**Research Article**

# Impact of Medications for Opioid Use Disorder on Healthcare Resource Utilization and Costs for Patients Served By a State Medicaid Program

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**Abstract:**

**Objectives:** Although evidence-based recommendations from treatment guidelines support the use of medications for opioid use disorder (MOUD) in addition to psychosocial counseling, about 86.6% of patients diagnosed with opioid use disorder (OUD) do not receive MOUD and several barriers still restrict access to MOUD in the United States. This study assesses the impact of MOUD on healthcare resource utilization (HCRU) and costs for Medicaid beneficiaries.

**Methods:** An exploratory retrospective matched-cohort analysis was performed among Medicaid patients not concurrently enrolled in Medicare using anonymized claims data from South Carolina Medicaid between 7/1/2016 and 12/31/2019. Patients newly diagnosed with OUD who received MOUD were matched based on age, gender, and race to patients who did not receive MOUD to evaluate HCRU and costs in the 6 months prior to and 12 months following initial OUD diagnosis.

**Results:** A total of 397 matched pairs of MOUD and non-MOUD patients were identified for this analysis. A significantly lower percentage of patients had emergency department visits (63.2% vs 74.3%; $P$=0.0005) and hospitalizations (21.9% vs 37.8%; $P$<0.0001) in the matched MOUD cohort compared to the non-MOUD cohort. All-cause total direct costs were numerically lower for the matched MOUD cohort ($15,212 vs $17,451; $P$=0.3388), as numerically higher all-cause pharmacy costs associated with MOUD utilization were offset by significantly lower all-cause medical costs compared to the non-MOUD cohort ($9,265 vs $14,819; $P$=0.0005).

**Conclusions:** The results of this analysis suggest that MOUD utilization has a positive association with reducing HCRU and all-cause medical costs for Medicaid patients with OUD.

**Keywords:** opioid use disorder; opioid agonist treatment; South Carolina; Medicaid; medication for opioid use disorder; medication-assisted treatment

## Introduction:

Opioid use disorder (OUD), defined as a chronic pattern of opioid use leading to clinically significant impairment or distress, continues to be a significant public health issue in the United States (US) [1]. In 2017, the US Department of Health and Human Services (HHS) declared OUD a public health emergency as a result of increases in opioid misuse and abuse, opioid-related overdose deaths, and incidence of neonatal abstinence syndrome due to opioid misuse and abuse during pregnancy [2,3,4].

The misuse and abuse of opioids have both humanistic and economic impacts on patients, their families, caregivers, and society [3]. Patients with OUD have an increased risk of mortality, are more likely to have comorbidities, and have a greater economic burden [3,5]. Between February 2021 and February 2022, the provisional predicted number of opioid-related overdose deaths reached 81,857 in the US [6]. Moreover, the Council of Economic Advisers estimated that OUD cost the US approximately $504 billion in 2015, including $431.7 billion in direct healthcare costs (ie, emergency department [ED] visits, inpatient hospital stays, physician outpatient visits, and medications) and $72.7 billion in indirect costs, such as lost productivity [7].

Medications for opioid use disorder (MOUD), including US Food and Drug Administration (FDA)-approved methadone, buprenorphine, and extended-release naltrexone, can help manage patients' withdrawal symptoms, control cravings, decrease the risk of an overdose, restore functionality, and improve quality of life [8]. The American Society of Addiction Medicine (ASAM) National Practice Guidelines recommend using a patient-centered, evidence-based treatment approach with FDA-approved MOUD in addition to psychosocial counseling for the treatment of OUD [9]. However, 2019 adjusted estimates suggest past-year OUD affected 7,631,804 individuals in the US (2,773 per 100,000 adults 12 years or older), relative to only 1,023,959 individuals who received MOUD (365 per 100,000 adults 12 years or older) [10]. This implies that approximately 86.6% of individuals with OUD nationwide who may benefit from MOUD treatment do not receive it [10]. Treatment with MOUD increased across most states from 2010 to 2019, but many regions still experience wide gaps between OUD prevalence and treatment with MOUD [10]. Based on a survey assessing barriers for use of MOUD among current and future primary care physicians (PCPs) in South Carolina (SC), cost, insurance authorizations, and lack of PCP education and MOUD awareness limited the utilization of MOUD in practice [11].

Medicaid beneficiaries exhibit higher rates of OUD, receive a higher number of opioid prescriptions, and have higher rates of overdose deaths than the general population [12]. Recent federal and state strategies to combat OUD included the integration of social programs and MOUD through pharmacy and medical utilization management policies (UMPs) to mitigate barriers to evidence-based treatment, like MOUD and counseling, and address adverse health outcomes associated with OUD [12,13]. Overall, UMPs vary substantially at the state level, and assessing their impact is challenging as prior authorization rules, preferred drug status, psychological counseling requirements, and/or quantity/dosing limits are likely to affect access to OUD treatment [12].

