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SUMMATIVE EVALUATION REPORT OF THE SUBSTANCE USE DISORDER (SUD) COMPONENTS OF NORTH CAROLINA'S 1115 WAIVER

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Chapter 1. Executive Summary

The purpose of the NC 1115 Waiver is to improve Medicaid beneficiary health outcomes through the implementation of a new delivery system, to enhance the viability and sustainability of the NC Medicaid program by maximizing the receipt of high-value care, and to reduce the burden¹ of substance use disorders (SUD) statewide.

This report evaluates changes in many metrics reflecting quality of care, process of care, and health outcomes, focused on the SUD components of the 1115 waiver, which were implemented beginning in May 2019. The full evaluation study period for the Summative Evaluation Report runs from October 1, 2015 – November 30, 2024.

Several major events affecting NC Medicaid and its beneficiaries occurred during the SUD implementation period. First, the COVID-19 pandemic began with stay-at-home orders in March 2020 and ended in May 2023. We developed a novel method of identifying the return-to-normal dates in our data. This period saw a disruption in care-seeking, an increase in behavioral health needs, and a change in the Medicaid-covered population resulting from continuous enrollment. Second, the launch of Standard Plans (SPs) occurred on July 1, 2021. While most of the population with SUD diagnoses enrolled in Tailored Plans (TPs) in July 2024, the launch of SPs may have affected outcomes for people with SUD if SPs' benefit design affected access to care or if SPs changed providers' patterns of care, directly or indirectly. We found that 25% of the population identified as having a substance use disorder were enrolled in SPs. Third, in preparation for Tailored Plans, the state launched a Tailored Care management (TCM) program on December 1, 2022. TCM is part of the SUD changes that this evaluation is intended to capture, but the launch of this new care management program targeting those who would eventually be enrolled in Tailored Plans, as well as some beneficiaries who remained in Medicaid Direct, may have affected patterns of care on or after the TCM launch. Finally, NC expanded Medicaid under the Affordable Care Act on December 1, 2023, which brought in a whole new set of Medicaid beneficiaries, some of whom had SUD diagnoses and thus were included in the latter part of the evaluation period.

We use interrupted time series (ITS) models to examine the trends in metrics before the start of the SUD waiver and during the waiver implementation period. These models control for changes due to other factors such as the COVID-19 time period, SP implementation, month effects, county effects, and beneficiary-level controls for age, race/ethnicity, sex, and the Chronic Disease Payment System (CDPS-Rx) condition grouper. This report does not incorporate a comparison group that was not exposed to the NC Medicaid transformation and thus the models will attribute any remaining factors that occurred during the SUD implementation period to the SUD waiver, with the exception of alternative approaches include in Supplement 1. We take this into account when describing results.

Below, we summarize the findings by major hypothesis.

¹ The original goal was stated as "Reduce Substance Use Disorder." It has since been modified to "Reduce the Burden of Substance Use Disorder."

Hypothesis 3.1: Expanding coverage of SUD services will result in improved care quality and outcomes for beneficiaries with SUD.

We examined 28 metrics reflecting quality of care and outcomes for Medicaid beneficiaries with substance use disorders to test Hypothesis 3.1. Analysis of these variables found that five metrics demonstrated meaningful improvements, eight showed no change, and 15 trended counter to the intended direction.

The metrics that improved during the SUD waiver represent important indicators of treatment access and system capacity. Most notably, the treatment rate among beneficiaries diagnosed with SUD increased substantially, with rates more than 13 percentage points higher than would have been expected without the waiver, representing a clinically significant improvement in connecting individuals with needed services. There is some evidence of a shift in care away from inpatient settings – the proportion receiving care in Institutes for Mental Disease and inpatient settings both decreased. Access to routine preventive and ambulatory healthcare services also was significantly higher than what would have been projected in the absence of the SUD waiver. Additionally, the number of SUD providers increased by 48% from approximately 5,800 to 8,600 during the study period, demonstrating successful infrastructure expansion.

Metrics demonstrating no change provided important context for interpreting other findings. SUD diagnosis rates remained stable at approximately 3.6% of the fully eligible Medicaid population of all ages throughout the study period, providing a consistent foundation for measuring treatment access improvements, although this increased to over 4% after Medicaid expansion. Hospital readmission rates for individuals with SUD diagnoses similarly remained stable at approximately 20%, indicating that expanded treatment access did not translate into improved outcomes as measured by this quality indicator.

Many metrics moved counter to the intended direction, demonstrating implementation challenges, reflecting system capacity constraints affecting care coordination and timeliness. Treatment initiation and engagement rates for newly diagnosed individuals with any type of SUD fell 34 and 29 percentage points below projected levels, respectively, indicating severe difficulties in connecting individuals to timely treatment despite expanded infrastructure, although the projected rates in the absence of the waiver were based on a strong pre-implementation upward trend that may not have been sustainable. However, the estimated initiation and engagement rates did not grow and even declined over baseline levels.

Similarly, follow-up care after emergency department visits for people with substance use disorder diagnoses declined 9-12 percentage points below expected rates, suggesting care coordination challenges during a critical transition period. These patterns indicate that while the waiver successfully scaled overall treatment capacity, rapid system transformation may have strained the mechanisms necessary to deliver timely, coordinated care.

Interpretation of these findings requires consideration of significant concurrent policy changes, particularly the December 2023 implementation of Medicaid expansion and July 2024 implementation of Tailored Plans. The enrollment of newly eligible adults—many

without established healthcare connections or prior SUD diagnoses—affected multiple metrics during the 2024 observation period, as did the earlier transition to Tailored Care Management. The statistical models account for these compositional changes in the Medicaid beneficiary population and secular trends in measures, but these major system transformations represent important contextual factors in understanding observed patterns, particularly the visible declines in some metrics during late 2023 and 2024.

Hypothesis 3.2: Expanding coverage of SUD services will increase the use of MOUD and other appropriate opioid treatment services and decrease the long-term use of prescription opioids.

We examined ten opioid-related metrics reflecting medications and other treatments for OUD and harmful long-term use of opioids to test Hypothesis 3.2. Because many opioid-related metrics are calculated only annually, the limited number of time points means that our evaluation was unable to precisely quantify the effect of the SUD waiver on several opioid-related outcomes. For these metrics, we present annual trends and highlight qualitative findings.

Controlling for changes in the beneficiary population, the percent of beneficiaries with a SUD diagnosis receiving MAT and the percent of beneficiaries with an OUD diagnosis receiving MOUD showed no change from baseline. However, this represents some progress as these measures were declining from baseline trends at the time of the Interim Report. We examined unadjusted measures of specific medication treatments and observed large gains in use of buprenorphine and methadone, while injectable and oral naltrexone use have not changed. The data also show a steady decrease in annual trends in continuity of pharmacotherapy for OUD, indicating that an increasing percent of beneficiaries who are newly treated with MOUD are not being retained in treatment longer-term. We also observed increased rates of psychosocial service use within the first 12 months of MAT use. Despite an overall downward trend in use of such services, the waiver proved to have a mitigating effect over time.

Some metrics evaluating the harmful use of long-term opioids demonstrated progress toward safer prescribing practices, but results were mixed. Annual rates for use of opioids from multiple providers in persons without cancer and concurrent use of opioids and benzodiazepines both declined over the study period, with respective rates below 1% and 15% in 2024. However, we observed an increase in the annual unadjusted rate of use of opioids at high dosage in persons without cancer that paralleled patterns of the opioid epidemic in North Carolina – use of opioids at high dosage in persons without cancer increased sharply between 2018 and 2022 before declining back to baseline levels between 2023 and 2024.

These changes occurred in a quickly changing landscape of state and federal regulations for opioids. This includes enactment of the NC STOP Act of 2017, changes to North Carolina’s opioid treatment program payment approach, North Carolina’s Medicaid expansion, the implementation of Tailored Plans, and an easing of federal regulations on take-home doses and telehealth for MOUD and removal of the “X-waiver” previously required to prescribe buprenorphine for OUD. The lack of solid evidence of continued access, initiation, and

engagement in treatment among beneficiaries with OUD diagnoses indicates that continued monitoring of access and outcome measures is still needed.

Hypothesis 3.3: Expanding coverage of SUD services will result in no changes in total Medicaid and out-of-pocket costs for people with SUD diagnoses and increases in Medicaid costs on SUD IMD services.

We examined eleven different categories of Medicaid spending separately, measured as inflation adjusted spending per recipient with a SUD diagnosis and as covariate-adjusted monthly measures of access to each service type. Seven out of eleven PMPM measures increased, including total spending on SUD treatments, total spending on people with SUD, behavioral health, inpatient, IMD, acute crisis spending, and total spending on non-SUD services for people with a SUD diagnosis. Two PMPM measures declined (outpatient evaluation and management and pharmacy spending), and two measures did not change substantially between implementation and demonstration end point (outpatient services and emergency department).

We also found increases in the percent of beneficiaries with SUD diagnoses receiving care in eight out of eleven categories, with only two categories demonstrating lower rates of access after controlling for changes in beneficiary characteristics during the Demonstration period (inpatient and IMD use). One measure of access did not change (acute crisis services).

These findings account for both the greater number of beneficiaries receiving benefits, especially after the start of the PHE and after Medicaid expansion, and measures of use also account for changes in case mix.

In summary, increasing PMPM expenditures, not unexpected as services were expanded to more beneficiaries, were found in most categories of services. These increases reflect both greater proportions of beneficiaries using many types of services as well as potentially greater intensity of service use. Inpatient care expenditures occurred for proportionately fewer beneficiaries than expected after SUD waiver change, but unadjusted inpatient PMPM increased, indicating potentially sicker patients receiving inpatient services or more intensive hospital-based services received.

Chapter 2. General Background Information

This document is the Summative Evaluation Report (SER) of the SUD components of North Carolina's 1115 waiver. It is one of three SERs to be submitted for the demonstration evaluation (with the Healthy Opportunities Pilots and the Managed Care Transformation being the other two). The purpose of the NC 1115 Waiver is to improve Medicaid beneficiary health outcomes through the implementation of a new delivery system, to enhance the viability and sustainability of the NC Medicaid program by maximizing the receipt of high-value care, and to reduce the burden of substance use disorders statewide. North Carolina's 1115 waiver, entitled "North Carolina Medicaid Reform Demonstration," was approved by the Centers for Medicare & Medicaid Services (CMS) on October 24, 2018. The demonstration consists of two major elements: components to address the opioid use epidemic and general substance use treatment needs in the state of North Carolina, and other components to restructure Medicaid and Health Choice delivery system and benefit structure in NC. The SUD components were first authorized on January 1, 2019.

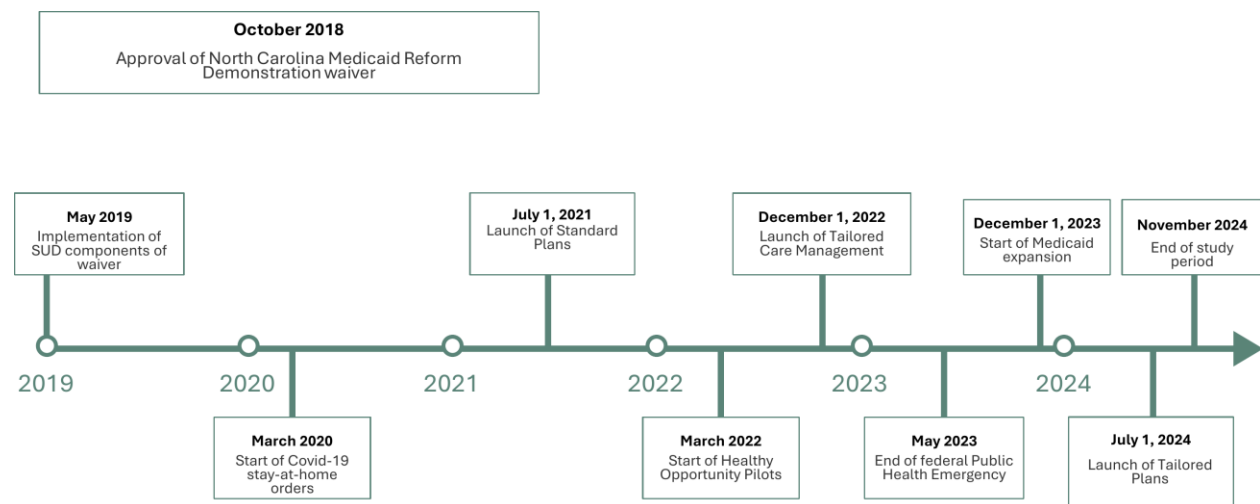
The SUD waiver components consist of several important policy changes. First, as of July 2019, the State was approved to begin billing for substance use services received in an "Institute for Mental Disease," the traditional term for specialty facilities that have more than 16 beds with most patients receiving treatment for mental illness and/or substance use disorder. IMDs typically consist of psychiatric hospitals and residential SUD treatment facilities. State Medicaid programs are unable to bill for services in IMDs for Medicaid beneficiaries between the ages of 21 and 64. The ability of the State to bill for SUD services in an IMD creates substantial savings for the State by allowing NC to receive federal financial participation or federal match for these services, reducing the price of IMD services to the state by almost 66%. Second, the state modified numerous policies that expand SUD services in the state by increasing the types of providers who can bill Medicaid for SUD services and expanding the continuum of care to be consistent with the American Society of Addiction Medicine (ASAM) continuum. These benefit expansions started during the first year of the waiver and continue to be implemented. For example, coverage for residential treatment for SUD and co-occurring mental health disorders is still being expanded, with American Society for Addiction Medicine levels 3.1 and 3.3 expected to launch January 1, 2026, and levels 3.5 and 3.7 expanded to additional populations on the same date.

Finally, Medicaid enrollees with severe SUD, severe mental illness (SMI), intellectual or developmental disabilities (I/DD), and/or traumatic brain injuries (TBI) who meet criteria established by the Department of Health and Human Services (DHHS) were enrolled in separate capitated plans with specialized features that have enhanced behavioral health benefits, called BH I/DD Tailored Plans. The transition to Tailored Plans was initially scheduled to occur earlier in the demonstration but ultimately launched July 1, 2024. (See [Figure 1](#) below for a timeline of key implementation dates across SUD and related waiver components). The organizations (LME/MCOs) that became Tailored Plans offered Tailored Care Management beginning on December 1, 2022, which may have increased screenings and referrals to services.

Other parts of the 1115 Waiver Demonstration may also have influenced health care use patterns for people with SUD diagnoses. For example, most Medicaid beneficiaries moved into Standard Plans (capitated health plans) on July 1, 2021, and the Healthy Opportunities Pilots (HOP) launched in spring 2022, adding new benefits to address social needs like food insecurity and housing instability in certain regions. However, this report focuses specifically on the direct impact of the SUD-related components of the waiver described above. Tailored Care Management, a specialized care management program for beneficiaries likely to be covered under a Tailored Plan, was offered starting December 1, 2022; see [Important Confounders during SUD Waiver Implementation](#) in Chapter 3 for additional examples.

While approximately 80% of Medicaid beneficiaries with SUD are covered under either a Standard or Tailored capitated plan under the demonstration, several groups are currently exempt from participation in any type of managed care, including Medicaid enrollees dually eligible for Medicare, Medicaid enrollees who are eligible through the Medically Needy program, those with limited eligibility such as through family planning waivers, those presumptively eligible for Medicaid, and prison inmates receiving Medicaid-covered inpatient services. In addition, Medicaid-only beneficiaries receiving long-stay nursing home services are also excluded. These beneficiaries will remain in fee-for-service Medicaid, now called NC Medicaid Direct. On December 1, 2025, after the time period for this report, children, youth, and young adults involved in the child welfare system were eligible to switch from NC Medicaid Direct to the new Children and Families Specialty Plan.

Figure 1: Study Period Timeline for SUD Waiver Evaluation



Chapter 3. Evaluation Questions and Hypotheses

There are three stated goals for the demonstration:

1. Measurably improve health outcomes via a new delivery system
2. Maximize high-value care to ensure sustainability of the Medicaid program, and
3. Reduce the burden of SUD²

All three goals can be used as a lens through which the SUD components of the waiver are evaluated, although the third goal is the most specific for this report.

The primary and secondary drivers, or pathways through which these goals will be achieved, are diagrammed below in [Figure 2](#). Although the first two Goals are less relevant for the SUD component of the waiver, they are included for context because there may be some effect on SUD services and/or populations. Goal 3 is additionally broken out in more detail in [Figure 3](#).

The primary drivers for Goals 1 and 2 include an increased use of alternative payment models (APMs), providing care with a whole person orientation, enhanced access to care, and more use of evidence-based practices and medicines. According to the NC Medicaid's Managed Care Quality strategy, the use of APMs is expected to increase through the use of prepaid health plans (PHPs) including SPs and TPs³. SPs are encouraged to use APMs to pay providers and are incentivized to move along the Health Care Payment Learning and Action Network's APM Framework⁴ towards more population-based models of payment and accountability. With the use of value-based payments (VBPs), SPs and TPs have more ability to place incentives upon providers to meet quality expectations. These pre-paid health plans are held to quality expectations and other oversight/compliance by the State; this puts more emphasis on quality and value than existed prior to the waiver.

It is well known that medical care is only responsible for a fraction of a person's health; other factors like social determinants of health (SDOH) and the broader environment are also considerable drivers. An increased emphasis on a whole person orientation will improve beneficiary outcomes. Several managed care initiatives specifically address SDOH; these include the Healthy Opportunities Pilots, the resource platform linking needs to local assets (called NCCare360), and mandated screening for patients' SDOH-related needs.

Multiple secondary drivers will improve the use of evidence-based practices (EBP). This driver is deliberately worded to account for both the recommendation of EBPs by providers as well as the ability and willingness of patients to participate in EBPs, including patients' ability to access recommended care (e.g., transportation needs met), trust in the provider's recommendation through shared decision-making, and adherence to the recommended treatment (e.g., medication). Some of the secondary drivers are focused on providers (e.g.,

² The original goal was stated as "Reduce Substance Use Disorder." It has since been modified to "Reduce the Burden of Substance Use Disorder."

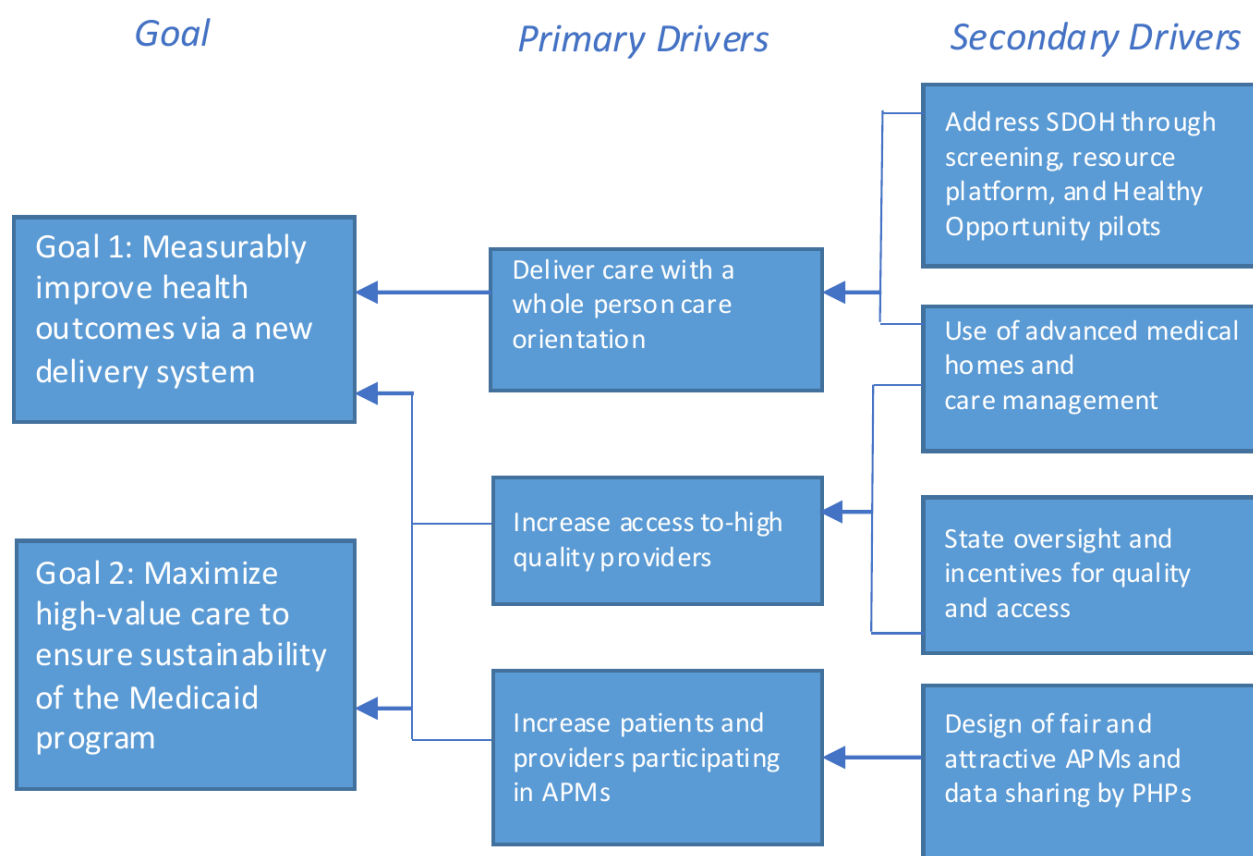
³ <https://medicaid.ncdhhs.gov/nc-medicaid-2023-quality-strategy/download?attachment>

⁴ <https://hcp-lan.org/apm-framework/>

quality improvement activity and shared data/transparency) while others are more focused on the patient and family (patient engagement, use of advanced medical homes). Likewise, oversight of the PHPs and providers will increase the use of EBPs, and access to the resource platform will attenuate social barriers inhibiting patients’ abilities to access evidence-based practices.

