadone, within 180 days of index event (pharmacy or OTP)	154 (23.6%)	127 (29.1%)	1202 (32.4%)	-5.1 (-8.5, -1.8)	-4.8 (-8.2, -1.4)	-0.3 (-4.6, 3.9)

OTP = opioid treatment program

Analyses use 20% random sample of fee-for-service Medicare data from 2020-2021 and replicate cohort creation methods of the main analyses presented in Tables 2 and S9. We used logistic regression adjusted for state, age at index event, index event (inpatient detox or rehabilitation, opioid overdose, opioid related infection), and race and ethnicity. Reported 95% confidence intervals reflect Huber-White adjusted standard errors to account for the correlation of observations within state of residence
Buprenorphine receipt is measured by pharmacy fill (Part D), or common procedure terminology (CPT) code for weekly use in OTP (G2068-G2072, G2079) Methadone receipt measured by CPT code for OTPs who dispense methadone through federally licensed treatment centers (G2067 or G2078), which Medicare began reimbursing in 2020.

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