In a prior study, the authors conducted a population-level trend analysis to examine the potential impact of UMPs implemented by SC Medicaid between January 1, 2018 and December 31, 2019 to enhance the provision, funding, and coverage of MOUD. Policy changes included reimbursement to Act 301 Behavioral Health Centers for providing MOUD through telemedicine, increased flexibility to reimburse the Institutions for Mental Disease for providing treatment for OUD, availability of the full spectrum of pharmacotherapies approved for the treatment of OUD to Medicaid members, enrollment of opioid treatment programs (OTPs) in the Medicaid provider network, and initiation of MOUD in the ED [14]. Comparing 2018 to 2019, the authors found significant increases in the rates of MOUD utilization (19.3% to 28.9% of patients; $P<0.0001$) and counseling therapy (20.7% to 22.4% of patients; $P<0.0001$) among SC Medicaid beneficiaries diagnosed with OUD, while the proportion of patients with 1 or more opioid

prescription claims significantly decreased (35.4% to 28.2% of patients; $P<0.0001$) between the 2 years [15].

The aim of the current study is to examine the association between MOUD use and healthcare resource utilization (HCRU) and costs among SC Medicaid beneficiaries diagnosed with OUD.

**Methods:**

This retrospective matched-cohort study used anonymized administrative medical and pharmacy claims and enrollment data from SC Medicaid between July 1, 2016 and December 31, 2019. Patients were included if they had a new diagnosis of OUD between January 1, 2017 and December 31, 2018, which was designated as the patent's index date. A new OUD diagnosis was defined as a diagnosis of OUD without evidence of an OUD diagnosis or MOUD use in the 6 months prior. Patients were required to be aged ≥18 years on their index date; continuously eligible for Medicaid benefits for ≥6 months before and ≥12 months after their index date; and not dual-eligible for Medicare during their time in the study. The 6 months before the index date (baseline period) was used to characterize the study population, while the 12 months following the index date (post-index period) was used to assess the study outcomes.

MOUD use was defined as a prescription claim or medical claim for buprenorphine, naltrexone, or buprenorphine-naloxone. Included patients were divided into 2 groups: MOUD patients (defined as patients with a claim for MOUD in the 12-month post-index period) and non-MOUD patients (defined as patients without a claim for MOUD in the 12-month post-index period). MOUD patients were further categorized as those who received their first MOUD within 90 days of their index date and those who received their first MOUD more than 90 days after their index date. MOUD patients who initiated MOUD within 90 days of their index date were then matched to non-MOUD patients in a 1:1 ratio based on age, gender, and race using the greedy nearest-neighbor matching technique without replacement [16]. The resulting matched comparator groups were termed as the matched MOUD cohort and the matched non-MOUD cohort. Restricting the MOUD cohort to patients who initiated MOUD within the first 90 days following diagnosis allowed for sufficient follow-up time after MOUD initiation to observe any potential impact on HCRU and costs.

Demographics included age at index diagnosis, gender, and race. The following clinical characteristics were assessed during the baseline period: Quan-adapted Charlson Comorbidity Index (CCI) score; specific comorbid conditions, including substance use disorders, depressive disorders, chronic pain and pain types (low back pain, neck pain, osteoarthritis, fibromyalgia, cancer-associated pain and/or neuropathic pain); and use of medications that may increase the risk of opioid overdose (antidepressants, benzodiazepines, antipsychotics, sedative/hypnotics).

All-cause outcomes were based on all medical and pharmacy claims for the patient. OUD-related medical utilization included medical claims where the primary diagnosis was OUD, and OUD-related pharmacy utilization included all prescriptions for opioids and MOUD. All-cause and OUD-related HCRU outcomes included the percentage of patients with ≥1 inpatient hospital admission, percentage of patients with ≥1 ED visit, mean number of ED visits per patient, mean number of outpatient physician office visits per patient, mean number of other outpatient visits per patient, and mean prescription fills per patient. OUD-related HCRU outcomes also included the percentage of patients with ≥1 opioid prescription, mean number of opioid prescription fills per patient, percentage of patients with ≥1 MOUD prescription, and mean number of MOUD prescription fills per patient. All-cause and OUD-related cost outcomes were based on the paid amounts and included the mean inpatient hospital cost, mean ED cost, mean outpatient physician office cost, mean other medical cost, mean pharmacy cost, and mean total healthcare cost. OUD-related cost outcomes also included the mean opioid prescription cost and mean MOUD prescription cost.

Descriptive statistics were used to analyze demographic and clinical characteristics. Frequencies and percentages were reported for categorical variables. Mean, standard deviation (SD), median, and

interquartile range (IQR) values were reported for continuous measures. The number and percentage of patients with ≥1 visit for each HCRU category was reported. The total number of visits for each HCRU category was calculated for each patient, and then summary statistics for visit counts were provided by comparator group, including patients with zero utilization. Summary statistics were also provided for each cost category by comparator group, including patients with zero costs. McNemar's tests were used to compare binary categorical measures, and paired $t$ tests were used to compare continuous measures between the matched comparator groups. All statistical tests were performed assuming a 2-sided hypothesis of no difference between groups. Analyses were conducted in SAS Enterprise Guide version 8.2. Costs were adjusted to 2019 US dollars based on the medical component of the Consumer Price Index [17]. Note that the results reported in this study are not official findings of the SC Department of HHS.