Finally, these primary drivers also improve the ability of patients to access care more generally. These will improve provider satisfaction and willingness to treat and manage Medicaid beneficiaries. As providers become more satisfied with the Medicaid program, more providers will be willing to serve Medicaid beneficiaries, and many will increase the number of Medicaid beneficiaries they are able to serve.

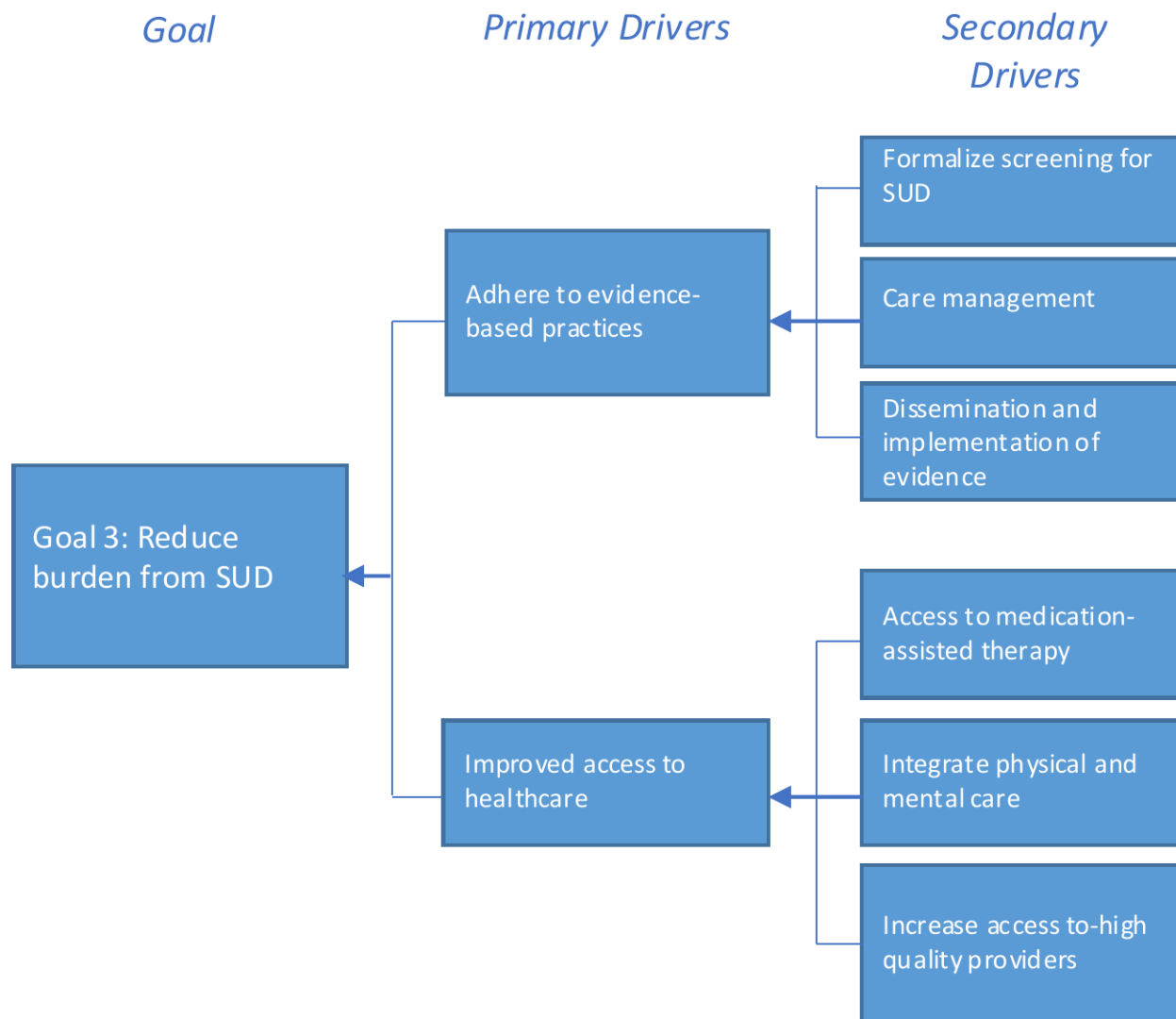
Figure 2: Driver Diagram for Goals 1 and 2



Goal 3 is “reduce the burden of substance use disorder.” In [Figure 3](#), we provide additional detail on this goal, which includes reducing the burden of SUD in terms of both reductions in mortality and morbidity. The primary intention of the SUD components of the waiver is to provide beneficiaries with SUD the high-quality care they need and to reduce excessive and long-term use (greater than 90 days) of opioids. Secondary drivers include formalized screening for SUD, better care management, dissemination and implementation of evidence, an increase in prescribers of medications for opioid use disorders (MOUD, sometimes

referred to as Medication Assisted Therapies [MAT]),⁵ integration between physical and behavioral health, and increased access to high-quality providers. The secondary drivers lead to treatment being provided in the most appropriate care setting, adherence to medications and SUD services (including, as above, the notion that providers need to be recommending EBPs as well), and improving rates of treatment and engagement with SUD treatment and providers.

Figure 3: Driver Diagram for Goal 3



⁵ We use both terms in this report: MOUD is the currently preferred term while MAT is the traditional name and is included here only when it is the name of specific outcome metrics or interventions. They are not perfectly synonymous – MAT includes therapies beyond medication, and MOUD is specific to opioid use disorders –but for most purposes in this document they are sufficiently similar.

Each of the three goals leads to several hypotheses that will be tested in the demonstration evaluation through the related research questions. The research questions specific to SUD services or beneficiaries with SUD diagnoses include:

Goal 3: Reduce the burden of SUD

Hypothesis 3.1: Expanding coverage of SUD services will result in improved care quality and outcomes for patients with SUD.

- Research question 3.1.a Does the expanded coverage of SUD services increase the quality of care for patients with SUD?
- Research question 3.1.b Does the expanded coverage of SUD services improve health outcomes for people with SUD?

Hypothesis 3.2: Expanding coverage of SUD services will increase the use of MOUD and other appropriate opioid treatment services and decrease the long-term use of prescription opioids.

- Research question 3.2.a Does the expanded coverage of SUD services increase the use of MOUD?
- Research question 3.2.b Does the expanded coverage of SUD services increase the use of non-medication opioid treatment services at the appropriate level of care?
- Research question 3.2.c Does the expanded coverage of SUD services decrease the probability of long-term use of prescription opioid therapy for chronic pain?⁶

Hypothesis 3.3: Expanding coverage of SUD services will result in no changes in total Medicaid and out-of-pocket costs for people with SUD diagnoses; increases in Medicaid costs on SUD IMD services; increases in SUD pharmacy, outpatient, and rehabilitative costs; and decreases in acute care crisis-oriented, inpatient, ED, long-term care and other SUD costs.

- Research question 3.3a Does the expanded coverage of SUD services change total Medicaid costs?
- Research question 3.3b Does the expanded coverage of SUD services change out-of-pocket costs to Medicaid enrollees with an SUD diagnosis?
- Research question 3.3c Does the expanded coverage of SUD services increase Medicaid costs on SUD IMD services, SUD pharmacy, outpatient, and rehabilitative costs?
- Research question 3.3d Does the expanded coverage of SUD services decrease Medicaid costs on acute care crisis-oriented, inpatient, ED, long-term care and other SUD costs?

⁶ Long-term use of opioids refers to use of non-MOUD opioids for more than 90 days.

- Research question 3.3e Does the expanded coverage of SUD services decrease Medicaid spending on non-SUD services for people with an SUD diagnosis?

We also reported results related to general health and utilization of preventative care and mental health treatments for beneficiaries with a SUD diagnosis. The selected metrics were drawn from those relevant to people with SUD diagnoses and available in our database.

Evaluation Measures

This Summative Evaluation Report assesses the degree to which the Demonstration has been effective in achieving its goals and examines the processes, facilitators and barriers experienced during the initial Demonstration period using a set of metrics relevant to beneficiaries with SUD that measure the quality of care, the process of care, and the outcomes of care.

[Table 1](#) details the quantitative measures to be used to test each hypothesis, the source or custodian of each measure, the sample or population to which the measure is relevant, and the proposed data sources. Measures were generated from the CMS-required metrics for SUD 1115 waiver demonstrations, PHP Quality Metrics,⁷ the Managed Care Quality Strategy,⁸ the SUD guidance documents,^{9, 10} and other public sources. Several of these measures will be employed for multiple hypotheses, to examine the effect of different components of the waiver on outcomes or in different Medicaid populations. The data sources and analytic methods are further described below. For most of these measures, we used claims and encounter data, which includes a) fee-for-service (FFS) claims data prior to July 1, 2021 as well as remaining populations or services subject to FFS payments after July 1, 2021; b) local management entity – managed care organization (LME/MCO) encounter data including TP encounters; and c) SP encounter data. Unless otherwise stated, metrics are examined only for fully-eligible beneficiaries (excluding anyone with partial eligibility such as through the family planning waiver) and for the entire age profile.

⁷ BH I/DD Tailored Plan Quality Metrics. Available at: <https://files.nc.gov/ncdma/4---Addendum-3-RFA-30-2020-052-DHB-Section-VII-Attachments-A-P.pdf>

⁸ NC Medicaid Managed Care Quality Strategy. Available at: <https://medicaid.ncdhhs.gov/transformation/quality-management-and-improvement>

⁹ Monitoring Metrics for Section 1115 Demonstrations with SUD Policies. Available at: <https://www.medicaid.gov/medicaid/section-1115-demo/downloads/evaluation-reports/sud-monitoring-metrics.pdf>

¹⁰ NC Substance Use Disorder Implementation Plan Protocol. Available at: <https://www.medicaid.gov/Medicaid-CHIP-Program-Information/By-Topics/Waivers/1115/downloads/nc/Medicaid-Reform/nc-medicaid-reform-demo-sud-imp-plan-prtcl-20190425.pdf>

Table 1: Measures included in the Summative Evaluation Report

Measure (Metric abbreviation)	Measure custodian	Numerator	Denominator	Process / Outcome
Hypothesis 3.1: Expanding coverage of SUD services will result in improved care quality and outcomes for patients with SUD				
Medicaid Beneficiaries with SUD Diagnosis, monthly (M3)	CMS	Coded as receiving MAT or have qualifying facility, provider, or pharmacy claims with a SUD diagnosis and a SUD-related treatment service	All beneficiaries	Outcome
Any SUD treatment (M6)	CMS	Beneficiaries receiving at least one SUD treatment or pharmacy claim	Beneficiaries with a SUD diagnosis	Outcome
Outpatient Services for SUD (M8)	CMS	Beneficiaries with a service claim for outpatient services for SUD	Beneficiaries with a SUD diagnosis	Outcome
Access to Preventive/Ambulatory Health Services for Adult Medicaid Beneficiaries with SUD (M32)	NCQA – HEDIS / CMS	Beneficiaries with an ambulatory or preventative care visit	Adult beneficiaries with SUD	Process
Access to Additional Services Using Provider Resource Directory - Connecting Primary Care to SUD Service Offerings (Q2)	Sheps / DHB created measure	Visits to a primary care provider within 30 days of a SUD service	Visits with a SUD diagnosis	Process

Intensive Outpatient and Partial Hospitalization Services (M9)	CMS	Beneficiaries who have a service or pharmacy claim for intensive outpatient and/or partial hospitalization services for SUD	Beneficiaries with a SUD diagnosis	Outcome
Withdrawal Management (M11)	CMS	Beneficiaries with a service or pharmacy claim for withdrawal management services	Beneficiaries with a SUD diagnosis	Outcome
Residential and Inpatient Services (M10)	CMS	Beneficiaries who have a service for residential and/or inpatient services for SUD	Beneficiaries with a SUD diagnosis	Outcome
Emergency Department Utilization for SUD per 1000 beneficiaries (M23)	CMS	Number of ED visits for SUD	All fully eligible beneficiaries	Process
Inpatient Stays for SUD (M24)	CMS	Number of inpatient discharges related to a SUD stay	All fully eligible beneficiaries	Process
Readmissions Among Beneficiaries with SUD (M25)	CMS	Acute readmissions for any diagnosis within 30 days of the index discharge date	All fully eligible beneficiaries with an index hospital stay	Outcome
Follow-Up After Emergency Department Visit for Alcohol and Other Drug Abuse or Dependence (M17.1)	NQF#: 3488 / NCQA – HEDIS / Adult Core Set	A follow-up visit with any practitioner within 7 and 30 days of the ED visit	ED visits for beneficiaries ages 18 and older with a principal diagnosis of AOD abuse or dependence	Outcome

Initiation and Engagement of Alcohol and Other Drug Abuse or Dependence Treatment (IET/M15)	NQF#: 0004 / NCQA – HEDIS / Adult Core Set	Beneficiaries who initiated AOD treatment within 14 days of the diagnosis and who were engaged in ongoing AOD treatment within 34 days of the initiation visit	Adult beneficiaries with a new episode of SUD	Process
Overdose Deaths (M26)	CMS	--	Adult beneficiaries with SUD diagnoses	Outcome
Death Rate from Overdose Post-prison Release	--	Beneficiaries who died from drug overdose within a year of being released from prison	Beneficiaries with a prison release in the criminal justice file	Outcome
SUD Provider availability (M13)	CMS	Total number of SUD providers who were enrolled and qualified to deliver Medicaid services	NA	Process
SUD Provider availability for MAT (M14)	CMS	Total number of SUD providers who were enrolled and qualified to deliver Medicaid services and who meet standards to provide buprenorphine or methadone as part of MAT	NA	Process

Hypothesis 3.2: Expanding coverage of SUD services will increase the use of MAT and other appropriate opioid treatment services and decrease the long-term use of prescription opioids				
Medication-Assisted Treatment (M12)	CMS	Beneficiaries who have a claim for a MAT dispensing event for SUD	Beneficiaries with a SUD diagnosis	Process
Medication-Assisted Treatment for Beneficiaries with OUD (M12_oud)	--	Beneficiaries who have a claim for a MAT dispensing event for OUD	Beneficiaries with an OUD diagnosis	Process
Use of Pharmacotherapy for Opioid Use Disorder by Medication Type	NQF 3400	Use of MOUD reported by buprenorphine, methadone, oral naltrexone, and injectable naltrexone	Beneficiaries with an OUD diagnosis	Outcome
Continuation of Pharmacotherapy for OUD (M22)	NQF#: 3175 / USC	Adult beneficiaries who have at least 180 days of continuous MOUD treatment	Adult beneficiaries with OUD and at least one claim for pharmacotherapy	Outcome
<i>Percent of individuals initiating MAT who receive psychosocial services within the first 12 months (Q3)</i>	--	Psychosocial visits during the current and prior 3 months	Beneficiaries in their first 12 months of receiving MAT	Process
Percent of Enrollees Diagnosed with OUD Receiving Non-medication Opioid Treatment Services	--	Evidence of psychosocial service for OUD	Beneficiaries with an OUD diagnosis	Process
Use of Opioids at High Dosage in Persons without	NQF#: 2940 / PQA / Adult Core Set	Beneficiaries who received prescriptions for	Adults with two or more prescription claims for opioids	Outcome

Cancer (M18/OHD-AD)		opioids with an average daily dosage of ≥ 90 morphine milligram equivalents (MME) over a period of 90 days or more	filled on different service dates and with a cumulative days' supply of 15 or more days	
Use of Opioids from Multiple Providers in Persons Without Cancer (M19/OMP)	NQF#: 2950 / PQA	Evidence of opioid prescription claims from 4 or more prescribers AND 4 or more pharmacies within 180 days	Adults with two or more prescription claims for opioids filled on different service dates and with a cumulative days' supply of 15 or more days	Outcome
Use of Opioids at High Dosage and from Multiple Providers in Persons Without Cancer (M20/OHDMP)	NQF#: 2951 / PQA	Evidence of opioid prescription claims with an average daily dosage of ≥ 90 morphine milligram equivalents (MME) AND from 4 or more prescribers AND 4 or more pharmacies	Adults with two or more prescription claims for opioids filled on different service dates and with a cumulative days' supply of 15 or more days	Outcome
Concurrent Use of Opioids and Benzodiazepines (M21/COB)	NQF#: 3389 / PQA / Adult Core Set	Received concurrent prescriptions for opioids and benzodiazepines	Adult beneficiaries with two or more prescriptions of opioids on different service dates and with a cumulative days' supply of 15 or more days	Process
Hypothesis 3.3: Expanding coverage of SUD services will result in no changes in total Medicaid and out-of-pocket costs for people with SUD diagnoses; increases in Medicaid costs on SUD IMD services; increases in SUD pharmacy, outpatient,				

and rehabilitative costs; and decreases in acute care crisis-oriented, inpatient, ED, long-term care and other SUD costs				
Percent of beneficiaries with any expenditure in month		Beneficiaries with a SUD diagnosis and any healthcare expenditure	All beneficiaries with a SUD diagnosis	Outcome
Total SUD spending PMPM (M28)	CMS	Average monthly SUD treatment service expenditure per beneficiaries with a SUD diagnosis	All beneficiaries with a SUD diagnosis	Outcome
Percent of beneficiaries with any outpatient expenditure in month		Beneficiaries with a SUD diagnosis and an outpatient expenditure	All beneficiaries with a SUD diagnosis	Outcome
Outpatient Expenditures PMPM		Average monthly outpatient expenditure per beneficiaries with a SUD diagnosis	All beneficiaries with a SUD diagnosis	Outcome
Percent of beneficiaries with any outpatient E&M expenditure in month		Beneficiaries with a SUD diagnosis and an outpatient E&M expenditure	All beneficiaries with a SUD diagnosis	Outcome
Outpatient E&M Expenditures PMPM		Average monthly outpatient E&M expenditure per beneficiaries with a SUD diagnosis	All beneficiaries with a SUD diagnosis	Outcome
Percent of beneficiaries with BH expenditures in month		Beneficiaries with a SUD diagnosis and a behavioral health expenditure	All beneficiaries with a SUD diagnosis	Outcome
Behavioral health expenditures PMPM		Average monthly behavioral health expenditure per	All beneficiaries with a SUD diagnosis	Outcome

		beneficiaries with a SUD diagnosis		
Percent of beneficiaries with pharmacy expenditures in month		Beneficiaries with a SUD diagnosis and a pharmacy expenditure	All beneficiaries with a SUD diagnosis	Outcome
Pharmacy expenditures PMPM		Average monthly prescription drug expenditure per beneficiaries with a SUD diagnosis	All beneficiaries with a SUD diagnosis	Outcome
Percent of beneficiaries with any ER expenditure in month		Beneficiaries with a SUD diagnosis and an ER expenditure	All beneficiaries with a SUD diagnosis	Outcome
Emergency Room Expenditures PMPM		Average monthly emergency room expenditure per beneficiaries with a SUD diagnosis	All beneficiaries with a SUD diagnosis	Outcome
Percent of beneficiaries with any inpatient expenditures in month		Beneficiaries with a SUD diagnosis and an inpatient expenditure	All beneficiaries with a SUD diagnosis	Outcome
Inpatient expenditures PMPM		Average monthly inpatient expenditure per beneficiaries with a SUD diagnosis	All beneficiaries with a SUD diagnosis	Outcome
Percent of beneficiaries with any acute crisis service in month	DHB created measure	Beneficiaries with a SUD diagnosis and an acute crisis service expenditure	All beneficiaries with a SUD diagnosis	Outcome
Acute crisis service expenditures PMPM	DHB created measure	Average monthly acute crisis service expenditure per	All beneficiaries with a SUD diagnosis	Outcome

		beneficiaries with a SUD diagnosis		
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Chapter 4. Evaluation Methodology

This chapter contains two key elements. The first is how to interpret the results. The second deals with technical details of the specific statistical design. Readers uninterested in the technical details can skip the second section.