**Results:**

In total, 10,311 non-dual-eligible Medicaid patients were newly diagnosed with OUD between January 1, 2017 and December 31, 2019, with no OUD diagnosis or MOUD use 6 months prior to the index date (**Figure 1**). Of these patients, 2,655 were continuously eligible for Medicaid benefits 6 months prior through 12 months following their index date. In the 12-month post-index period, 555 patients (20.9%) had claims for MOUD, and the remaining 2,100 patients (79.1%) did not receive any MOUD. Of the 555 patients who were treated with any MOUD in the 12-month post-index period, the majority (n=401, 72.3%) received the first MOUD within 90 days of their index date. Matching the 401 MOUD patients to the 2,100 non-MOUD patients resulted in 397 matched pairs of MOUD and non-MOUD patients.

**Figure 1: Attrition Diagram for Matched Cohort Analysis**
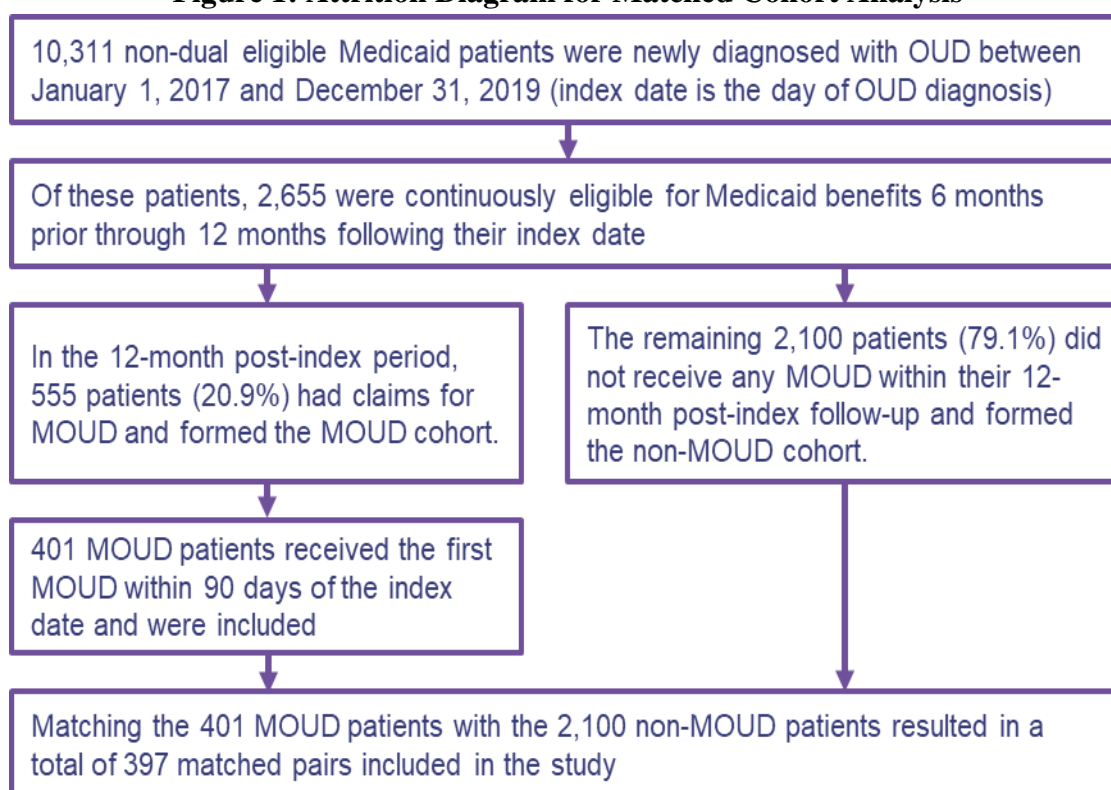


Key: MOUD=medications for opioid use disorder; OUD=opioid use disorder.

Both matched cohorts were relatively young, with a median age of 36 years, predominantly female (79.1%), and largely White (71.5%) (**Table 1**) The most common comorbidities were chronic pain, other substance use disorders, and depression. With the exception of comorbid substance use disorders, all other comorbid conditions were more prevalent in the non-MOUD cohort vs the MOUD cohort. Moreover, antidepressants, benzodiazepines, and antipsychotics were more commonly prescribed in the non-MOUD cohort.