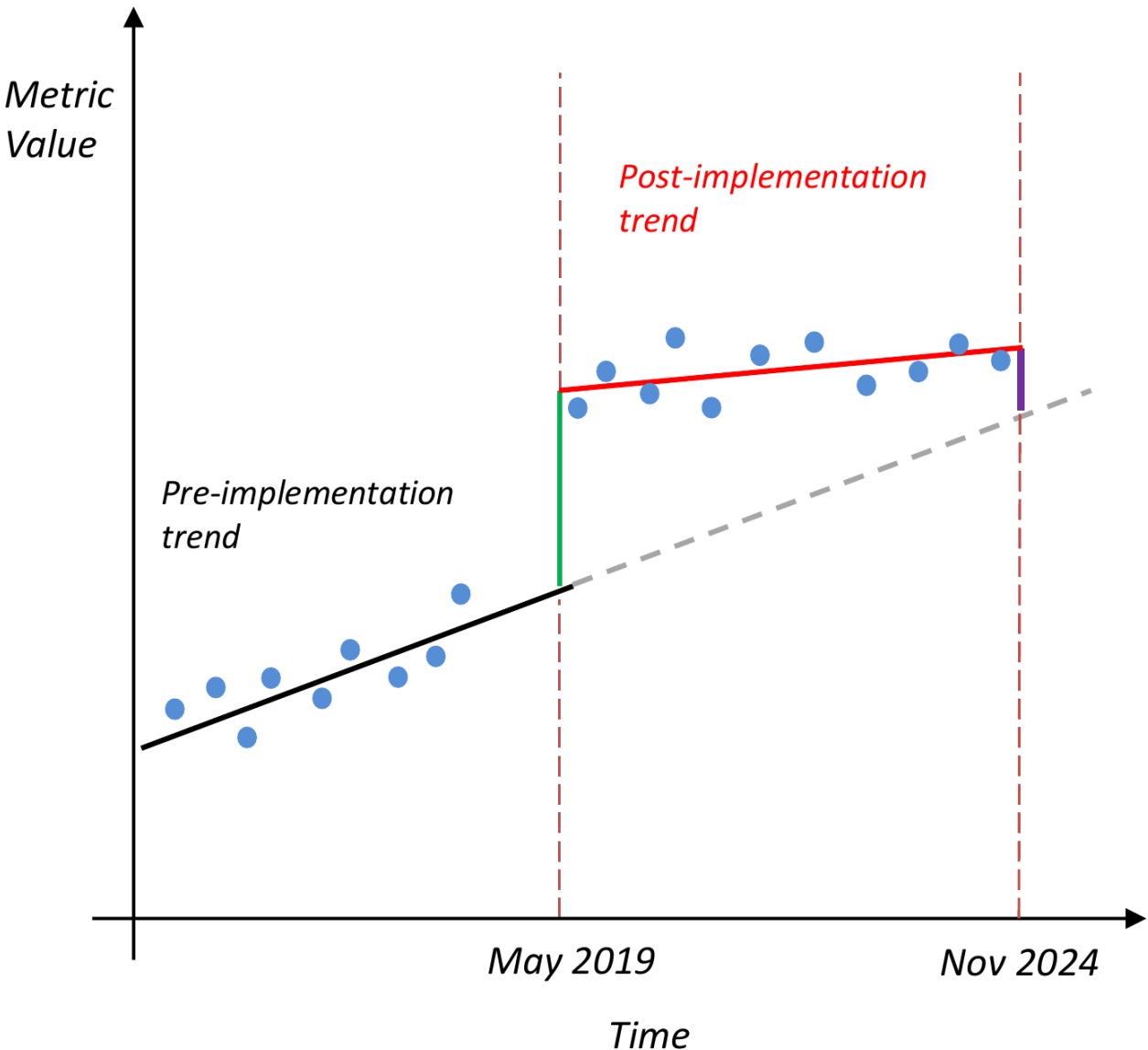
How to Read the Results

Progress due to the waiver was defined for monthly metrics as metrics improving beyond what would have occurred without the implementation of the SUD components of the waiver. The challenge in this construct, as it is with all analytic studies, is identifying “what it would have been in the absence of the waiver” – also known as the counterfactual.¹¹ Using an interrupted time series (ITS) analysis, we compared pre- and post-implementation trends while controlling for factors like beneficiaries’ chronic disease burden, demographics, seasonality, Medicaid expansion, and COVID effects. If improvements slowed after the waiver began, we considered that a deficiency, since the waiver aimed to accelerate progress in SUD care. Thus, the “effect” of the waiver is defined as the difference between the observed rates and those we estimate would have occurred without the waiver. The counterfactual will usually be different from the values at the time the waiver was implemented.

These effects can be viewed graphically in [Figure 4](#) (for illustration purposes, COVID effects are not shown). Blue dots represent average monthly values. The black line represents the pre-implementation trend. The green line represents the average “jump” in metric value at the time of policy change (effect #1). The red line shows the time trend post-implementation. The difference in slope between the black (pre-implementation) and red (post-implementation) lines represents how trends changed after the SUD implementation (effect #2). The grey dotted line extends the pre-implementation trend forward to November 2024; this represents the best estimate for what metrics would have been in the absence of implementation. The combination of the initial “jump” and the difference in trend means that the post-implementation estimate differs from the best estimate of what the metric would have been if the implementation had not occurred. The difference between the predicted outcomes with and without SUD implementation at the end of the study period (Nov 2024) is shown by the purple line (effect #3).

¹¹ “Best Practices in Causal Inference for Evaluations of Section 1115 Eligibility and Coverage Demonstrations” available at <https://www.medicaid.gov/medicaid/section-1115-demo/downloads/evaluation-reports/causal-inference.pdf>

Figure 4: Simplified Example of Interrupted Time Series

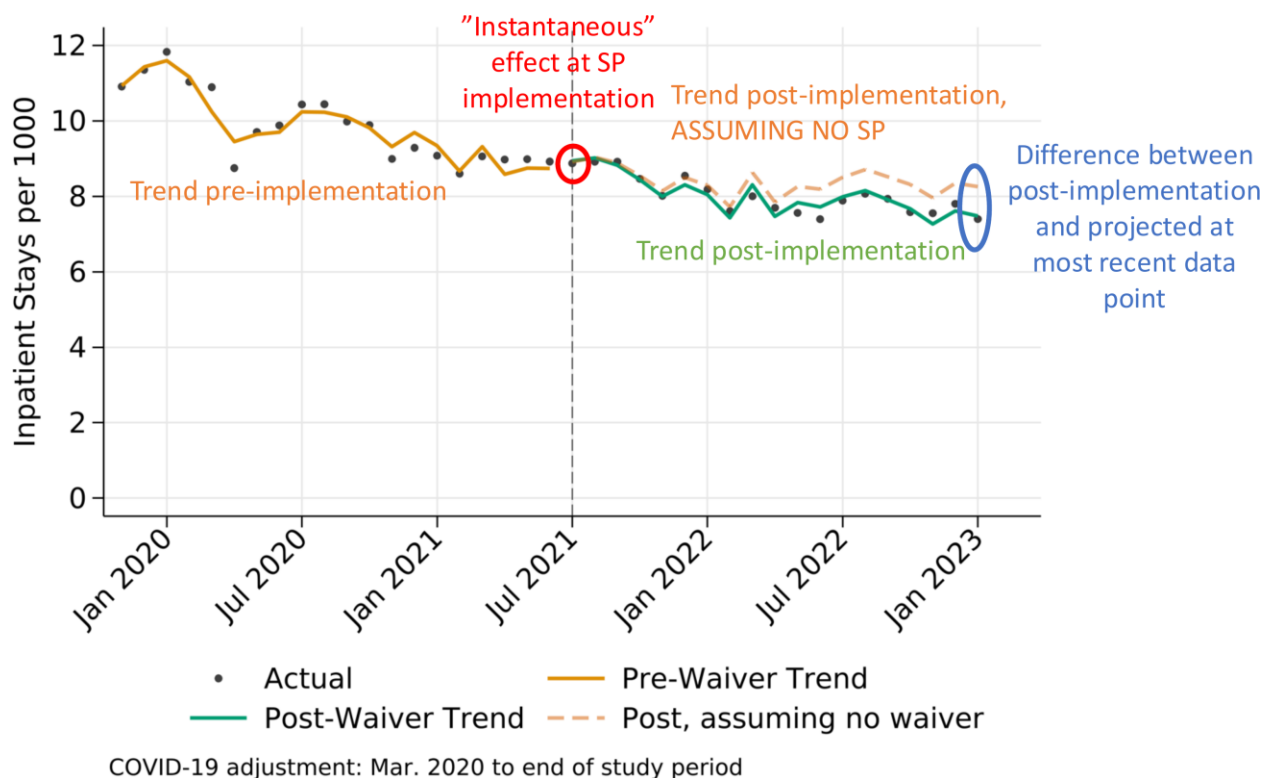


In practice, the figures in the Results section are more complicated because they account for changes in diagnoses and seasonal effects (e.g. increased flu diagnoses in the winter). But at their core, the “effects” of the SUD waiver are described with these three perspectives: an effect at launch, a slope/trend difference over the period since SUD waiver implementation, and the resulting difference in “current” values.

The image above ([Figure 4](#)) shows the “simplified concept”; the image below ([Figure 5](#)) is an annotated example of the actual results. This result in [Figure 5](#) shows almost no “instantaneous effect” shown by the red circle – the green and orange lines in July 2021 are nearly identical. Post-implementation, the green line generally slopes down more than the orange; this leads to a difference in November 2024 (blue circle) where the green line lies

below the orange line. The conclusion here, ignoring statistical significance, is that post-implementation this measure is less than the measure would have been in the same month if SUD policies had NOT been implemented.

Figure 5: Annotated Example of Results



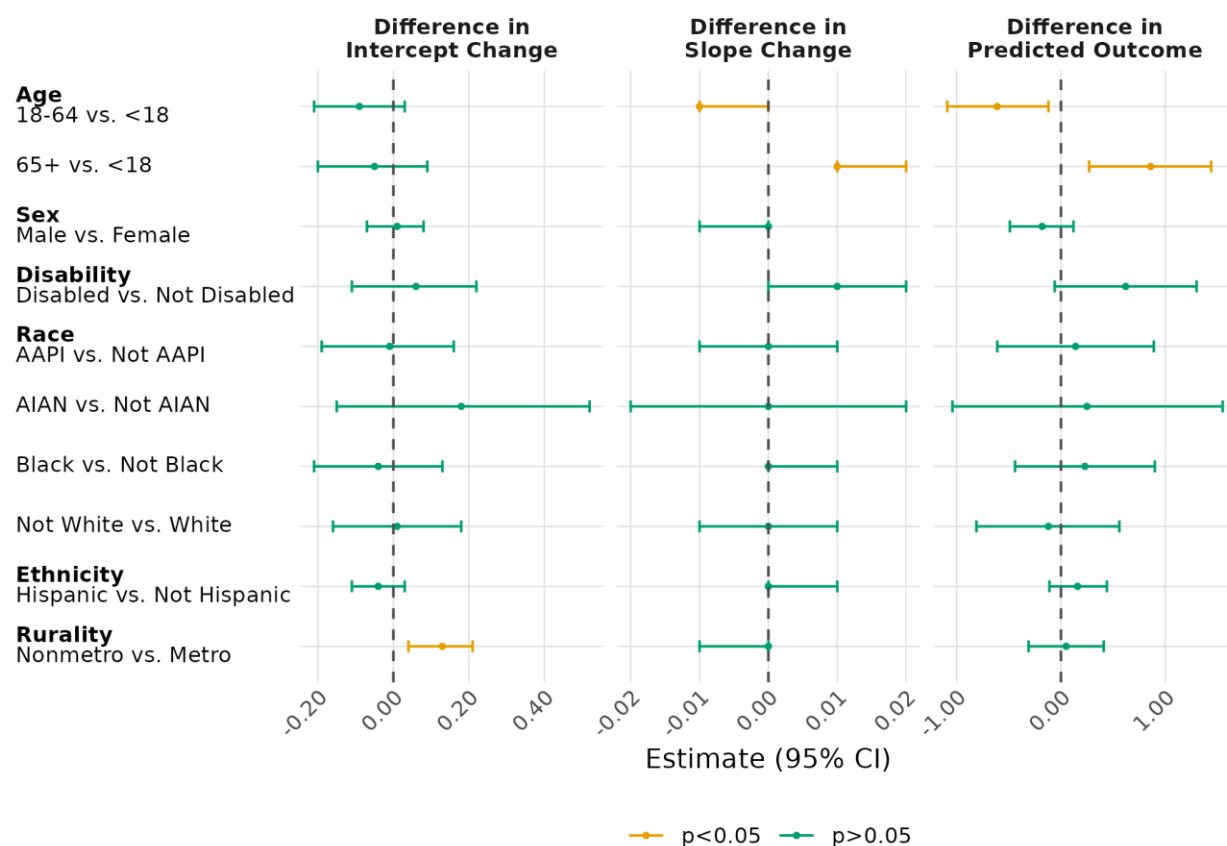
Each metric includes a table with the format as shown below. The shading of the cells below aligns with the color in (Figure 5). Orange represents the “baseline” (pre-implementation) slope. Green denotes the post-implementation slope. Red denotes the “instantaneous” difference. Blue refers to the difference in the last data point. The row below each point estimate provides the 95 percent confidence interval around the estimate. Those 95% confidence intervals that contain zero are not statistically significant. For example, suppose the instantaneous difference is .0274 with a confidence interval of (0.0825, 0.1373); 0 lies between the two endpoints and thus there is no statistical evidence of an effect. In contrast, the difference at the final data point is -0.7839 with a confidence interval (CI) of (-1.0293, -0.5386), which does not contain zero and thus there is statistical evidence of a difference. Not shown explicitly in Figure 5 is the difference in slopes; that is denoted by -0.0451 (-0.0557, -0.0345) and thus there is statistical evidence of a difference in slope for the two periods.

Table 2: Example of Table Included with each Metric

	Baseline	SP Waiver Implementation	Difference
Predicted Average Outcome May 2019	8.9313 (-8.8455, -9.0170)	8.9586 (-8.8911, -9.0261)	0.274 (-0.0825, -0.1373)
Slope	0.102 (-0.0161, -0.1880)	0.057 (-0.0292, -0.1431)	-0.0451* (-0.0557, -0.0345)
Predicted Average Outcome Nov 2024	10.4901 (-10.2494, -10.7308)	9.7062 (-9.6429, -9.7695)	-0.7839* (-1.0293, -0.5386)
N	64,219,845		

We also conducted analyses on a number of subpopulations for some of the metrics. To summarize results from the subgroup analyses, metrics supporting such analyses contain a figure (“forest plot”) such as shown in [Figure 6](#). It presents the three estimates of interest: the immediate effect (labeled “intercept change”), the difference in the slope or trend over the SUD implementation period (or “slope change”), and the difference in predicted outcome at the end of the study period across subgroups. Statistically significant differences are shown in orange. For the example metric in the figure below, there was no immediate difference between 65+ and 18–64-year-olds, but the 65+ population had a higher slope, which also led to a positive difference at the end of the study period. There was little evidence of a difference between men and women and most of the subgroups examined, except for age and rurality.

Figure 6: Example of Subgroup Plot



Evaluation Design

The evaluation design in this Summative Evaluation Report focused on the trends in and analysis of the measures outlined in [Table 1](#). We conducted analyses of metrics on a monthly or annual basis. Some of these results have already been reported to NC DHHS through data dashboards developed as part of the Evaluation and through verbal and written reports.

Evaluation Period

The evaluation study period for the Summative Evaluation Report was from October 1, 2015 – November 30, 2024. The figures display “Jan 2025” because we display January and July for each of the years. The baseline period (October 1, 2015 – April 30, 2019) was slightly less than five years prior to the start of Demonstration but adjusted to start after the launch of ICD-10 codes. Monthly metrics are reported for the full study period unless a washout period or lag is required. Annual measures consist of both calendar-year metrics (baseline begins January 1, 2016) or Demonstration Year metrics (baseline begins November 1, 2015).

May 1, 2019 was used as the assumed start of the SUD waiver in this report, since approval was received in April 2019. Many waiver SUD changes were phased in over time and thus our estimates will be conservative since those “post-waiver” estimates include a “pre-

implementation” period. We note in the results section if the metrics were trending up or down during the SUD implementation period.

Important Confounders during SUD Waiver Implementation

Several major events occurred during the SUD implementation period. First, the PHE from the COVID-19 pandemic began with stay-at-home orders in March 2020. The PHE dramatically reduced the use of most Medicaid-funded health care services and resulted in several policies implemented to attempt to reduce the impact on Medicaid beneficiaries and providers; likewise, continuous enrollment meant that some beneficiaries who would have rolled off of Medicaid (e.g. children who age into adults and thus would no longer have been eligible; some mothers more than 90 days post-partum) remained covered during this period. The PHE ended in April 2023, although different types of service returned to normal at different times during the PHE. We developed a novel method of identifying the return-to-normal dates in our data, as described below. Our estimation analysis included the relevant COVID period as identified in our return-to-normal analysis.

Second, the launch of Standard Plans occurred on July 1, 2021. While much of the population with an SUD were eventually enrolled in a Tailored Plan, the launch of Tailored Plans was delayed to July 1, 2024. Beneficiaries considered eligible for Tailored Plans remained in fee for service Medicaid (NC Medicaid Direct) until Tailored Plan launch. The launch of SPs may have affected outcomes for people with SUD due to reduced substance use disorder benefits in SPs or if SPs changed providers’ patterns of care, directly or indirectly. In addition, gearing up for TP launch may have affected patterns of care examined here and would be attributed to the waiver in our analysis. In addition, in preparation for the launch of TPs, the entities that became TPs began offering a specialized care management program for people expected to enroll in TPs as well as some people who remained on Medicaid Direct. This specialized care management program, called Tailored Care Management (TCM), was offered starting December 1, 2022.

North Carolina implemented Medicaid expansion under the Affordable Care Act on December 1, 2023. The expansion made Medicaid available to low-income adults aged 19 through 64 who earned up to 138% of the federal poverty line. Within the first year, over 600,000 people enrolled in Medicaid under this expansion. The large influx of enrollees may have put pressure on providers and potentially changed the health composition of enrollees with SUD.

Finally, Hurricane Helene devastated several western NC counties in late September 2024, at the end of the Demonstration period. Our statistical analysis controls for region-specific differences during the full study period but does not separately control for this natural disaster. Declines in services used during this period could affect the estimates observed here, although only a small fraction of Medicaid beneficiaries live in affected regions, so we do not anticipate a large impact on our estimates.

Data Sources

The primary data sources for the quantitative analysis were the NC Medicaid FFS claims and membership files and the LME/MCO TP and SP encounter data. The claims and encounter data include specific information on services paid through the Medicaid program (or its subcontracting MCO or PHP plans), administrative diagnoses received, Medicaid enrollment information, and demographic characteristics. This set of data is referred to as “Medicaid data” below.

There were two sources of data proposed in the evaluation design we had anticipated using to test metrics for Hypotheses 3.1-3.3 but were not available or became irrelevant. The Controlled Substances Reporting System (CSRS) data has not yet been made available to the evaluators. The DEA waiver data was abandoned both because the DEA stopped making this data available and because of changes in the National DEA waiver policy that no longer required a waiver to prescribe buprenorphine, one of the key treatments for opioid use disorder. Metrics using these data are therefore not included in the analyses.

Analysis of Monthly Measures

Most of the measures analyzed for this report were generated monthly and, thus, had sufficient data points to conduct interrupted time series (ITS) analysis models. ITS is a statistical technique that is used to answer the question: “Did the intervention change the outcome’s level or trend compared to what we would have expected if the waiver hadn’t been implemented?” For this report, ITS analysis allowed estimation of whether implementation of SUD components of the waiver shifted the outcomes up or down on average, as compared to prior to the implementation of the SUD waiver. The ITS analysis also examines differences in the rate of change of the outcomes after the implementation of the SUD waiver components as compared to what we would have expected without a waiver.