**Table 1: Demographics and Patient Characteristics for Matched MOUD and Non-MOUD Cohorts among Non-Dual-Eligible SC Medicaid Beneficiaries with an OUD Diagnosis**

| Demographics and Patient Characteristics[a] | MOUD Cohort (n=397) | Non-MOUD Cohort (n=397) |
|---|---|---|
| Age as of index OUD claim (in years) | | |
|     Mean (SD) | 36.5 (9.9) | 36.5 (9.9) |
|     Median (IQR) | 36.0 (13.0) | 36.0 (13.0) |
| Age distribution, years, n (%) | | |
|     18-34 | 176 (44.3) | 176 (44.3) |
|     35-44 | 142 (35.8) | 142 (35.8) |
|     45-54 | 51 (12.8) | 51 (12.8) |
|     55-64 | 28 (7.1) | 28 (7.1) |
| Gender, n (%) | | |
|     Female | 314 (79.1) | 314 (79.1) |
|     Male | 83 (20.9) | 83 (20.9) |
| Race, n (%) | | |
|     White | 284 (71.5) | 284 (71.5) |
|     Black or African American | 26 (6.5) | 26 (6.5) |
|     Asian | 0 (0) | 0 (0) |
|     Other | 87 (21.9) | 87 (21.9) |
| Quan CCI score, n (%) | | |
|     Mean (SD) | 0.2 (0.8) | 0.4 (1.1) |
|     Median (IQR) | 0.0 (0.0) | 0.0 (0.0) |
| Quan CCI score category, n (%) | | |
|     0 | 353 (88.9) | 313 (78.8) |
|     1 | 30 (7.6) | 48 (12.1) |
|     2 | 5 (1.3) | 20 (5.0) |
|     ≥3 | 9 (2.3) | 16 (4.0) |
| Specific comorbidities, n (%) | | |
|     Substance use disorders | 340 (85.6) | 248 (62.5) |
|     Depressive disorders | 91 (22.9) | 137 (34.5) |
|     Any chronic pain | 163 (41.1) | 206 (51.9) |
|         Low back pain | 135 (34.0) | 165 (41.6) |
|         Neck pain | 50 (12.6) | 75 (18.9) |
|         Osteoarthritis | 23 (5.8) | 34 (8.6) |
|         Fibromyalgia | 30 (7.6) | 52 (13.1) |
|         Neuropathic pain | 24 (6.0) | 50 (12.6) |
|         Cancer-associated pain | 0 (0) | 2 (0.5) |
| Select medications, n (%) | | |
|     Antidepressants | 123 (31.0) | 148 (37.3) |
|     Benzodiazepines | 70 (17.6) | 97 (24.4) |
|     Antipsychotics | 7 (1.8) | 12 (3.0) |
|     Sedative/hypnotics | 69 (17.4) | 67 (16.9) |

[a]Percentages may not add up to 100% due to rounding.

Key: CCI=Charlson comorbidity index; IQR=interquartile range; MOUD=medications for opioid use disorder; OUD=opioid use disorder; SC=South Carolina; SD=standard deviation.

*HCRU*

In the post-index period, all-cause HCRU was higher in comparison to the baseline period across all measures. Compared to the non-MOUD control group, the MOUD cohort was significantly less likely to have all-cause ED visits (63.2% vs 74.3% of patients; *P*=0.0005) and all-cause hospitalizations (21.9% vs 37.8% of patients; *P*<0.0001) (**Figure 2**). A numerically lower proportion of patients in the MOUD cohort had OUD-related ED visits (10.3% vs 11.1% of patients; *P*=0.7218) and OUD-related inpatient hospital admissions (4.8% vs 7.1% of patients; *P*=0.1699) compared to the non-MOUD cohort (**Table 2**). The MOUD cohort also had a significantly lower average number of all-cause ED visits (1.8 [SD=2.7] vs 3.1 [SD=5.0]; *P*<0.0001) and a significantly lower percentage of patients with at least 1 claim for prescription opioids (27.0% vs 58.7%; *P*<0.0001) than the non-MOUD cohort. Conversely, the MOUD cohort had a significantly higher average number of all-cause outpatient physician office visits (19.1 [SD=22.8] vs 10.5 [SD=12.7]; *P*<0.0001) compared to the non-MOUD cohort.