ITS analysis models took the following form:

$$E(Y_{it}) = (\beta_0 + \beta_1 Time_t + \beta_2 Post_t + \beta_3 Time_t * Post_t + \beta_4 Z_{it})$$

The expected value of each metric for person i in month t , $E(Y_{it})$ was estimated as a function of a linear combination of covariates ($f(\cdot)$). $Time_t$ represents time relative to the start of the baseline period. $Post_t$ is an indicator for all person-months after the start of the SUD waiver on May 1, 2019. The matrix Z_{it} included an interruption due to SP implementation, month fixed effects, county cluster fixed effects (defined below), and beneficiary-level controls: age in quadratic form, race, ethnicity, sex, disability, Tailored Plan enrollment, Medicaid expansion eligibility, and CDPS-Rx, a set of risk-adjustment terms. The specific functional form of CDPS-Rx used in these models were binary indicators of disease categories from the prior 12 months with at least 0.1% population prevalence, and a count of the number of disease categories to control for complexity.

We sought to account for geographical variation across the state by including region-level fixed effects, with counties merged into “county regions” to account for small samples in less populated counties. We used the Geocorr 2022 engine from the Missouri Census Data Center to assign North Carolina’s 100 counties into 2022 Public Use Microdata Areas (PUMAs). Each

county was initially assigned to the PUMA containing the plurality of the county's population. This process led to some PUMAs having a population less than 100,000 people. In those cases, we expanded the “cluster” to include the cluster with fewer than 100,000. Each county cluster was designed to have a 2020 population of at least roughly 100,000, yielding 46 distinct clusters (see [Figure 7](#)). We included county cluster fixed effects to control for time invariant differences within each cluster and clustered the standard errors on this dimension as well.

Figure 7: County Clusters



Accounting for COVID-19

The covariates also included separate controls for the months during which utilization was affected by COVID-19. COVID-19 affected schooling, employment, and health service use in a multitude of ways that are still being assessed. The period during which COVID-19 can be expected to affect the health service use outcomes measured in the SER is not immediately clear, since different types of health care faced distinct shocks and demands (for example, variation in ease of switching to telehealth as a primary service delivery mode). In our analysis, we sought to separate the impact of the SUD 1115 Waiver from the effects of COVID-19. We developed a method to detect the period during which COVID-19 could be reasonably expected to affect service use patterns, confounding estimates of SUD 1115 Waiver effects. The key idea for this method is to forecast health care utilization among a

population exposed to COVID but not exposed to the SUD 1115 Waiver: NC Medicaid beneficiaries never diagnosed with SUD and those never eligible for SPs in the managed care transition.

The general approach for this method was to: 1) identify individuals who were affected by COVID but not by the 1115 waiver; 2) analyze their healthcare use; 3) determine when their use “returned to normal” – when the anomaly of healthcare use resulting from the global pandemic subsided; and then 4) apply that time period to the 1115 analyses to account for the anomalous healthcare seeking patterns during that time, and thus separating the “COVID effect” from the “1115 effect.”

To estimate the length of the COVID-19 period, we analyzed a sample consisting of NC Medicaid beneficiaries who were fully eligible and enrolled in NC Medicaid for at least one month between January 2016 and November 2024 and who were never diagnosed with SUD during that period. We excluded beneficiaries who were eligible for SPs for this step of the analysis. We also excluded beneficiaries enrolled through Medicaid expansion, which was implemented in December 2023. In the analysis of pharmacy utilization, we excluded beneficiary-months in which the beneficiary was currently dual-enrolled in Medicaid and Medicare, as Medicare Part D, rather than Medicaid, is the primary payer for medications for dual enrollees. For analytic tractability, we used a 20% sample of beneficiaries in the first step of the analytic approach (described below).

We defined five types of general care utilization relevant to the monitoring metrics: inpatient utilization, evaluation and management (E&M) outpatient visits, prescription drug fills, emergency department (ED) visits, and dental appointments. Outpatient visits for anything other than E&M were not included in the initial categorization. The outcome for inpatient, outpatient, ED, and dental utilization was the number of visits (or admissions) in the month, while the outcome for pharmacy utilization was any fill within the month.

We took a two-step approach to forecasting utilization in the absence of COVID-19. In the first step, we estimated the average aggregate monthly utilization adjusted for beneficiary characteristics. To do so, we modeled each type of utilization as a function of age in quadratic form, number of months fully eligible within the past 12 months, race (Black, White, Native American, Asian/Pacific Islander, Unknown), ethnicity (Hispanic/Not Hispanic), sex (female vs. male), disability status, indicator variables from the CDPS, the number of CDPS conditions (discretized into 0, 1-2, 3-4, 5+ conditions), and a set of indicator variables for calendar month (e.g., January 2016, February 2016, ..., December 2024) and county cluster. Then, we estimated the average marginal predictions for each month and saved these for the second step. For the count outcomes (inpatient, outpatient, ED, dental), we used negative binomial models. For the binary outcome (any vs. no pharmacy fills) we used a linear probability model.

In the second step, we used the aggregate monthly predictions to forecast utilization. To do so, we estimated a model with a linear time trend and month fixed effects to account for

seasonality on data prior to March 2020, then predicted utilization through November 2024.¹² We used the standard error of the forecast to create 95% prediction intervals, which we used instead of confidence intervals because they indicate uncertainty around each individual predicted value. When actual utilization remained within the predicted utilization bounds for four or more consecutive months, we defined the first month of this series of months as the point at which utilization “returned to normal” (RTN) or systematically returned to pre-COVID-19 utilization. We then incorporated the RTN date in the ITS models used in this report, adjusting for a COVID-19-specific intercept and slope in the period between March 2020 and the month before the return to normal.

To evaluate the performance of this approach, we conducted a simulation study using time series data similar to that used in the second analytic step discussed here. In that study, we assessed the performance of different “rules” about the required number of consecutive months within the prediction interval. We found that, when lengths of time from one month to six months inside the interval were considered, the estimator using four consecutive months was the most accurate estimator of the duration of COVID-19 in terms of percent bias and root mean squared percent error.

We estimated the following RTN dates for each type of utilization:

- Outpatient services returned to normal in September 2020
- Emergency Department returned to normal in May 2023¹³
- Inpatient utilization returned to normal in May 2020, and
- Pharmacy fills and dental visits had not returned to normal as of November 2024.

Choice of Functional Form

Our primary concern was potential confounding from unobserved time invariant heterogeneity at the beneficiary level – factors affecting individual beneficiaries’ health and care-seeking that are unobserved by the analysts and do not change over time. Therefore, we prioritized models that could account for such time-invariant heterogeneity, for example using person-level fixed effects. The monthly metrics took on three forms: binary (yes vs no) indicators, counts (i.e., non-negative integers), and expenditures that were non-negative positive numbers with a few very large values. Because utilization was measured at the person-month, many count and expenditure metrics had a large proportion of zero values. We used the following algorithm to determine the functional form of $f(\cdot)$ in estimation.

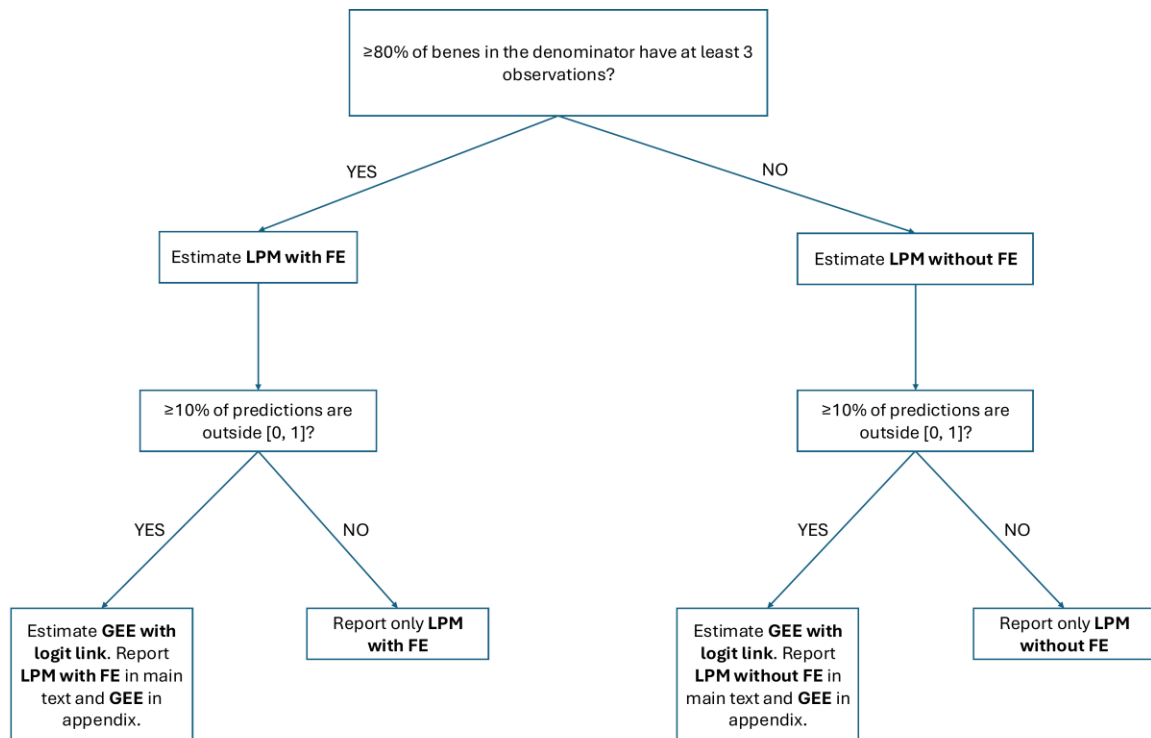
For each binary metric, we looked at the degree to which beneficiaries had more than three observations to contribute to the study sample (see [Figure 8](#)). If at least 80 percent of beneficiaries had at least three observations, we employed a linear probability model (LPM)

¹² Inpatient, ED, and outpatient utilization were only available through August 2024 as of July 2025.

¹³ Admittedly, the ED period was longer than we expected and is largely driven by a secular decrease in ED visits that has persisted since the PHE. Although the easiest interpretation of the “COVID effect” is a short-run, temporary shock to care-seeking due to the pandemic, it can also include longer-term changes to care-seeking by the population – e.g. increased use of telehealth leading to lower ED use.

with person-level fixed effects (FE). If less than 80 percent of beneficiaries had at least three observations, we estimated a LPM without person-level fixed effects. We also assessed the degree to which LPM generated reasonable predictions, a known limitation of LPM in certain cases; if more than ten percent of predictions were outside the range of feasible probabilities (i.e., from zero to one), then we also implemented a Generalized Estimating Equation (GEE) as a sensitivity analysis.

Figure 8: Binary Metrics Decision Flowchart



Note: GEE models will use an exchangeable correlation structure.

For each count metric, we estimated a two-part hurdle model to account for the large proportion of zeros in the outcome. The first part of the model used a binary indicator equal to one for those with positive outcomes and 0 otherwise. We followed the same decision algorithm as the binary metrics for the first part of the hurdle models to decide whether to use person-level fixed effects and whether to use LPM or logit via GEE. For the second part of the hurdle model, we estimated a negative binomial model using a sample of beneficiaries with positive counts for the metric.

For all expenditure models, members with values above the 99.9th percentile were excluded because they frequently resulted in convergence issues and upon investigation, these were often members with multi-year long admissions, high-cost drugs or treatments for rare or costly conditions, or other costly experiences that were likely to be unaffected by the Waiver.

All regression models clustered standard errors at the county cluster level, except LPMs without fixed effects which were clustered at the person level. We use estimates from these regression models to generate average marginal effects of the SUD waiver on 1) the level of each outcome at the time of SUD waiver implementation, 2) the trends in the outcomes, and 3) the predicted outcomes at the end of our analysis period. Some of the expenditure models with particularly large sample sizes and model complexity were estimated based on a 20 percent random sample of beneficiaries.

Analysis of Annual Measures

A number of the metrics reported are annual, rather than monthly metrics, which limits the number of data points observed.¹⁴ For annual metrics, we present adjusted predictions from annual ITS models and, when necessary, plots of unadjusted population estimates to evaluate the trends in annual measures. Annual ITS models are controlled for the same time, geographic, and beneficiary-level covariates as defined for the monthly ITS analysis, as described above. Controls for the interruption of SP implementation, COVID-19 effects, yearly fixed effects, and beneficiary-level indicators for Tailored Plan enrollment were excluded from the annual ITS models to prevent overfitting of the annual data.

Despite our best efforts to fit annual ITS models, an inadequate number of baseline datapoints prevent us from attributing observed changes in annual outcomes to the SUD waiver implementation as we could for monthly measures. For this reason, we do not present estimation tables for annual ITS models, but instead, we plot average predicted estimates for pre- and post-implementation trends. Counterfactual trends are not plotted due to inadequate model fit.

There are a handful of annual measures for which the annual ITS analysis could not be fit. We present unadjusted population rates for these measures, presented as bar graphs and line graphs in the Chapters below.

Annual measures that required a lookback (or “washout”) period for the identification of the eligible population excluded the first year of the baseline period, as described above. For measures drawn from the SUD monitoring report, we applied Version 5.0 of the SUD Technical Specifications to all years of available data at the time of analyses.

Cost of Care

Research question 3.3 examines the costs of SUD care and out-of-pocket costs to beneficiaries. We use actual payments on Medicaid-covered care in our analysis. This means that we are not taking a strictly Medicaid perspective for this analysis, which would only include direct fee-for-service payments and the capitated payments to PHPs but would omit the services delivered through PHPs since those come at no net cost to NC DHHS. For this report, we opted to use payments to reflect the intensity of service use.

¹⁴ Specifically, a typical annual model has nine data points, and including time-specific intercepts and slopes for the various events (SUD launch, COVID, SP launch) quickly means we run out of time-specific data points.

Subgroup Analyses

To assess whether waiver effects varied across population subgroups, we conducted subgroup analyses for key measures with person-level data (Medicaid Beneficiaries with SUD Diagnosis, Any SUD Treatment, and Access to Preventive/Ambulatory Health Services). These analyses examined differences across key demographic and geographic characteristics, including age (65+ vs. 18-64), sex (male vs. female), disability status, race (Asian American/Pacific Islander (AAPI), American Indian/Alaska Native (AIAN), Black, White vs. their respective comparison groups), ethnicity (Hispanic vs. Not Hispanic), and geographic location (nonmetropolitan vs. metropolitan). Each subgroup variable was interacted with waiver-specific intercept and slope terms to assess whether implementation effects differed across populations. Detailed subgroup results for all available measures are provided in the Appendix.

Comparative Interrupted Time Series (CITS)

The primary analyses throughout this Report use Interrupted Time Series – a comparison of trends within North Carolina before and after MC launch. In Supplement 1, we report on the results using *Comparative Interrupted Time Series (CITS)* - a comparison of trends before and after MC launch in NC, relative to the trends before and after that same date among Arizona Medicaid beneficiaries. Supplement 1 includes details on the approach, including the justification for the approach. Briefly, the CITS approach uses the Arizona data as a control so that changes within North Carolina are compared to trends in Arizona, serving as a proxy for national trends. For a limited set of metrics, values were computed for Arizona's Medicaid beneficiaries at the Center for Health Information and Research at Arizona State University. The *results* of ITS models – not the *data*, but simply the *results* – were shared with the Sheps Center team, who used emerging methods to compare the trends in the two datasets without the two university teams having access to data from the other state. This approach should be viewed as a robustness analysis to determine the stability of the conclusions to alternative approaches. For further details, refer to Supplement 1.

Chapter 5. Limitations

Our analysis approach used distinct time periods to examine different phases of waiver activities, although these were not as distinct as would be ideal. Efforts to create a waiver were initiated by North Carolina's General Assembly several years before the baseline period used for analysis. If provider behavior changed because of expectations of upcoming changes to the NC Medicaid program, then our baseline period does not capture a true baseline, but rather a baseline under increasing expectation of Medicaid transformation.

An additional concern when using encounter data is how accurate and complete these data are, given that the incentives for complete reporting are not as strong as in fee-for-service claims. Furthermore, there were new and complex data flows that had to be designed and implemented, with each plan having its own data infrastructure. Any deficits in quality of encounter data would confound the managed care estimates, since they would be contemporaneous to the implementation of capitated care. The evaluation team monitored the quality of encounter data as the SPs were implemented and reported any data quality concerns to NC DHHS as soon as they were discovered to improve data quality; data quality issues were resolved quickly by the plans and NC DHHS, and we believe most known remaining data quality issues had a minor if any impact on these analyses.

A limitation of the ITS approach is that it is subject to confounding from events that occur during the post-period such as the availability of treatments, changes in the health services environment, or even unrelated events such as COVID-19 or Hurricane Helene. We controlled for the COVID-19 pandemic by comparing trends in care from Medicaid beneficiaries that were not affected by either the SUD or the managed care components of the waiver; changes we saw during this period were more likely to be from the PHE. Because there were only 10 months of data during the SUD implementation period before the COVID PHE began, it was much harder to tease out independent effects of the waiver. In addition, we fully acknowledge that there are many dimensions in which health care use have not returned to normal post-COVID-19. Telehealth continues to be used (albeit at a lower rate), especially for behavioral health care, which may permanently affect patterns of care-seeking. Providers and practices may still function differently from before the pandemic in ways that were not fully captured in these data. Finally, Medicaid made several of the PHE policies permanent, which may also affect patterns of care that are difficult to tease out from the SUD waiver effects.

The evaluation team examined options for a contemporaneous comparison group to conduct difference-in-differences analyses for the evaluation. We examined other state Medicaid programs in the hopes of finding one that was comparable to NC prior to its Medicaid transformation. The evaluation team received permission to use BCBSNC Marketplace plan data, available to the Sheps Center, as a comparison group, but have discovered that there are very few children covered in these plans, so they were not comparable for children's metrics. There are some similarities for adult metrics, but the sample sizes were modest. The evaluation team has begun comparing selected metrics with Arizona's Medicaid data, which one of our team leads has access to on a timely basis (with a 1-month lag). We have selected

a limited number of outcomes to examine with difference-in-differences analyses with Arizona's Medicaid program as a comparison group, included in Supplement 1.

Additionally, the evaluation could not assess all aspects of the Demonstration due either to data limitations or statistical limitations. For example, we did not have information on enrollees' labor market status and thus were not able to evaluate whether improved services increase the ability of enrollees to participate in the labor market. Finally, several variables planned for analysis were not included in this report for various reasons. Please see [Table 3](#) below for specific measures and reasons for exclusion.

Table 3: Excluded Measures

Measure number from original design	Measure name	Hypothesis	Reason for exclusion
Measures that are obsolete, retired, or otherwise were not available for analysis in the Summative Evaluation Reports			
1	Getting Care Quickly	1.1	CAHPS data was not available for analysis in this report.
2	Getting Needed Care	1.1	CAHPS data was not available for analysis in this report.
14	Customer Service	1.1	CAHPS data was not available for analysis in this report.
15	Rating of Health Plan	1.1	CAHPS data was not available for analysis in this report.
16	Rating of all Health Care	1.1	CAHPS data was not available for analysis in this report.
17	Rating of Personal Doctor	1.1	CAHPS data was not available for analysis in this report.
81	Medical Assistance with Smoking and Tobacco Use Cessation	1.2, 1.4	CAHPS data was not available for analysis in this report.
105	Coordination of Care (consumer perceptions)	2.2	CAHPS data was not available for analysis in this report.
90	Number of providers with DEA DATA 2000 waivers	1.3, 3.2	DATA 2000 waivers are no longer a DEA requirement
91	Number of providers with DEA DATA 2000 waivers who have	1.3, 3.2	DATA 2000 waivers are no longer a DEA requirement

	written prescriptions for Medicaid enrollees for MAT		
18	Adult BMI Assessment	1.1	Retired Measure
20	Tobacco Use screening and follow-up	1.1	Retired Measure
29	Annual Monitoring for Patients on Persistent Medications	1.1	Retired Measure
49. – 57.	Comprehensive Diabetes Care (9 measures)	1.1	Retired Measure
23	Flu vaccine for Adults age 18-64	1.1, 1.4, 1.5	Very low rates of detection, measure deemed not reliable
10	Dental Sealants for Children at Elevated Caries Risk	1.1, 1.5	Rates were low and dental was not included under managed care
108	Medication Reconciliation Post-Discharge	2.2	Administrative data do not capture this metric well
110	Out-of-pocket costs to Medicaid enrollees	3.3	Administrative data available to the evaluation team were insufficient for this metric; values are not reliable.
Measures that were not included because of substitutions with other measures			
5. – 8.	Children and Adolescents' Access to Primary Care Practitioners (4 measures)	1.1	Substituted Well-Child Visits

26	Medication Management for People with Asthma	1.1, 1.4	Similar to Asthma Medication ratio, which was included
42	Frequency of Prenatal Care ($\geq 81\%$ of expected visits)	1.1	Now included in the PPC Measure
62	Receipt of Preventative Dental Services	1.1	Because dental services remained in Medicaid Direct, we decided to analyze only one dental measure, Annual Dental Visits
93	Long-Term Use of Opioids	1.3, 3.2	We were unable to find an established metric reflecting this concept but included other measures of potentially harmful opioid use

Chapter 6. Results

Throughout this chapter, we present the results of our evaluation in an objective, clinical manner with minimal interpretation or discussion. Interpretation and discussion are covered in Chapter 7. In an effort to streamline our results based on the valuable feedback from CMS on the interim evaluation report, we do not provide a write-up of *all* analyses in Chapter 6; results across the complete set of metrics are included in the Appendix. Instead, here we focus on representative metrics – selected because they are key indicators of high interest to stakeholders, and/or provide examples of responses. We did our best to provide a balanced picture across the metrics.