**Figure 2: All-Cause ED Visits and Hospitalizations during Study Period, Matched Cohorts**

**(n=397 per Cohort)**
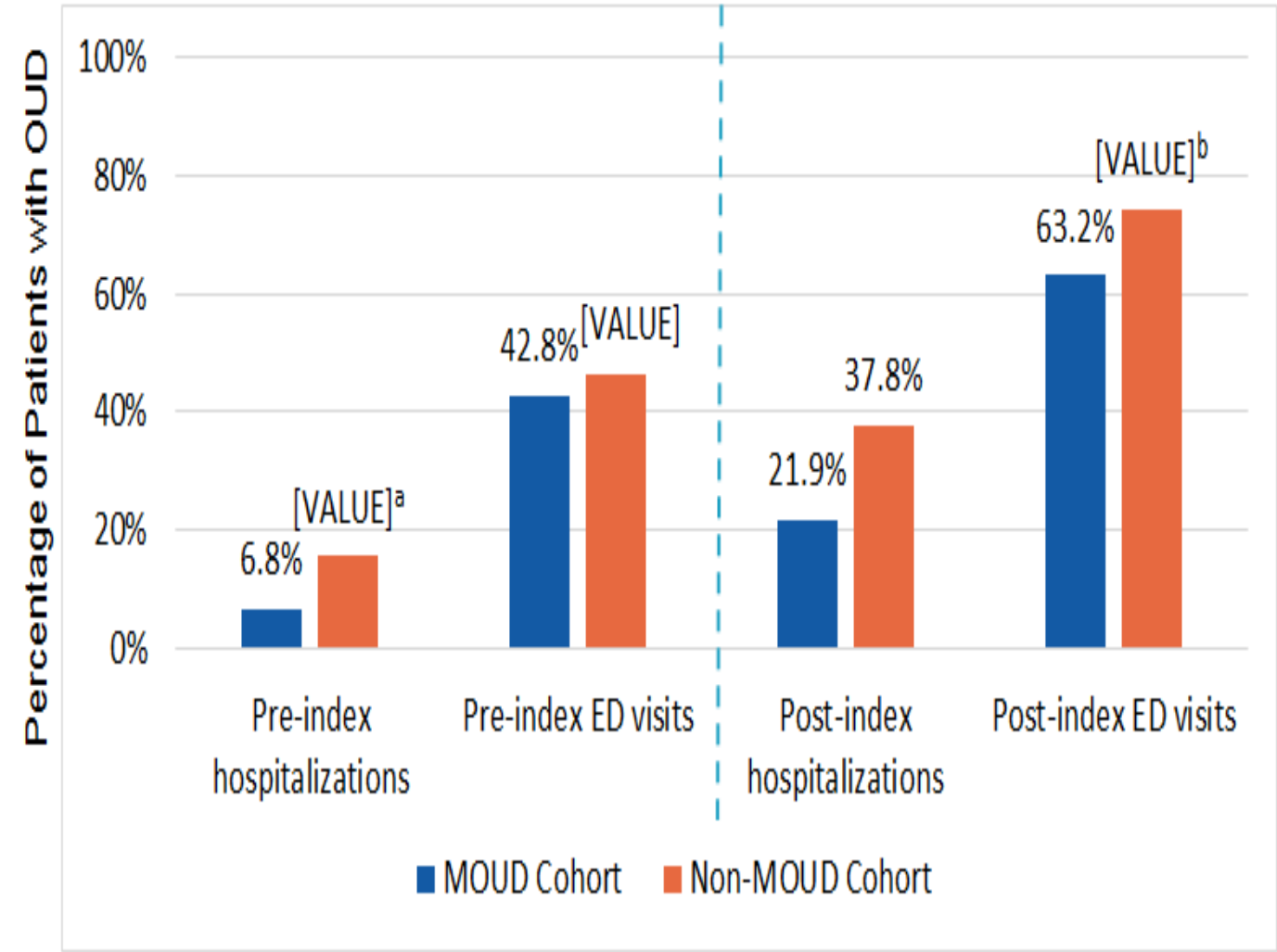


[a]*P*<0.0001.

[b]*P*=0.0005.

Pre-index period = 6 months. Post-index period = 12 months.

Key: ED=emergency department; MOUD=medications for opioid use disorder; OUD=opioid use disorder.

**Table 2: HCRU by Matched MOUD and Non-MOUD Cohorts among Non-Dual-Eligible SC Medicaid Beneficiaries with an OUD Diagnosis**

| HCRU | Baseline (6 Months) | | | Post-Index (12 Months) | | |
|---|---|---|---|---|---|---|
| | MOUD (n=397) | Non-MOUD (n=397) | *P* Value[a] | MOUD (n=397) | Non-MOUD (n=397) | *P* Value[a] |
| **All-cause HCRU** | | | | | | |
| Patients with ≥1 inpatient hospital admission, n (%) | 27 (6.8) | 62 (15.6) | <0.0001 | 87 (21.9) | 150 (37.8) | <0.0001 |
| Patients with ≥1 ED visit, n (%) | 170 (42.8) | 185 (46.6) | 0.2827 | 251 (63.2) | 295 (74.3) | 0.0005 |
| ED visits per patient, mean (SD) | 0.9 (1.5) | 1.3 (2.7) | 0.0066 | 1.8 (2.7) | 3.1 (5.0) | <0.0001 |
| Outpatient physician office visits per patient, mean (SD) | 3.0 (4.8) | 4.1 (5.1) | 0.0009 | 19.1 (22.8) | 10.5 (12.7) | <0.0001 |
| Other outpatient visits per patient, mean (SD) | 2.5 (5.0) | 5.9 (15.9) | <0.0001 | 26.7 (28.9) | 22.8 (55.0) | 0.2148 |
| Prescription fills per patient, mean (SD) | 9.2 (11.7) | 13.9 (15.2) | <0.0001 | 35.2 (28.1) | 32.0 (35.5) | 0.1478 |
| **OUD-related HCRU[b]** | | | | | | |
| Patients with ≥1 inpatient hospital admission, n (%) | 0 (0) | 0 (0) | - | 19 (4.8) | 28 (7.1) | 0.1699 |
| Patients with ≥1 ED visit, n (%) | 0 (0) | 0 (0) | - | 41 (10.3) | 44 (11.1) | 0.7218 |
| ED visits per patient, mean (SD) | 0 (0) | 0 (0) | - | 0.2 (0.5) | 0.1 (0.4) | 0.5534 |
| Outpatient physician visits per patient, mean (SD) | 0 (0) | 0 (0) | - | 11.2 (18.4) | 0.2 (0.8) | <0.0001 |
| Other outpatient visits per patient, mean (SD) | 0 (0) | 0 (0) | - | 17.5 (26.2) | 2.1 (10.6) | <0.0001 |
| Patients with ≥1 opioid prescription, n (%) | 186 (46.9) | 205 (51.6) | 0.1950 | 107 (27.0) | 233 (58.7) | <0.0001 |
| Opioid prescription fills per patient, mean (SD) | 1.7 (2.6) | 2.5 (3.6) | 0.0001 | 0.9 (3.4) | 4.6 (7.0) | <0.0001 |
| Patients with ≥1 MOUD prescription, n (%) | 0 (0) | 0 (0) | - | 393 (99.0) | 0 (0) | - |
| MOUD prescription fills per patient, mean (SD) | 0 (0) | 0 (0) | - | 14.5 (11.5) | 0 (0) | <0.0001 |