Summary Statistics

[Table 4](#) presents the demographic, geographic, and clinical characteristics of our study population at the time of waiver implementation in May 2019. The population comprised 68,916 Medicaid beneficiaries with a documented SUD diagnosis. Beneficiaries were predominantly female (57.2%) with a median age of 40 years (IQR 30-55); most were working-age adults aged 18-64 years (88.5%), with smaller proportions under 18 (5.3%) and 65 years or older (6.2%).

The self-reported racial composition included 61.8% identifying as White, 36.8% as Black, 4.5% as American Indian, and 0.5% as Asian/Native Hawaiian or Other Pacific Islander; race categories were not mutually exclusive. Hispanic beneficiaries comprised 2.5% of our population.

More than half of beneficiaries had a documented disability (52.0%), and most resided in metropolitan areas (67.9%). Just over one-fifth (21.9%) had a diagnosed opioid use disorder. The comorbidity burden was substantial: the mean number of CDPS categories per beneficiary was 4.14 (SD 2.55) out of a possible 14 categories, with approximately 70% of beneficiaries falling into groups of higher comorbidity (3-4 categories: 30.6%; 5+ categories: 39.0%).

Table 4: Characteristics of the North Carolina Medicaid population with a SUD diagnosis at time of SUD Waiver implementation (May 2019)

		Frequency(N)	Percent (%)
Sex			
	Male	29,472	42.77%
	Female	39,444	57.23%
	Age (median, IQR)	40	(30-55)
Age Groups			
	<18	3,662	5.31%
	18-64	60,986	88.49%
	65+	4,268	6.19%
Race+			
	White	42,570	61.77%
	Black	25,384	36.83%
	Asian/Native Hawaiian or Other Pacific Islander	346	0.50%
	American Indian	3,096	4.49%
	Unknown	88	0.13%
Hispanic			
	Hispanic	1,719	2.49%
	Not Hispanic	67,197	97.51%
Disabled			
	Disabled	35,862	52.04%
	Not Disabled	33,054	47.96%
Rurality			
	Nonmetro	22,112	32.09%
	Metro	46,804	67.91%

Diagnosed with OUD			
	Yes	15,090	21.90%
	No	53,826	78.10%
Number of CDPS Categories* (mean, SD)		4.14	(2.55)
Number of CDPS Categories*			
	0	2,156	3.13%
	1-2	18,819	27.31%
	3-4	21,053	30.55%
	5+	26,888	39.02%
Total sample size (May 2019 beneficiaries with a SUD diagnosis in the current or prior 12 months)		68,916	

+ Race categories are not mutually exclusive. Beneficiaries are counted in each race category they identify with. Category sums will exceed the sample total and proportions will exceed 100%.

* Total Number of CDPS categories (out of 14)

Hypothesis 3.1: Expanding coverage of SUD services will result in improved care quality and outcomes for patients with SUD.

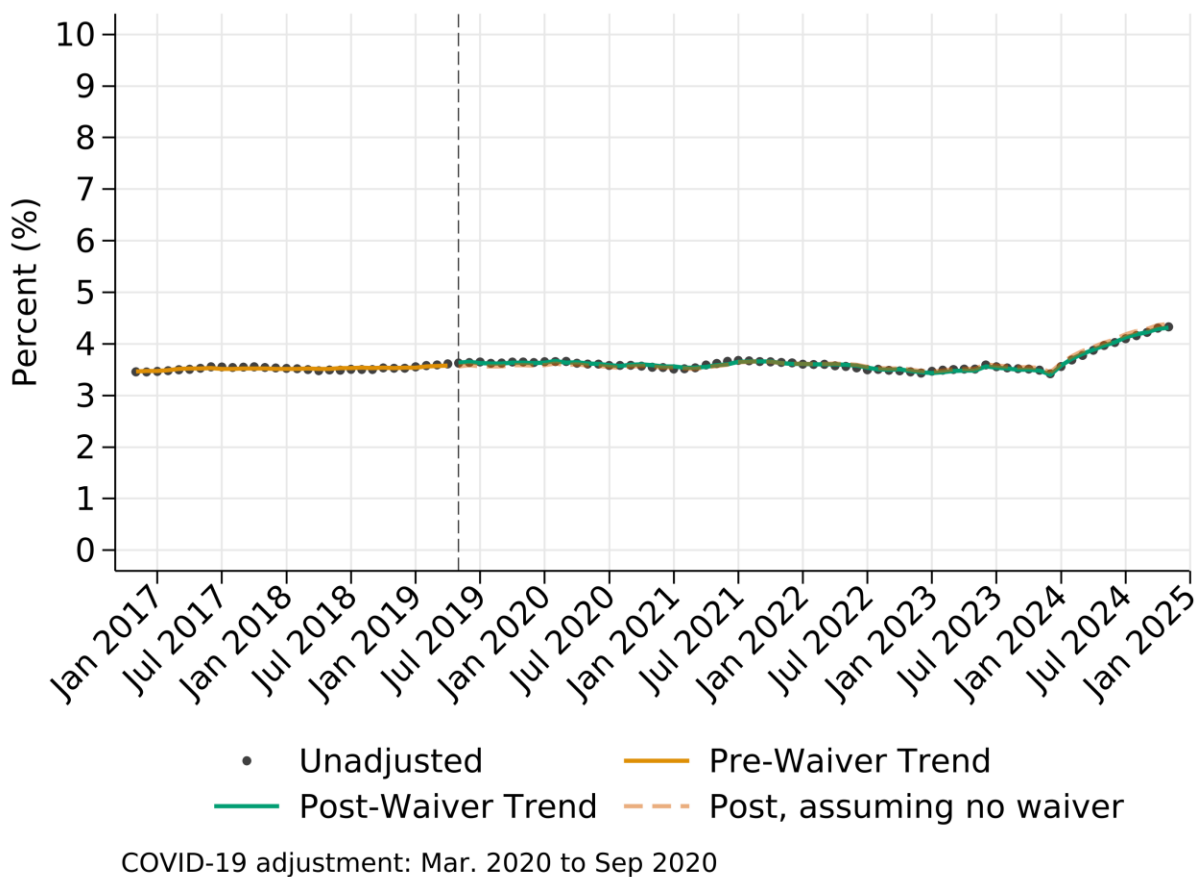
Of the 28 metrics analyzed to test this hypothesis, we found that 5 metrics showed a meaningful improvement, 8 showed no change, and 15 moved in the opposite direction from Demonstration goals, showing potential waiver implementation challenges. Below, we present findings from six representative measures that examine the domains described above. However, the results from the other measures associated with Hypothesis 3.1, listed in [Table 1](#), can be found in Chapter 7.

Medicaid Beneficiaries with a SUD Diagnosis

A core component of improving the care and quality for those with a SUD diagnosis is to ensure beneficiaries are receiving an appropriate diagnosis. Overall, we found no statistically significant effect of the SUD components of the waiver on SUD diagnosis rates in the full Medicaid population of all ages, controlling for model covariates. We do observe an uptick in the rate of SUD diagnoses after Medicaid expansion, indicating a potentially higher rate of SUD diagnoses in the newly eligible population. We also found a decline in the rate of diagnosis in the 18-64 population and an increase in the rate of diagnosis for the population age 65+ ([Figure 10](#)) compared to the rate of diagnoses in youth (age<18) after the implementation of the SUD waiver. Furthermore, compared to youth, we found a lower

prevalence in the percent of beneficiaries aged 18-64 diagnoses with SUD at the end of the demonstration period than we would have estimated without the SUD waiver, but a higher rate of diagnosis among those 65+ than we would have estimated without the SUD waiver.

Figure 9: Trends in Medicaid Beneficiaries with SUD Diagnosis (monthly)



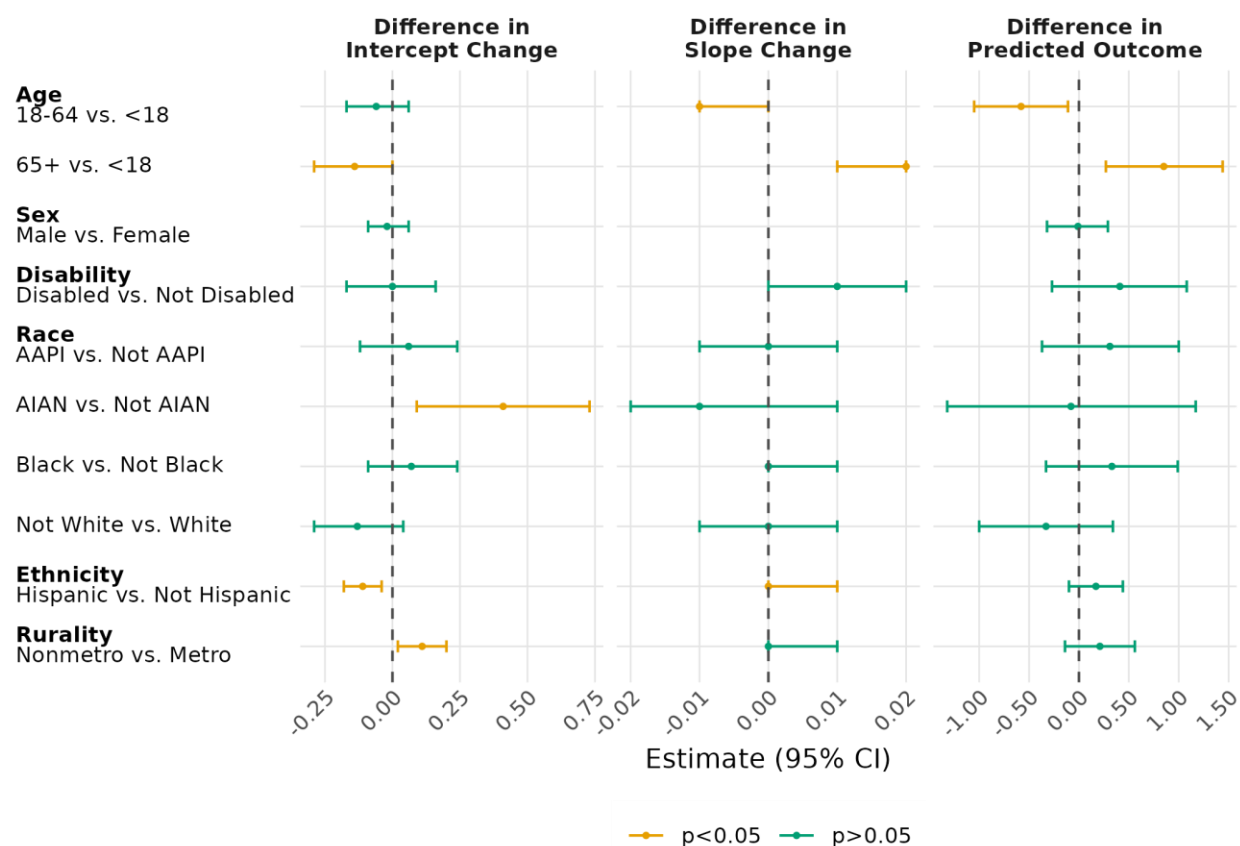
Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from the population of individuals in the NC Medicaid population as determined in the metric specifications.

Table 5: Interrupted time series estimates of Medicaid Beneficiaries with SUD Diagnosis (monthly)

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	3.64* (3.55, 3.72)	3.68* (3.63, 3.72)	0.039 (-0.048, 0.13)
Monthly Change	0.0009 (-0.0020, 0.0039)	-0.0017 (-0.0047, 0.0014)	-0.0026 (-0.0064, 0.0013)
Predicted Average Outcome Nov 2024	3.70* (3.47, 3.93)	3.57* (3.48, 3.66)	-0.13 (-0.39, 0.13)
N	42,254,887		

Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from the population of individuals in the NC Medicaid population as determined in the metric specifications.

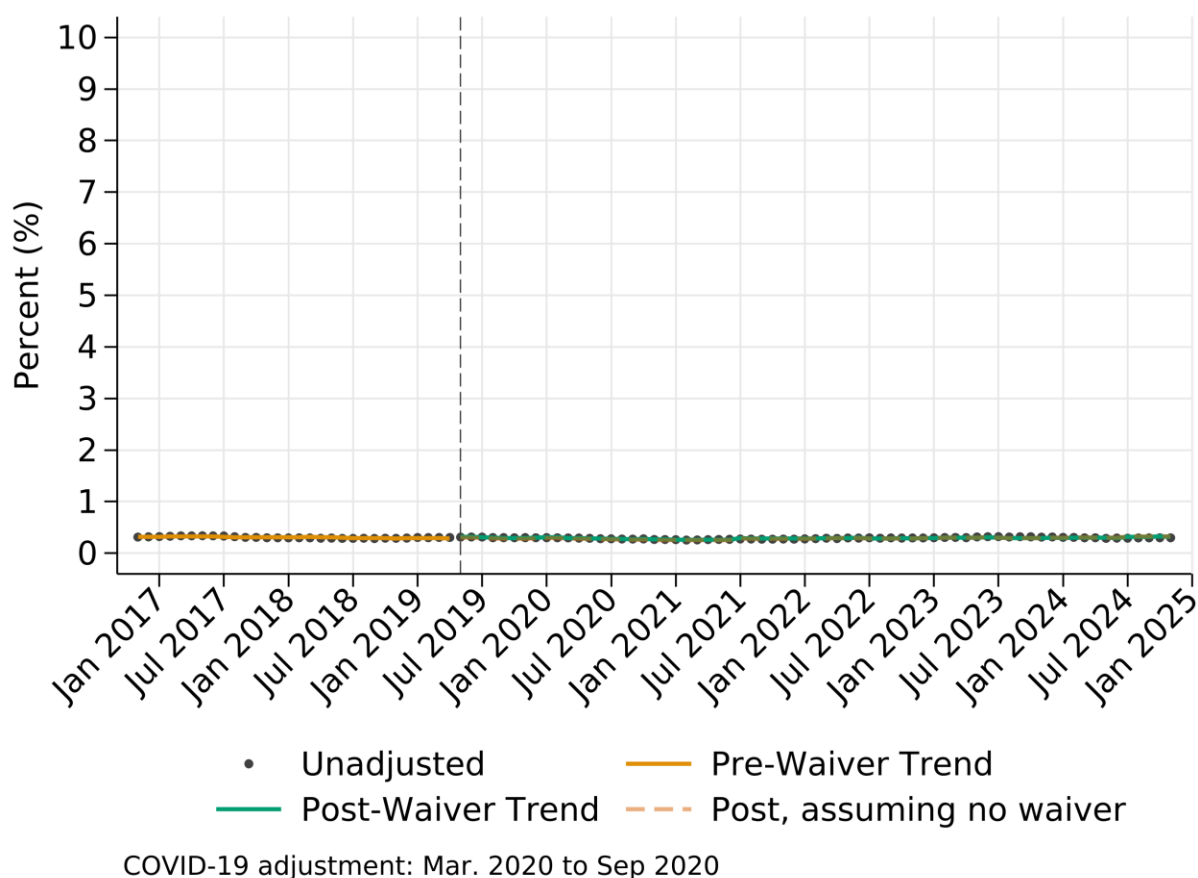
Figure 10: Comparison groups in Medicaid Beneficiaries with SUD Diagnosis (monthly)



Notes: Estimates from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Each of the subgroup variables is interacted with the Waiver-specific intercept and slope. The difference in intercept change (for example), is the intercept change for the first subgroup (e.g., 65+) minus the intercept change for the second subgroup (e.g., 18-64).

To better understand age-specific patterns, we additionally stratified analyses by age groups. Among youth aged 12-17, SUD diagnosis rates remained extremely low and stable throughout the study period, fluctuating around 0.20-0.50% with no statistically significant waiver effect (Table 6, Figure 11). We also found no evidence of a change in the monthly trend nor in the difference between observed and counterfactual rates at the study endpoint.

Figure 11: Trends in Medicaid Beneficiaries with SUD Diagnosis (monthly): Ages 12-17



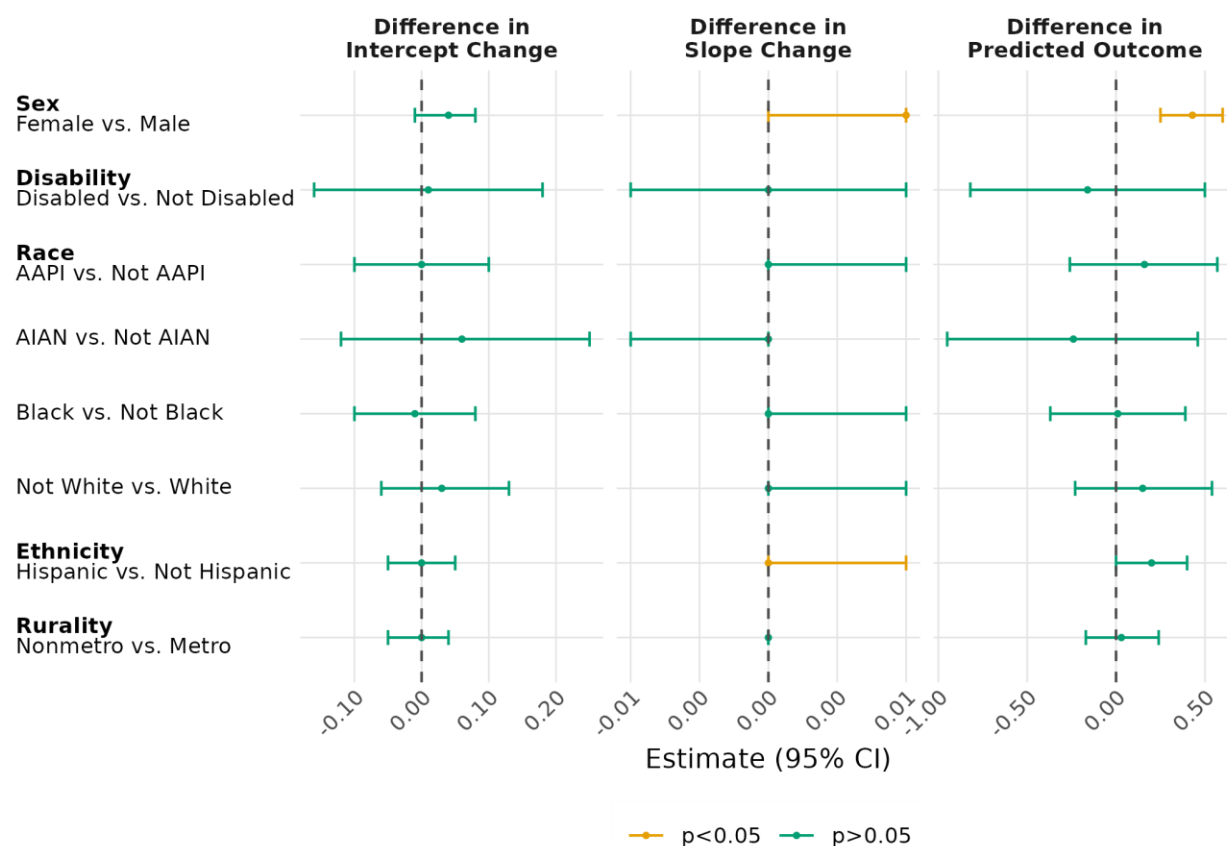
Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from the population of individuals in the NC Medicaid population as determined in the metric specifications.

Table 6: Interrupted time series estimates of Medicaid Beneficiaries with SUD Diagnosis (monthly): Ages 12-17

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	0.20* (0.16, 0.24)	0.23* (0.21, 0.25)	0.031 (-0.0025, 0.065)
Monthly Change	0.0043* (0.0024, 0.0063)	0.0039* (0.0024, 0.0055)	-0.0004 (-0.0030, 0.0022)
Predicted Average Outcome Nov 2024	0.49* (0.33, 0.65)	0.49* (0.44, 0.54)	0.0035 (-0.18, 0.19)
N	24,029,681		

Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from the population of individuals in the NC Medicaid population as determined in the metric specifications.

Figure 12: Comparison groups in Medicaid Beneficiaries with SUD Diagnosis (monthly): Ages 12-17

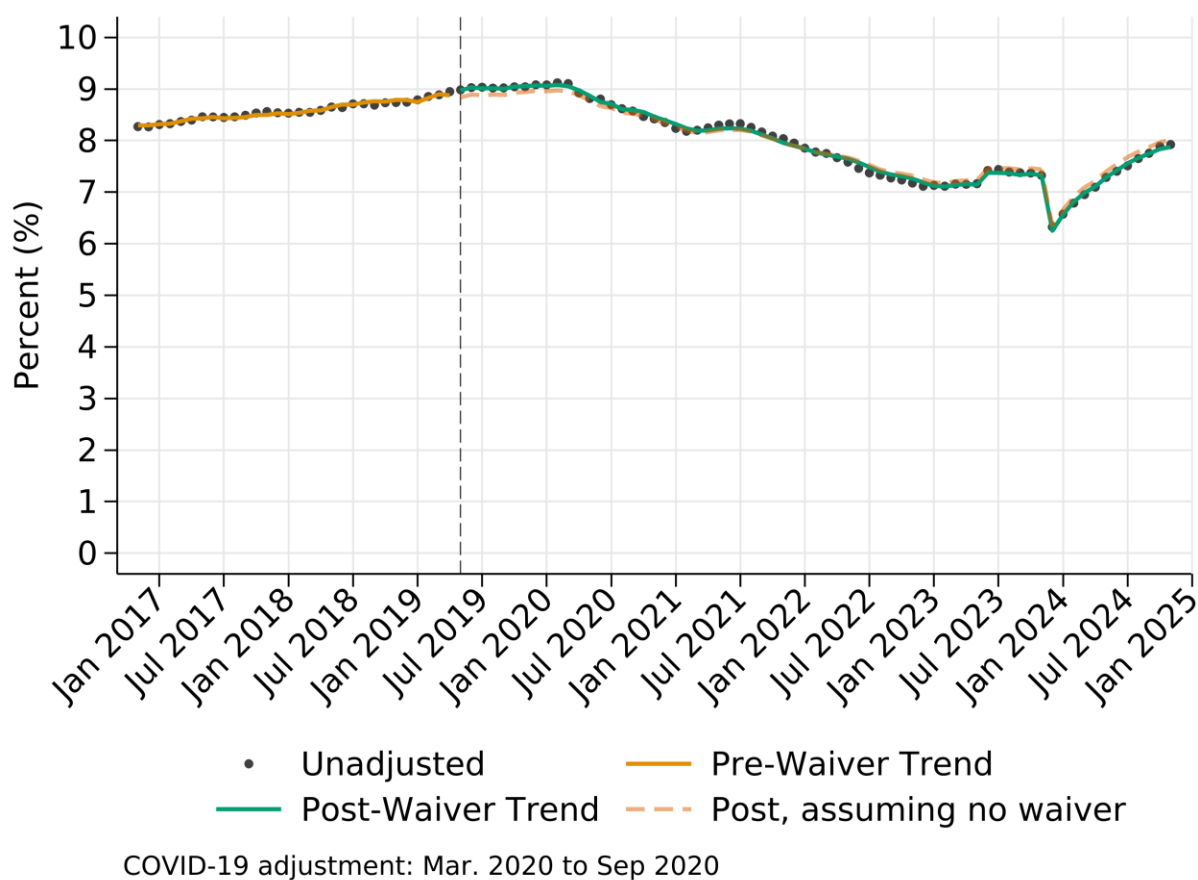


Notes: Estimates from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Each of the subgroup variables is interacted with the Waiver-specific intercept and slope. The difference in intercept change (for example), is the intercept change for the first subgroup (e.g., 65+) minus the intercept change for the second subgroup (e.g., 18-64).

Among adults aged 18+, diagnosis rates were substantially higher than in youth aged 12-17, ranging from approximately 7.00-9.00% throughout the study period compared to 0.20-0.50% among youth (Table 7, Figure 13). While the overall waiver effect was not statistically significant—with a monthly trend change of -0.01 percentage points per month (95% CI: -0.02, 0.01) and an endpoint difference of -0.37 percentage points (95% CI: -1.02, 0.29)—the markedly higher prevalence in this age group compared to youth aged 12-17 and the overall population (3.60-3.70%) suggests that adults aged 18+ represent a key target population for SUD prevention and treatment interventions.

Subgroup analyses for adults aged 18+ revealed differential waiver effects among certain populations—particularly older adults and those with disabilities during the study period (Figure 14).

Figure 13: Trends in Medicaid Beneficiaries with SUD Diagnosis (monthly): Ages 18+



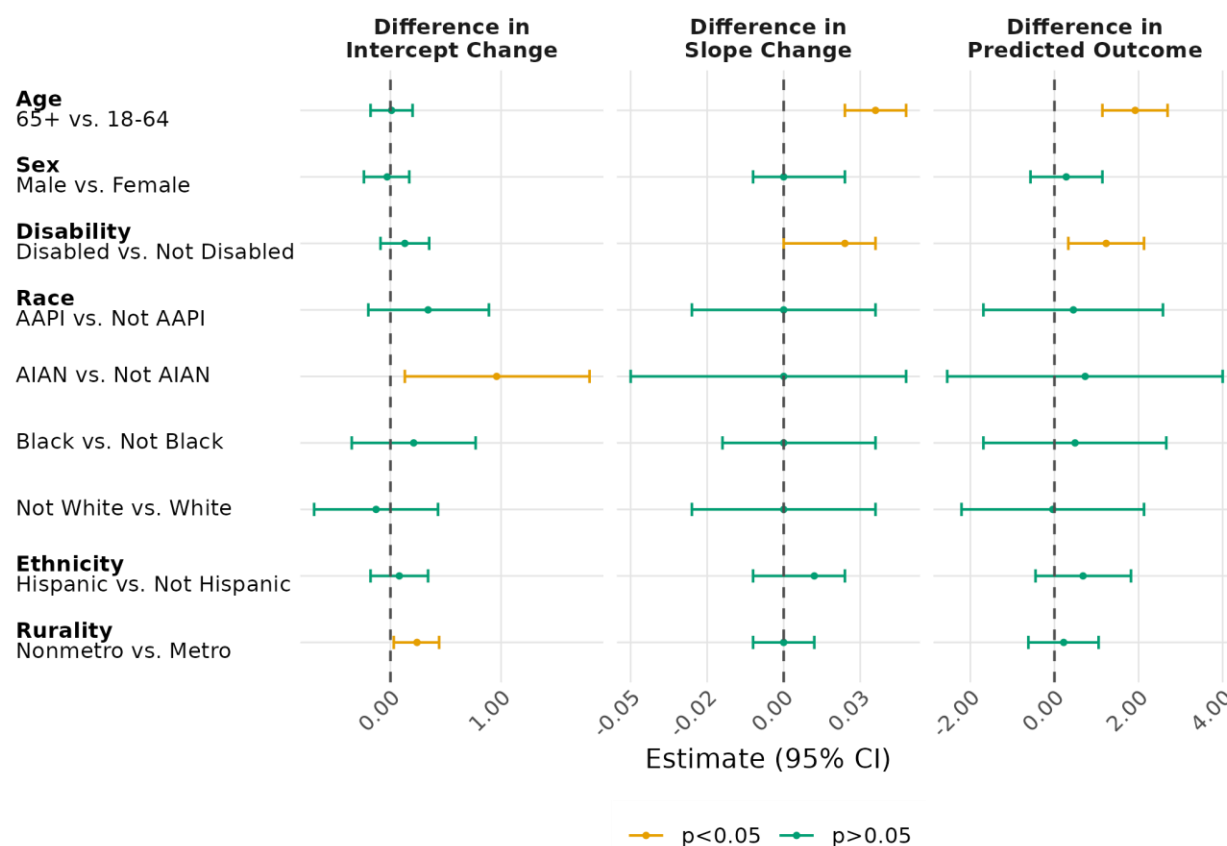
Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from the population of individuals in the NC Medicaid population as determined in the metric specifications.

Table 7: Interrupted time series estimates of Medicaid Beneficiaries with SUD Diagnosis (monthly): Ages 18+

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	8.08* (7.91, 8.26)	8.13* (8.03, 8.24)	0.052 (-0.14, 0.25)
Monthly Change	0.0005 (-0.0059, 0.0068)	-0.0059 (-0.015, 0.0034)	-0.0063 (-0.018, 0.0053)
Predicted Average Outcome Nov 2024	8.17* (7.64, 8.71)	7.81* (7.60, 8.02)	-0.37 (-1.02, 0.29)
N	18,208,653		

Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from the population of individuals in the NC Medicaid population as determined in the metric specifications.

Figure 14: Comparison groups in Medicaid Beneficiaries with SUD Diagnosis (monthly): Ages 18+



Notes: Estimates from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Each of the subgroup variables is interacted with the Waiver-specific intercept and slope. The difference in intercept change (for example), is the intercept change for the first subgroup (e.g., 65+) minus the intercept change for the second subgroup (e.g., 18-64).

Some contextual considerations are warranted when interpreting temporal patterns described in [Figure 9](#) and [Figure 13](#). During the Public Health Emergency (PHE) continuous enrollment period (March 2020 - March 2023), the retention of beneficiaries who would have otherwise experienced disenrollment may have introduced compositional changes to the study population; individuals retained during this period may have differed systematically from the typical Medicaid population in ways that affected observed SUD diagnosis rates. Similarly, the subsequent increase in diagnosis rates following Medicaid expansion implementation in December 2023 may reflect an additional shift in population composition due to the enrollment of newly eligible adults, potentially confounding attribution of observed changes to programmatic interventions.

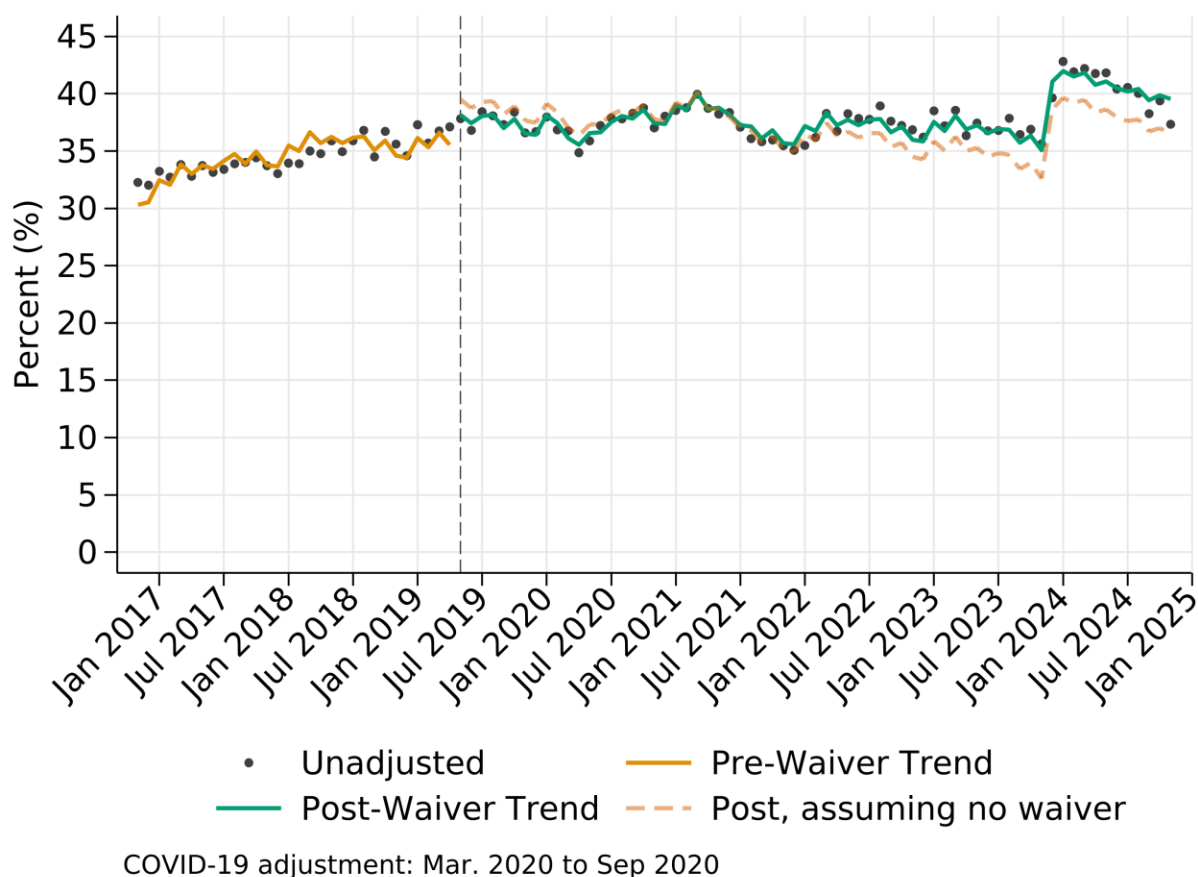
Any SUD Treatment Among Adult Medicaid Beneficiaries with SUD

One of the fundamental measures of waiver success is whether beneficiaries diagnosed with substance use disorders can access treatment services. While diagnosis rates remained stable throughout the waiver period, the percentage of diagnosed beneficiaries who received treatment services changed substantially.

Prior to waiver implementation, as shown in [Table 8](#), the baseline rate of Medicaid beneficiaries with SUD diagnoses who received any SUD treatment service was 36.52% (95% CI: 35.67, 37.37) with a significant negative monthly trend of -0.14 percentage points (95% CI: -0.19, -0.10). Following waiver implementation, this declining trajectory was reversed. The immediate implementation effect demonstrated a significant positive increase of 2.29 percentage points (95% CI: 1.53, 3.05), and the monthly trend shifted from decline to growth of 0.16 percentage points per month (95% CI: 0.09, 0.24). By November 2024, the predicted treatment use rate was 37.20% (95% CI: 35.70, 38.70) compared to 24.05% (95% CI: 19.89, 28.21) in the counterfactual scenario—a significant difference of 13.15 percentage points (95% CI: 7.99, 18.31).

[Figure 15](#) shows periods of decline and recovery post-implementation, including dips during the early COVID-19 period and in 2021, followed by relative stability through early 2024 and an uptick and an uptick at the time of Medicaid expansion in December 2023. Despite these fluctuations, observed rates remained higher relative to the counterfactual projection.

Figure 15: Trends in Any SUD Treatment (Percent of SUD diagnosed beneficiaries who receive a SUD treatment service)



Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population with a substance use disorder.

Table 8: Interrupted time series estimates of Any SUD Treatment (Percent of SUD diagnosed beneficiaries who receive a SUD treatment service)

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	36.52* (35.67, 37.37)	38.81* (38.22, 39.39)	2.29* (1.53, 3.05)
Monthly Change	-0.14* (-0.19, -0.099)	0.022 (-0.031, 0.076)	0.16* (0.087, 0.24)
Predicted Average Outcome Nov 2024	24.05* (19.89, 28.21)	37.20* (35.71, 38.70)	13.15* (7.99, 18.31)
N	7,656,186		

Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population with a substance use disorder.

The substantial difference between observed and counterfactual rates—approximately 13 percentage points higher treatment engagement than would have been expected without the waiver—indicates that waiver implementation may have been associated with a meaningful improvement in connecting diagnosed individuals with treatment services.

Access to Routine Healthcare

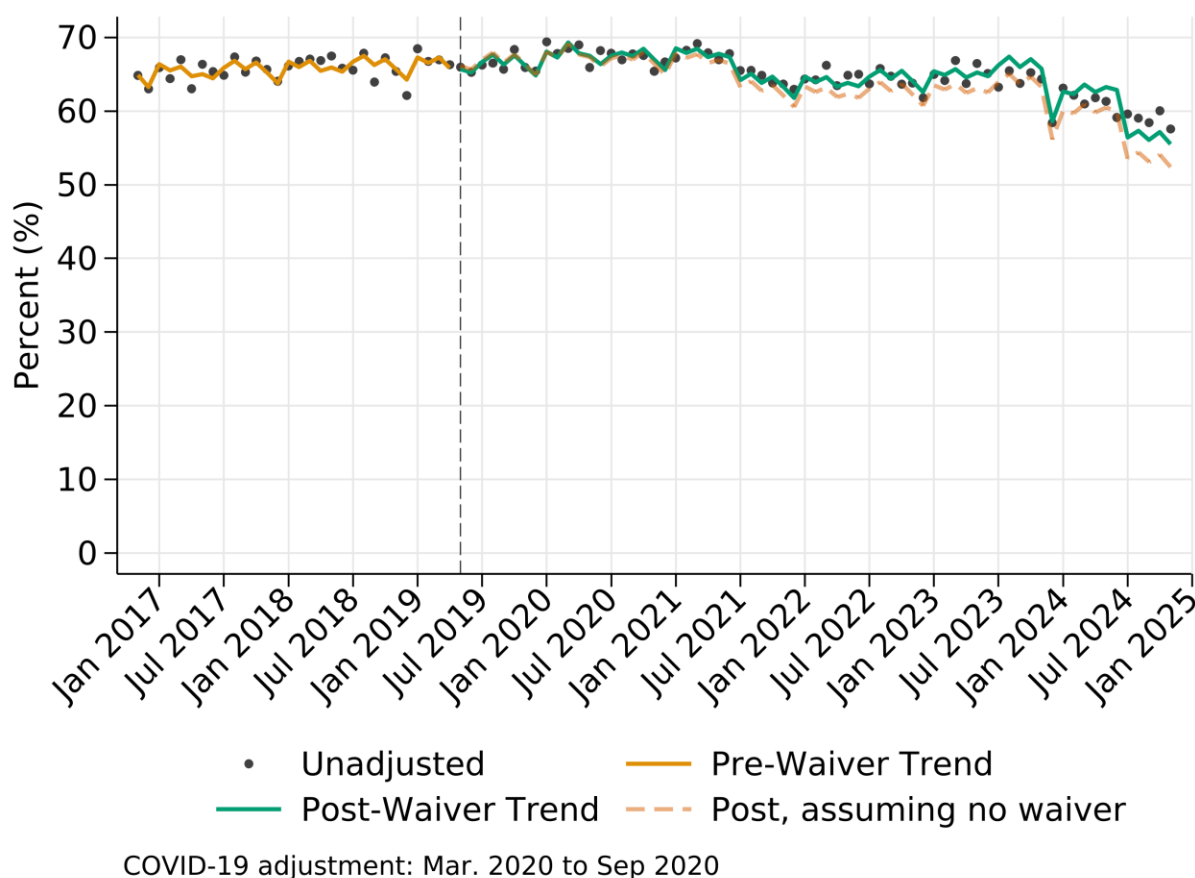
Access to preventive and ambulatory health services is an important indicator of healthcare system integration and continuity of care. For individuals with substance use disorders, maintaining connections to routine healthcare is essential, given their higher rates of chronic conditions, including diabetes, cardiovascular disease, and infectious diseases that require ongoing monitoring and management.¹⁵ Disruption of these established care relationships during system changes could negatively impact overall health outcomes and contradict the goals of improving care quality for this population.

Following the implementation of the waiver, as shown in [Table 9](#), access to preventive and ambulatory health services among SUD beneficiaries demonstrated modest changes over

¹⁵ Wu LT, Zhu H, Ghitza UE. Multicomorbidity of chronic diseases and substance use disorders and their association with hospitalization: Results from electronic health records data. *Drug Alcohol Depend.* 2018 Nov 1;192:316-323. doi: 10.1016/j.drugalcdep.2018.08.013. Epub 2018 Oct 2. PMID: 30312893; PMCID: PMC6358206.

the study period. The baseline rate in May 2019 was 62.76% (95% CI: 62.30, 63.22). There was a small immediate negative implementation effect (-0.43 percentage points, 95% CI: -0.81, -0.05) but a modest positive monthly trend change (0.05 percentage points per month, 95% CI: 0.03, 0.08). The time series shown in [Figure 16](#) shows some stability at approximately 66-68% through mid-2023, followed by a decline to approximately 55-58% by late 2024, coinciding with the implementation of Medicaid expansion in December 2023 and a further decline after the initiation of TPs in July 2024.

Figure 16: Trends in Access to Preventive/Ambulatory Health Services for Adult Medicaid Beneficiaries with SUD



Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population as determined in the metric specifications.