[a]*P* values were based on McNemar's tests for patient proportions and paired *t* tests for visit counts and prescription counts.

[b]Per the study inclusion criteria, there were zero OUD-related visits and MOUD use in the baseline period.

Key: ED=emergency department; HCRU=healthcare resource utilization; MOUD=medications for opioid use disorder; OUD=opioid use disorder; SC=South Carolina; SD=standard deviation.

*Costs*

All-cause total direct costs were numerically lower for the MOUD cohort compared to the non-MOUD cohort ($15,212 vs $17,451; *P*=0.3388) in the post-index period. Numerically higher all-cause pharmacy costs for the MOUD cohort ($5,947 vs $2,632; *P*=0.0705) were offset by significantly lower all-cause medical costs compared to the non-MOUD cohort ($9,265 vs $14,819; *P*=0.0005) in the post-index period (**Figure 3**). Conversely, OUD-related total direct costs were significantly higher for the MOUD cohort compared to the non-MOUD cohort ($5,622 vs $1,042; *P*<0.0001), primarily due to MOUD prescriptions and outpatient visits (**Table 3**).

**Figure 3: All-Cause Medical and Pharmacy Costs During Study Period, Matched Cohorts (n=397 per Cohort)**
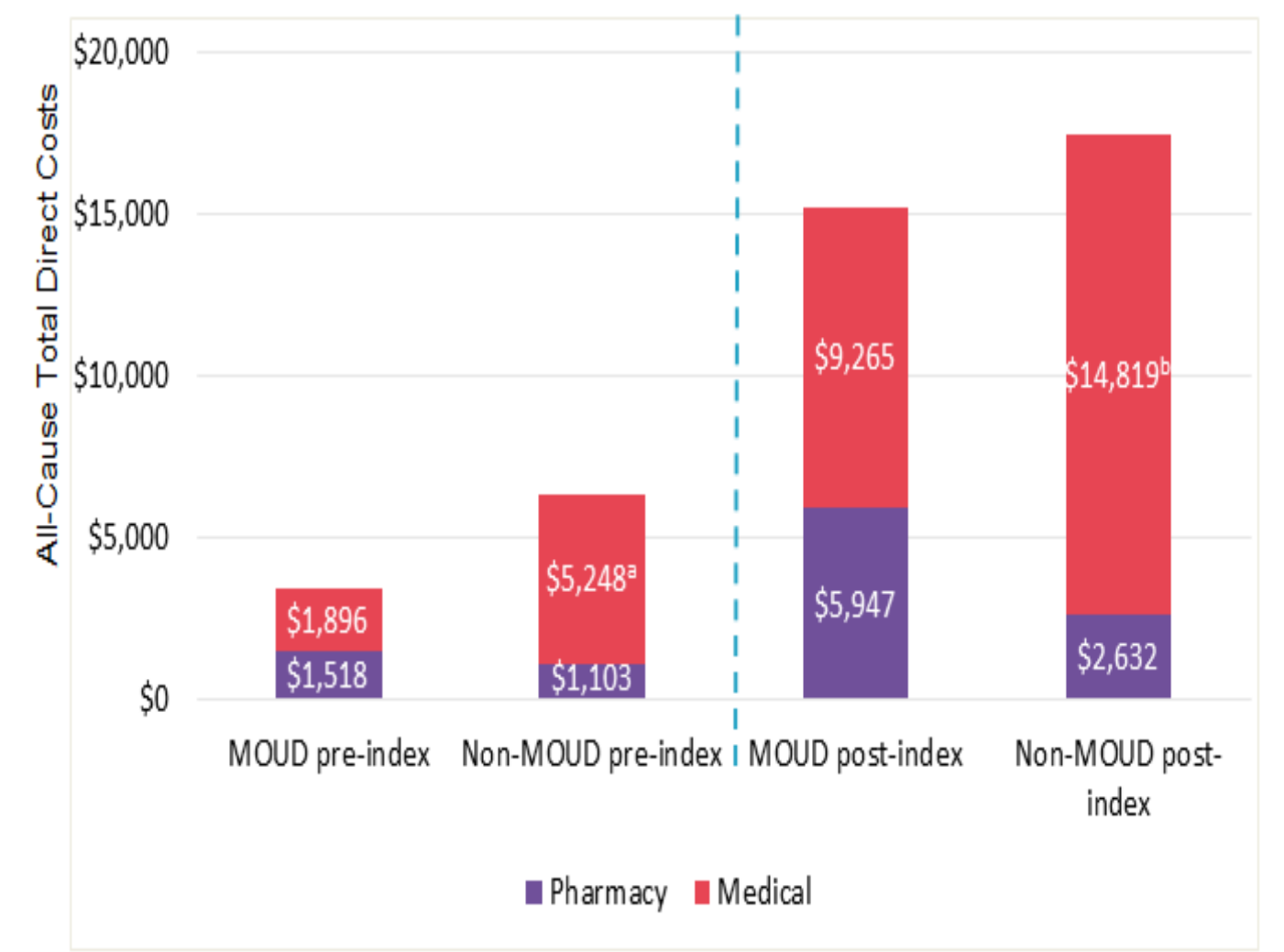


[a]*P*<0.0001.

[b]*P*=0.0005.

Pre-index period = 6 months.

Post-index period = 12 months.

Key: MOUD=medications for opioid use disorder.

**Table 3: Costs by Matched MOUD and Non-MOUD Cohorts among Non-Dual-Eligible SC Medicaid Beneficiaries with an OUD Diagnosis**

| Healthcare Costs, $[a] | Baseline (6 Months) | | | Post-Index (12 Months) | | |
|---|---|---|---|---|---|---|
| | MOUD (n=397) | Non-MOUD (n=397) | *P* Value[b] | MOUD (n=397) | Non-MOUD (n=397) | *P* Value[b] |
| **All-cause costs** | | | | | | |
| Inpatient hospital cost, mean (SD) | 685.3 (3,488.5) | 2,902.8 (12,756.7) | 0.0007 | 2,903.3 (9,376.2) | 8,023.0 (24,336.4) | 0.0001 |
| ED cost, mean (SD) | 420.1 (863.6) | 661.8 (1,501.6) | 0.0045 | 890.0 (1,532.1) | 1,591.8 (2,860.5) | <0.0001 |
| Outpatient physician cost, mean (SD) | 291.2 (663.6) | 413.1 (806.2) | 0.0171 | 1,755.9 (1,898.4) | 1,128.5 (2,813.5) | 0.0002 |
| Other medical cost, mean (SD) | 499.0 (1,076.8) | 1,270.7 (3,367.4) | <0.0001 | 3,716.0 (4,652.1) | 4,075.9 (8,104.3) | 0.4407 |
| Pharmacy cost, mean (SD) | 1,517.9 (12,819.2) | 1,102.5 (4,019.6) | 0.5313 | 5,947.1 (35,744.0) | 2,631.6 (7,738.7) | 0.0705 |
| Total direct healthcare cost, mean (SD) | 3,413.4 (13,651.6) | 6,350.9 (15,052.4) | 0.0033 | 15,212.2 (39,422.5) | 17,450.8 (30,736.9) | 0.3388 |
| **OUD-related costs[c]** | | | | | | |
| Inpatient hospital cost, mean (SD) | 0 (0) | 0 (0) | - | 319.2 (1,989.1) | 510.8 (2,571.7) | 0.2432 |
| ED cost, mean (SD) | 0 (0) | 0 (0) | - | 77.0 (291.8) | 73.3 (262.2) | 0.8403 |
| Outpatient physician cost, mean (SD) | 0 (0) | 0 (0) | - | 988.3 (1,370.0) | 12.9 (89.0) | <0.0001 |
| Other medical cost, mean (SD) | 0 (0) | 0 (0) | - | 2,017.3 (3.724.9) | 322.8 (1,973.7) | <0.0001 |
| Pharmacy cost, mean (SD) | 56.6 (318.3) | 80.2 (227.6) | 0.2340 | 2,220.4 (2,086.0) | 122.1 (403.6) | <0.0001 |
| Opioid prescription cost, mean (SD) | 56.6 (318.3) | 80.2 (227.6) | 0.2340 | 17.5 (142.3) | 122.1 (403.6) | <0.0001 |
| MOUD prescription cost, mean (SD) | 0 (0) | 0 (0) | - | 2,202.8 (2,083.1) | 0 (0) | <0.0001 |
| Total direct healthcare cost, mean (SD) | 56.6 (318.3) | 80.2 (227.6) | 0.2340 | 5,622.1 (5,244.9) | 1,041.9 (3,519.2) | <0.0001 |

[a]Costs were adjusted to 2019 US dollars based on the medical component of the Consumer Price Index [17].