Table 9: Interrupted time series estimates of Access to Preventive/Ambulatory Health Services for Adult Medicaid Beneficiaries with SUD

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	62.76* (62.30, 63.22)	62.33* (61.96, 62.71)	-0.43* (-0.81, -0.054)
Monthly Change	0.032* (0.015, 0.050)	0.086* (0.066, 0.11)	0.054* (0.025, 0.082)
Predicted Average Outcome Nov 2024	65.16* (63.54, 66.78)	68.26* (67.68, 68.84)	3.10* (1.19, 5.00)
N	2,825,540		

Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population as determined in the metric specifications.

By November 2024, the model-adjusted predicted access rate was 68.26% (95% CI: 67.68, 68.84) compared to 65.16% (95% CI: 63.54, 66.78) in the counterfactual scenario, representing a statistically significant difference of 3.09 percentage points (95% CI: 1.19, 5.00) in access to ambulatory health services over what was predicted in the absence of the SUD waiver. These findings suggest that despite the decline in unadjusted rates in [Figure 16](#), access to preventive and ambulatory services remained significantly higher than would have been expected in the absence of Waiver. This indicates that during the SUD waiver implementation, beneficiaries maintained and potentially improved existing healthcare connections, preserving a vital component for comprehensive care while expanding SUD-specific treatment options.

Readmissions Among Beneficiaries with SUD

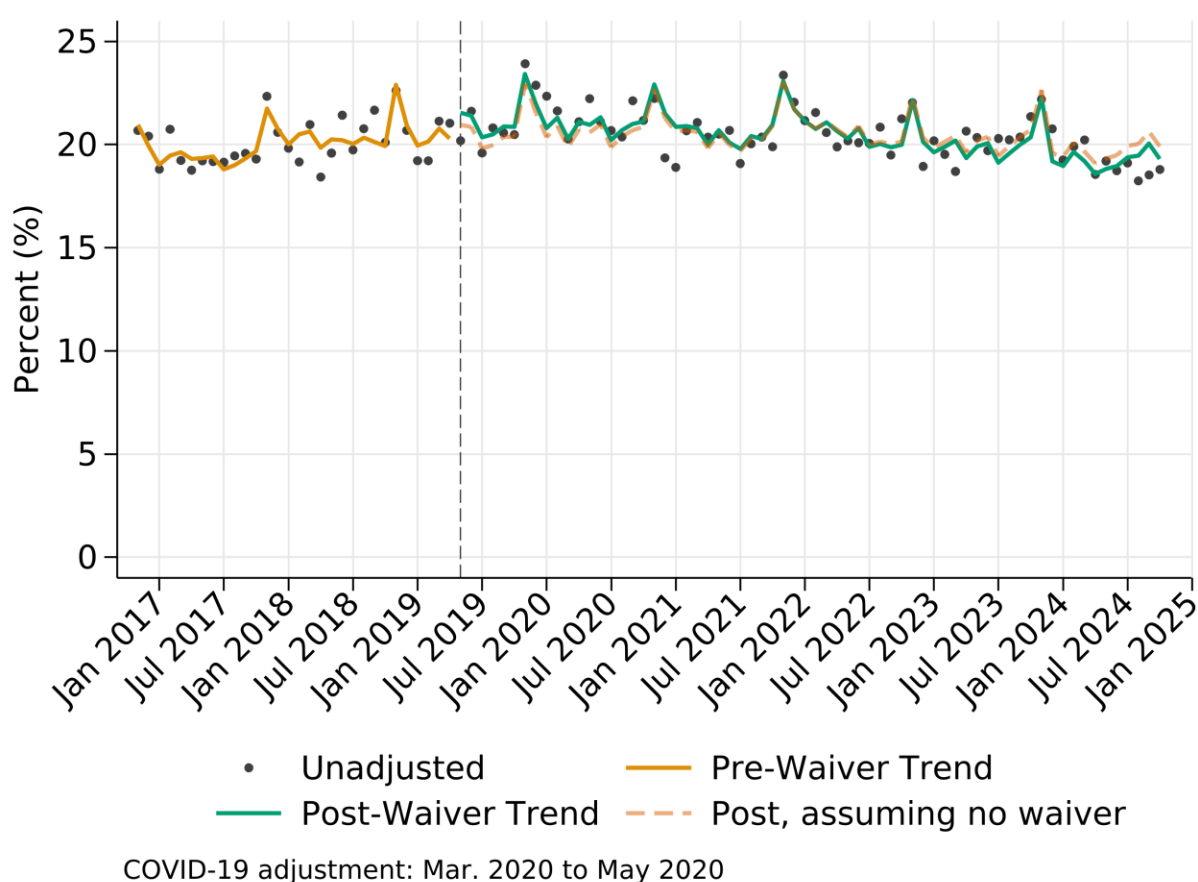
Hospital readmission rates serve as an important indicator of care quality, reflecting the adequacy of discharge planning, care coordination, and outpatient support systems.¹⁶ Throughout the study period, we found no differences in readmission rates or trends among beneficiaries with SUD diagnoses. As shown in [Table 26](#), the baseline rate in May 2019 was

¹⁶ Rowell-Cunsolo TL, Liu J, Hu G, Larson E. Length of hospitalization and hospital readmissions among patients with substance use disorders in New York City, NY USA. *Drug Alcohol Depend.* 2020 Jul 1;212:107987. doi: 10.1016/j.drugalcdep.2020.107987. Epub 2020 Apr 27. PMID: 32388493; PMCID: PMC7293944.

20.04% (95% CI: 19.08, 21.00), with a slight positive monthly trend of 0.03 percentage points per month (95% CI: -0.01, 0.06) pre-implementation. Following waiver implementation, there was no significant immediate effect (0.58 percentage points, 95% CI: -0.36, 1.51) and the monthly trend remained essentially unchanged (-0.02 percentage points per month change, 95% CI: -0.08, 0.04). We found no differences in the readmission rate for people with a SUD diagnosis at the endpoint of the evaluation period.

[Figure 17](#) shows readmission rates fluctuating around 20% throughout the study period, with periodic peaks suggesting seasonal patterns. Despite these fluctuations, there was no apparent change in the underlying trend following waiver implementation.

Figure 17: Trends in Readmissions Among Beneficiaries with SUD



Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population as determined in the metric specifications and with a substance use disorder.

Follow-Up After Emergency Department Visit for Alcohol and Other Drug Abuse or Dependence (7 and 30 days)

Emergency department visits for substance use often reflect acute crises, treatment gaps, or disease progression, making the period immediately following discharge a time when individuals are at elevated risk for adverse outcomes, including repeated ED visits, inpatient utilization, and treatment disengagement.¹⁷ Evidence-based guidelines recommend follow-up within 7 days to capitalize on crisis motivation, stabilize acute symptoms, and establish ongoing treatment connections, with 30-day follow-up serving as an indicator of sustained engagement.¹⁸

Prior to waiver implementation, follow-up rates were improving at both time points, as shown in [Table 10](#) and [Table 11](#). At 7 days, the baseline rate was 22.72% (95% CI: 21.53, 23.91) in May 2019 with a positive monthly trend of 0.13 percentage points per month (95% CI: 0.08, 0.18). At 30 days, the baseline rate was 32.18% (95% CI: 30.80, 33.56) with an even stronger positive monthly trend of 0.17 percentage points per month (95% CI: 0.11, 0.22).

Following SUD waiver implementation, both of these positive trends reversed. For 7-day follow-up, there was an unanticipated immediate negative implementation of -1.65 percentage points (95% CI: -3.14, -0.17), and the monthly trend shifted from improvement to decline with a change of -0.10 percentage points per month (95% CI: -0.18, -0.02). The pattern was even more pronounced for 30-day follow-up, with an immediate negative effect of -1.65 percentage points (95% CI: -3.14, -0.17) and a monthly trend change of -0.16 percentage points per month (95% CI: -0.25, -0.07).

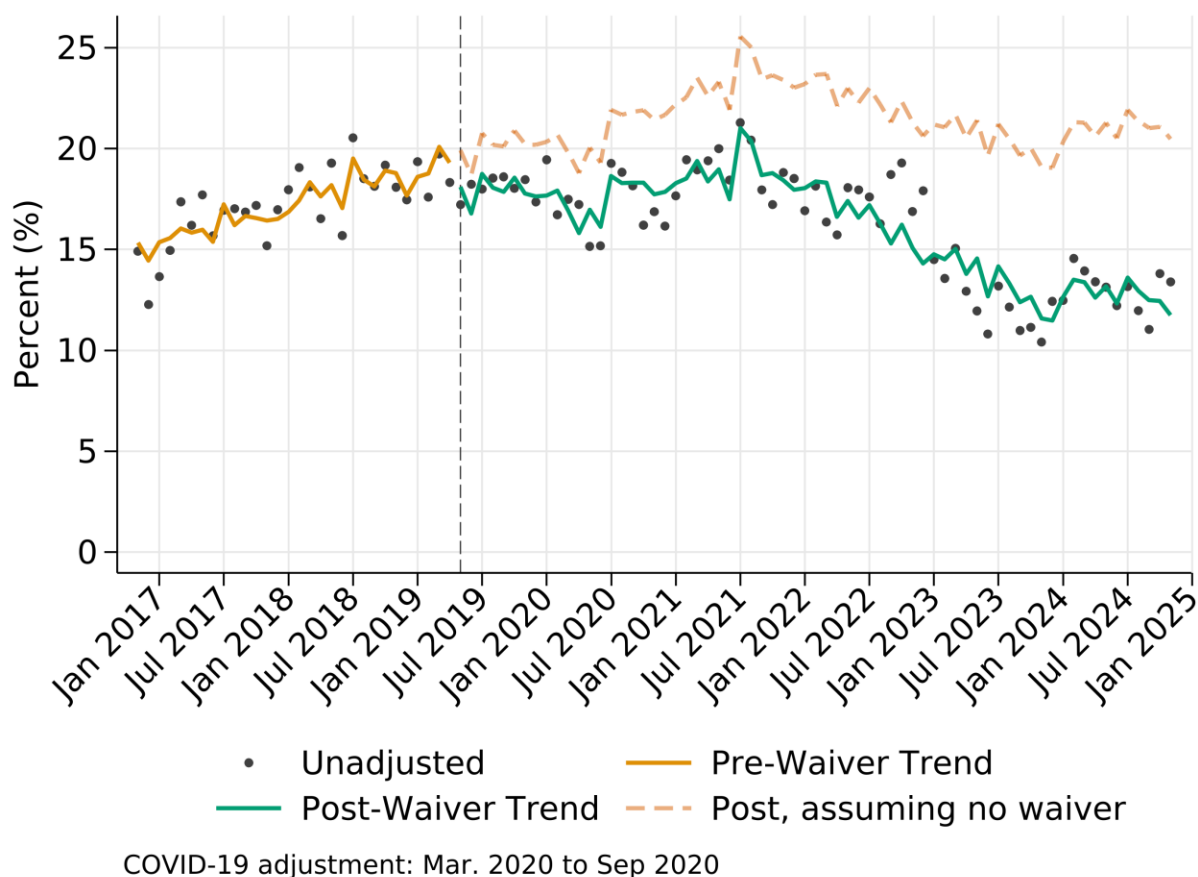
By November 2024, the differences between observed and expected follow-up rates were substantial. For 7-day follow-up, the predicted rate was 15.91% (95% CI: 13.81, 18.00) compared to 24.64% (95% CI: 20.40, 28.88) in the counterfactual scenario—a statistically significant difference of -8.73 percentage points (95% CI: -14.02, -3.44). For 30-day follow-up, the predicted rate was 23.73% (95% CI: 21.31, 26.14) compared to 35.78% (95% CI: 30.86, 40.71) in the counterfactual scenario—a difference of -12.13 percentage points (95% CI: -18.29, -6.04).

The time series for 7- and 30-day follow-up after the emergency department shows follow-up rates declining steadily from 2020 through 2024 at both time points ([Figure 18](#) and [Figure 19](#)), while counterfactual projections indicate that the rates should have continued to improve.

¹⁷ Zhang X, Wang N, Hou F, Ali Y, Dora-Laskey A, Dahlem CH, McCabe SE. Emergency Department Visits by Patients with Substance Use Disorder in the United States. *West J Emerg Med*. 2021 Aug 19;22(5):1076-1085. doi: 10.5811/westjem.2021.3.50839. PMID: 34546883; PMCID: PMC8463055.

¹⁸ <https://www.ncqa.org/report-cards/health-plans/state-of-health-care-quality-report/follow-up-after-high-intensity-care-for-substance-use-disorder-fui/>

Figure 18: Trends in Follow-Up After Emergency Department Visit for Alcohol and Other Drug Abuse or Dependence: Age 18 and older (FUA-AD): 7 days



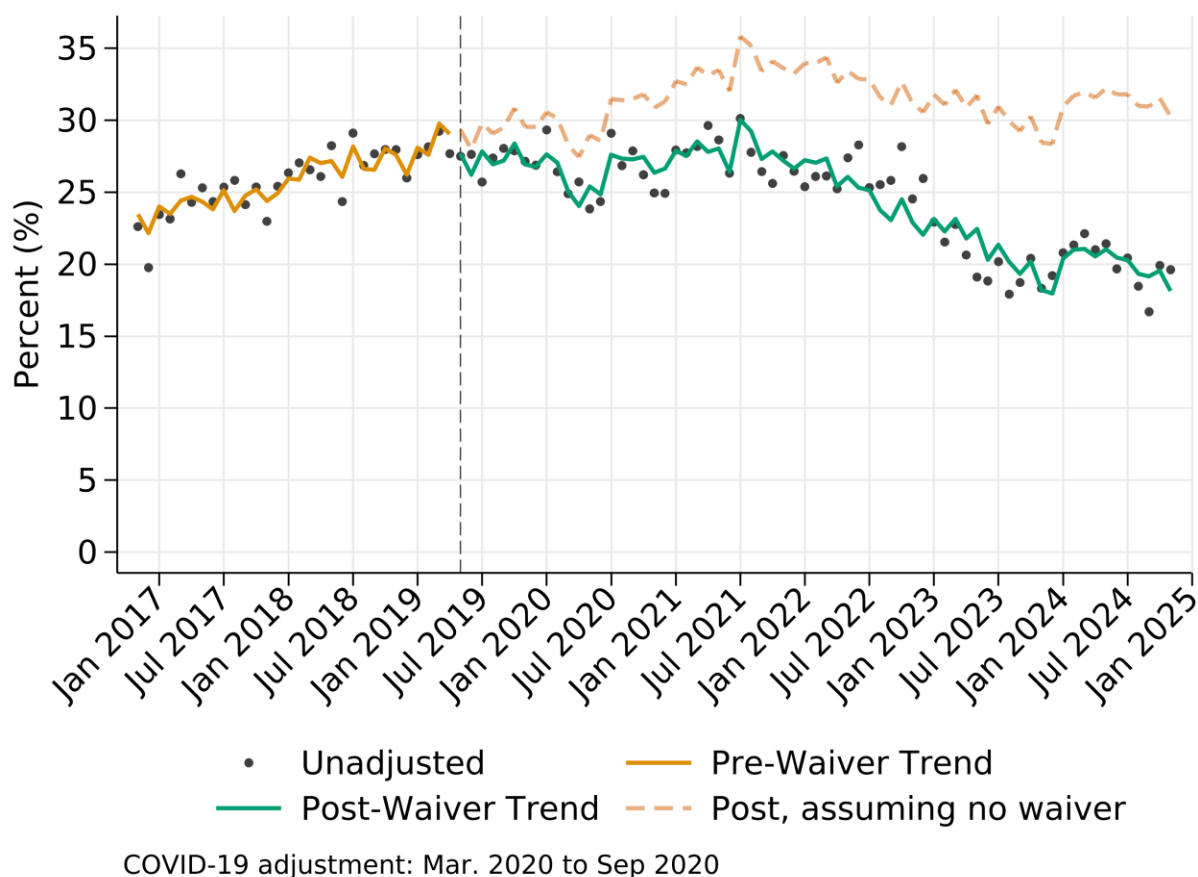
Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model. Estimates were generated from a random 20% sample of individuals (aged 18+) in the NC Medicaid population as determined in the metric specifications.

Table 10: Interrupted time series estimates of Follow-Up After Emergency Department Visit for Alcohol and Other Drug Abuse or Dependence: Age 18 and older (FUA-AD): 7 days

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	22.72* (21.53, 23.91)	20.89* (19.97, 21.81)	-1.83* (-3.11, -0.54)
Monthly Change	0.13* (0.082, 0.18)	0.026 (-0.037, 0.089)	-0.10* (-0.18, -0.024)
Predicted Average Outcome Nov 2024	24.64* (20.40, 28.88)	15.91* (13.81, 18.01)	-8.73* (-14.02, -3.44)
N	96,719		

Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model. Estimates were generated from a random 20% sample of individuals (aged 18+) in the NC Medicaid population as determined in the metric specifications.

Figure 19: Trends in Follow-Up After Emergency Department Visit for Alcohol and Other Drug Abuse or Dependence: Age 18 and older (FUA-AD): 30 days



Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model. Estimates were generated from a random 20% sample of individuals (aged 18+) in the NC Medicaid population as determined in the metric specifications.

Table 11: Interrupted time series estimates of Follow-Up After Emergency Department Visit for Alcohol and Other Drug Abuse or Dependence: Age 18 and older (FUA-AD): 30 days

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	32.18* (30.80, 33.56)	30.53* (29.46, 31.60)	-1.65* (-3.14, -0.17)
Monthly Change	0.17* (0.11, 0.22)	0.0085 (-0.064, 0.080)	-0.16* (-0.25, -0.067)
Predicted Average Outcome Nov 2024	35.78* (30.86, 40.71)	23.65* (21.24, 26.05)	-12.14* (-18.23, -6.04)
N	96,719		

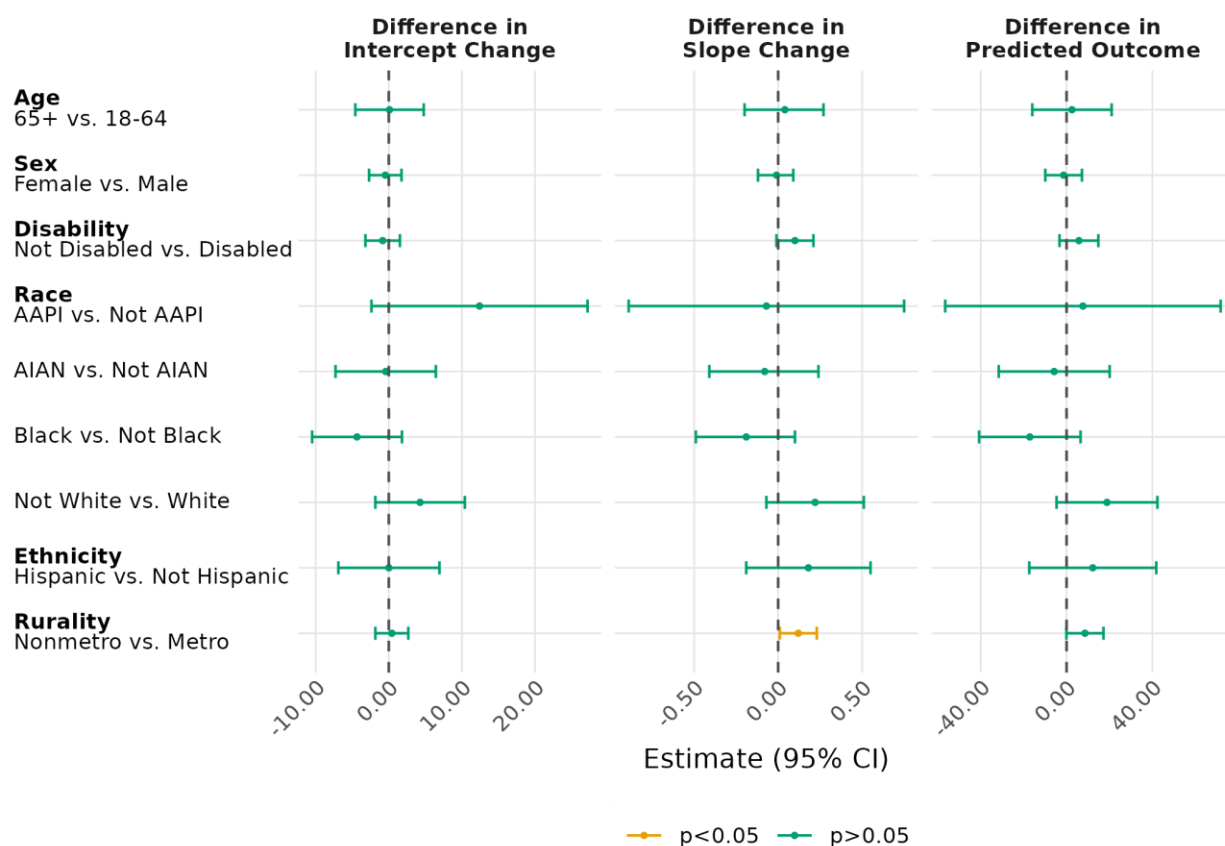
Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model. Estimates were generated from a random 20% sample of individuals (aged 18+) in the NC Medicaid population as determined in the metric specifications.