[b]*P* values were based on paired *t* tests.

[c]Per the study inclusion criteria, there were zero OUD-related visits and MOUD use in the baseline period.

Key: ED=emergency department; MOUD=medications for opioid use disorder; OUD=opioid use disorder; SC=South Carolina; SD=standard deviation.

**Discussion:**

This retrospective cohort study showed that patients in the matched MOUD cohort were significantly less likely to have all-cause ED visits and all-cause hospitalizations, resulting in numerically lower all-cause total direct costs and significantly lower all-cause medical costs compared to the non-MOUD cohort. Patients receiving MOUD also had significantly fewer all-cause ED visits, in addition to being less likely to have 1 or more claims for prescription opioids. These findings imply that increasing access to various formulations of MOUD through state and/or federal policies is likely to improve patient outcomes for Medicaid beneficiaries and result in downstream medical cost offsets associated with fewer acute opioid-related events.

The results from this study align with the findings of other published research evaluating the impact of increasing access to MOUD on HCRU and costs. An observational study of state billing and service data in Missouri found that the implementation of the "Medication First" State Targeted Response program to prescribe buprenorphine resulted in increased MOUD utilization (40.5%) and decreased median cost per month (21%) [18]. The same study also found that the increased utilization of buprenorphine resulted in fewer psychosocial services and improved treatment retention [18]. Other studies sought to investigate the association between Medicaid restrictions and utilization of MOUD and to assess the impact of removing such restrictions. An analysis of 2014 and 2017 National Drug Abuse Treatment System Survey data found the proportion of OTPs offering buprenorphine to be 43.2% in states that did not impose any utilization restrictions compared to only 17.3% of OTPs in states that imposed prior authorizations [19]. These findings suggest that state Medicaid prior authorization requirements are linked to reduced odds of MOUD availability at OTPs and may discourage MOUD prescribing [19]. Another study used enrollment and insurance claims data for Medicare beneficiaries between 2012 and 2017 to evaluate the association of prior authorization with the use of buprenorphine-naloxone and health outcomes [20]. The comparative interrupted time series analysis found that the removal of prior authorization resulted in an increase of 17.9 prescriptions filled for buprenorphine-naloxone per plan per year, which is a doubling of the average number of prescriptions. Moreover, there were decreases in inpatient admissions and ED visits related to substance use disorder by 0.1 admissions and 0.1 visits per plan per year, respectively [20].

The consistent theme across these studies is that more prescribing restrictions lead to higher all-cause healthcare costs and a reduction of access to MOUD [18,19,20]. The current study adds to published evidence by highlighting that MOUD utilization is associated with decreased all-cause HCRU and all-cause medical costs for Medicaid beneficiaries. Access to MOUD was further complicated by the COVID-19 pandemic, which has imposed additional direct and indirect risks to patients with OUD, especially those with low socioeconomic status [21]. Worsening mental health comorbidities reported during the COVID-19 pandemic were also associated with an increase in the likelihood of substance use behaviors, leading to more relapses and overdoses [22]. Consequently, there is a heightened need for additional policy changes and programs to limit restrictions and improve access to MOUD in the US, especially in light of the worsening outcomes for patients with OUD during the COVID-19 pandemic.

*Limitations*

Several limitations need to be considered when interpreting the results of this study. This study was limited to non-dual-eligible Medicaid patients in SC, and findings are likely not generalizable to all Medicaid patients in the US because care practices may differ in other states. While the analysis planned for balance in baseline demographic characteristics between the cohorts by using matching, some residual confounding may have remained due to variables not accounted for by the match. For example, the matched non-MOUD group had a higher comorbidity burden and higher all-cause HCRU and medical costs in the pre-index period than the matched MOUD group, which likely contributed to the differences in the outcomes in addition to the treatment effect of MOUD alone. Furthermore, total costs associated with OUD

may be underreported because some claims for healthcare encounters for complications of OUD may miss the OUD diagnosis code. The study timeframe captured a period when several policy changes to the SC Medicaid UMPs were under way. Since these changes were designed to enhance access to MOUDs and treatment for OUD in general, it is possible that conducting a similar study post-implementation of the policy changes would generate different, and presumably more favorable, results among patients with MOUD utilization.

## Conclusions:

This cohort analysis showed that Medicaid patients receiving MOUD were significantly less likely to have all-cause ED visits and hospitalizations compared to non-MOUD patients. Furthermore, all-cause total direct costs were numerically lower for the matched MOUD cohort, as numerically higher all-cause pharmacy costs associated with MOUD utilization were offset by significantly lower all-cause medical costs compared to the non-MOUD cohort. This study adds to the body of evidence suggesting that much-needed state and federal policy changes expanding access to MOUD are likely to improve patient outcomes and reduce HCRU and costs.

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