The widening follow-up gaps between 7 days (-8.73 percentage points) and 30 days (-12.14 percentage points) suggests that the system may have struggled with both immediate post-discharge engagement and with maintaining connections over the subsequent weeks. Strengthening care coordination at this juncture could be a potentially high-yield opportunity to address the capacity constraints observed throughout the treatment cascade.¹⁹

Subgroup analyses show no racial and disability-related disparities at 7 days (Figure 18), but a number of disparities emerged in 30-day follow-up patterns, suggesting potential differential care coordination capacity across geographic and population subgroups (Figure 21).

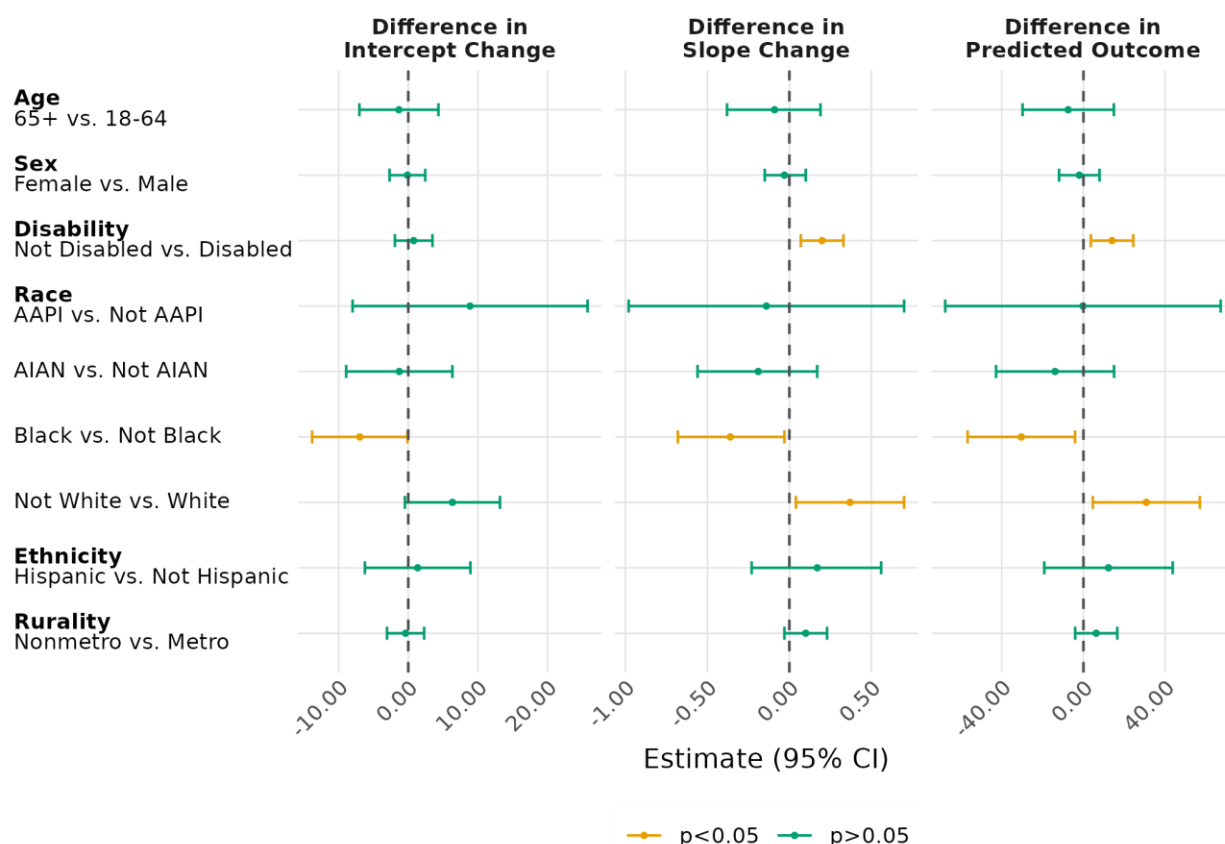
¹⁹ Garnick DW, Horgan CM, Acevedo A, Lee MT, Panas L, Ritter GA, Campbell K. Rural Clients' Continuity Into Follow-Up Substance Use Disorder Treatment: Impacts of Travel Time, Incentives, and Alerts. J Rural Health. 2020 Mar;36(2):196-207. doi: 10.1111/jrh.12375. Epub 2019 May 15. PMID: 31090968; PMCID: PMC6856385.

Figure 20: Comparison groups in Follow-Up After Emergency Department Visit for Alcohol and Other Drug Abuse or Dependence: Age 18 and older (FUA-AD): 7 days



Notes: Estimates from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model. Each of the subgroup variables is interacted with the Waiver-specific intercept and slope. The difference in intercept change (for example), is the intercept change for the first subgroup (e.g., 65+) minus the intercept change for the second subgroup (e.g., 18-64).

Figure 21: Comparison groups in Follow-Up After Emergency Department Visit for Alcohol and Other Drug Abuse or Dependence: Age 18 and older (FUA-AD): 30 days



Notes: Estimates from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model. Each of the subgroup variables is interacted with the Waiver-specific intercept and slope. The difference in intercept change (for example), is the intercept change for the first subgroup (e.g., 65+) minus the intercept change for the second subgroup (e.g., 18-64).

Initiation and Engagement of Alcohol and Other Drug Abuse or Dependence Treatment

Successful substance use disorder treatment depends on both timely initiation of care following diagnosis and sustained engagement in treatment services. The Initiation and Engagement of Alcohol and Other Drug Abuse or Dependence Treatment measure captures two sequential steps in the treatment pathway: initiation (receipt of treatment services within 14 days of a new diagnosis or identification event) and engagement (receipt of two or more additional treatment services within 34 days of initiation). These metrics assess the system's capacity to connect newly diagnosed individuals to care and sustain their participation

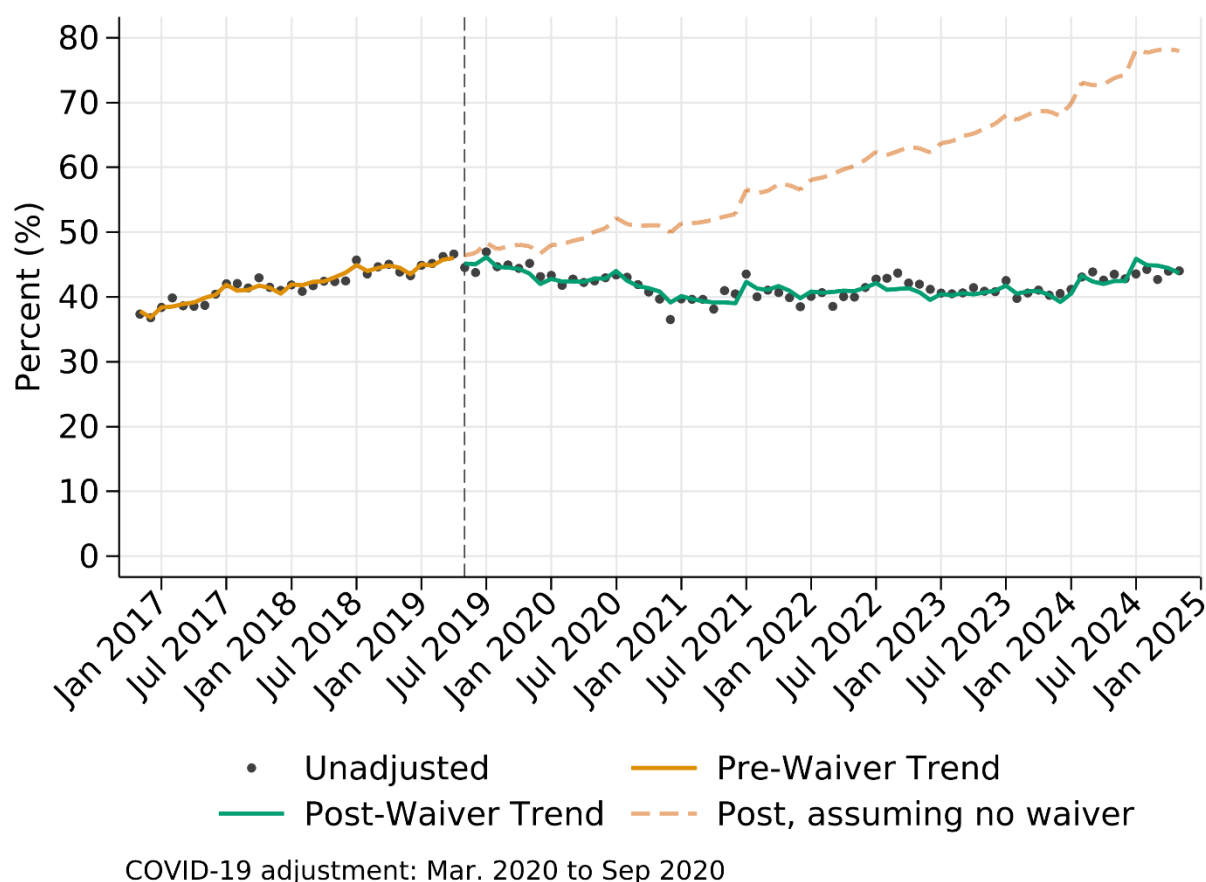
through the early treatment period, when treatment discontinuation rates are typically elevated.

Treatment Initiation

Prior to waiver implementation, treatment initiation rates demonstrated improvement, with a baseline rate of 45.05% (95% CI: 44.21, 45.88) in May 2019 and a statistically significant positive monthly trend of 0.25 percentage points per month (95% CI: 0.22, 0.28), as shown in [Table 12](#). However, following waiver implementation, there was an immediate negative implementation effect of -1.22 percentage points (95% CI: -2.07, -0.38), and the monthly trend shifted from positive to negative, with a change of -0.50 percentage points per month (95% CI: -0.55, -0.45). By November 2024, the model-predicted initiation rate was 34.72% (95% CI: 33.58, 35.85) compared to a counterfactual projection of 69.00% (95% CI: 66.11, 71.90)—representing a significant difference of -34.29 percentage points (95% CI: -37.75, -30.83).

[Figure 22](#) shows initiation rates declining initially following waiver implementation, then stabilizing around 40-43% through the remainder of the study period, while the counterfactual projection indicates continued linear growth. The substantial divergence between observed and projected rates may suggest system capacity constraints that impeded connecting newly diagnosed beneficiaries with initial treatment services within the 14-day window.

Figure 22: Trends in Initiation of Alcohol and Other Drug Abuse or Dependence Treatment (IET-AD)



Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model. Estimates were generated from a random 20% sample of individuals (aged 18+) in the NC Medicaid population as determined in the metric specifications.

Table 12: Interrupted time series estimates of Initiation of Alcohol and Other Drug Abuse or Dependence Treatment (IET-AD)

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	45.05* (44.21, 45.88)	43.82* (43.21, 44.44)	-1.22* (-2.07, -0.38)
Monthly Change	0.25* (0.22, 0.28)	-0.25* (-0.29, -0.21)	-0.50* (-0.55, -0.45)
Predicted Average Outcome Nov 2024	69.00* (66.11, 71.90)	34.72* (33.58, 35.85)	-34.29* (-37.75, -30.83)
N	432,268		

Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model. Estimates were generated from a random 20% sample of individuals (aged 18+) in the NC Medicaid population as determined in the metric specifications.

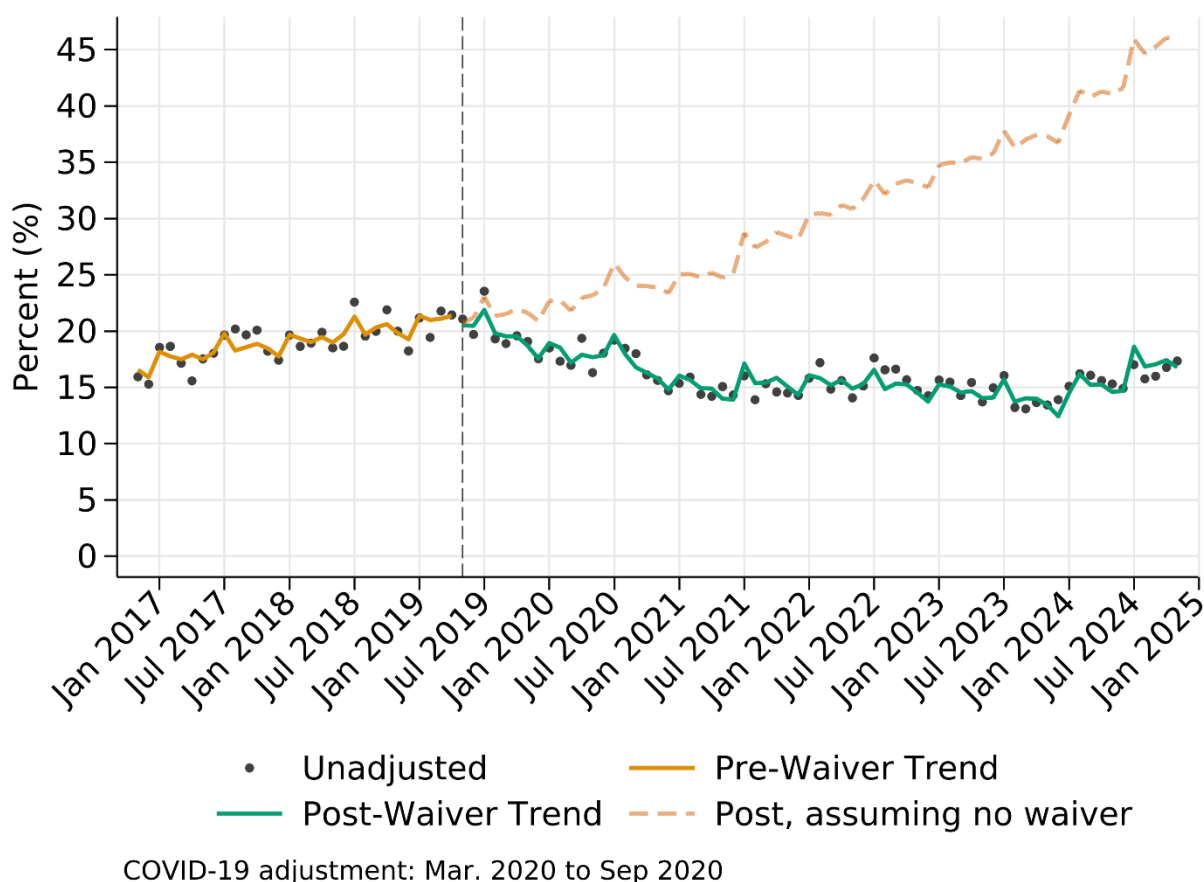
Treatment Engagement

Prior to waiver implementation, engagement rates demonstrated improvement with a baseline rate of 20.14% (95% CI: 19.51, 20.77) in May 2019 and a statistically significant positive monthly trend of 0.14 percentage points (95% CI: 0.12, 0.17), as shown in [Table 13](#).

Following waiver implementation, engagement rates deteriorated more sharply than initiation rates. The monthly trend changed by -0.44 percentage points per month (95% CI: -0.48, -0.40). By November 2024, the model-predicted engagement rate was 7.79% (95% CI: 6.95, 8.63) compared to a counterfactual projection of 36.89% (95% CI: 34.66, 39.14)—representing a difference of -29.11 percentage points (95% CI: -31.75, -26.46).

[Figure 23](#) shows engagement rates declining from approximately 20% to around 15%, while the counterfactual projection indicates rates should have approached 45% had the pre-waiver trends continued. These findings indicate that among individuals who initiated treatment, the proportion achieving sustained engagement was substantially lower than projected in the absence of the waiver. Capacity constraints of the treatment providers available to provide care for Medicaid beneficiaries, could be one explanation for this, although we find considerable growth in the number of providers elsewhere in this report. Although the comparison is to ambitious projections based on pre-period trends, we also note that the engagement rates plotted below have declined from the start of the SUD waiver implementation period, although rates appear to be trending back up in last 18 months.

Figure 23: Trends in Engagement of Alcohol and Other Drug Abuse or Dependence Treatment (IET-AD)



Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model. Estimates were generated from a random 20% sample of individuals (aged 18+) in the NC Medicaid population as determined in the metric specifications.

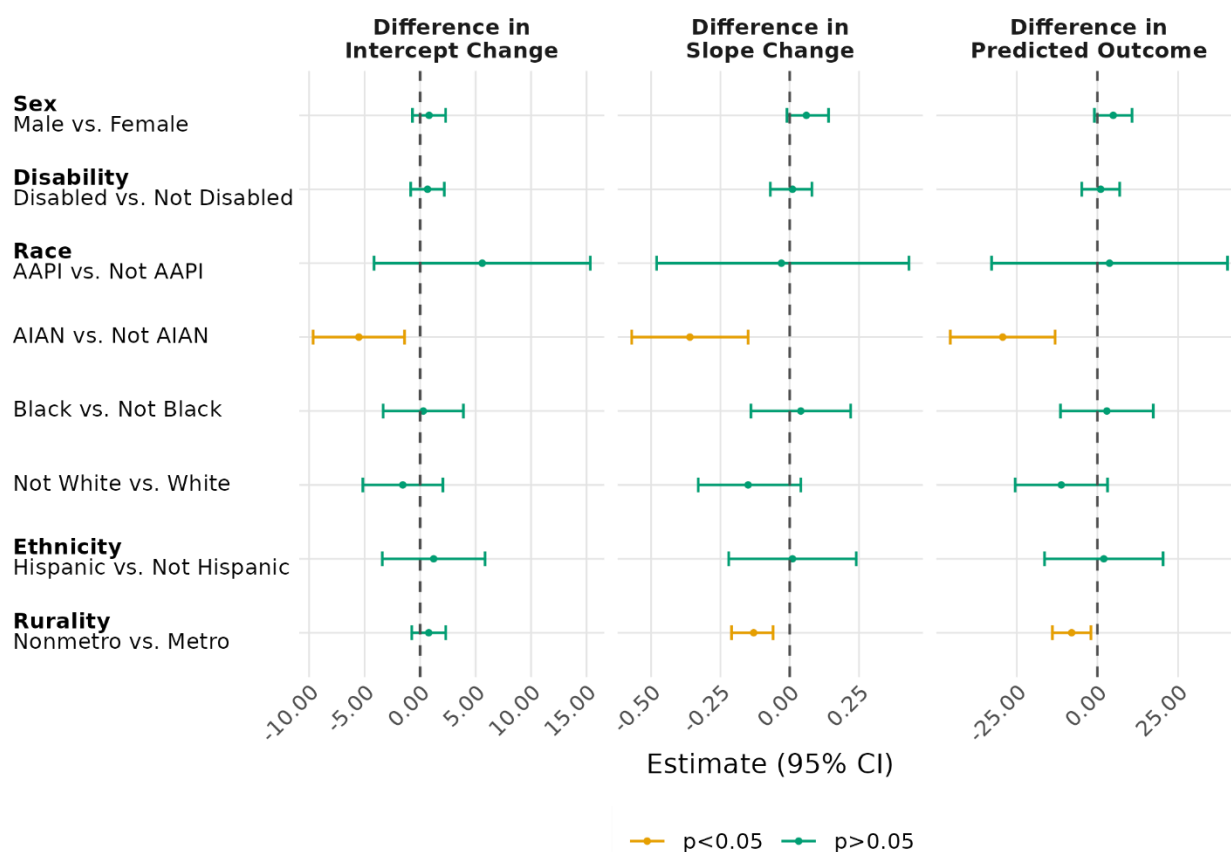
Table 13: Interrupted time series estimates of Engagement of Alcohol and Other Drug Abuse or Dependence Treatment (IET-AD)

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	20.14* (19.51, 20.77)	19.89* (19.44, 20.34)	-0.25 (-0.91, 0.42)
Monthly Change	0.14* (0.12, 0.17)	-0.29* (-0.32, -0.26)	-0.44* (-0.48, -0.40)
Predicted Average Outcome Nov 2024	36.90* (34.66, 39.14)	7.79* (6.95, 8.63)	-29.11* (-31.75, -26.46)
N	432,268		

Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model. Estimates were generated from a random 20% sample of individuals (aged 18+) in the NC Medicaid population as determined in the metric specifications.

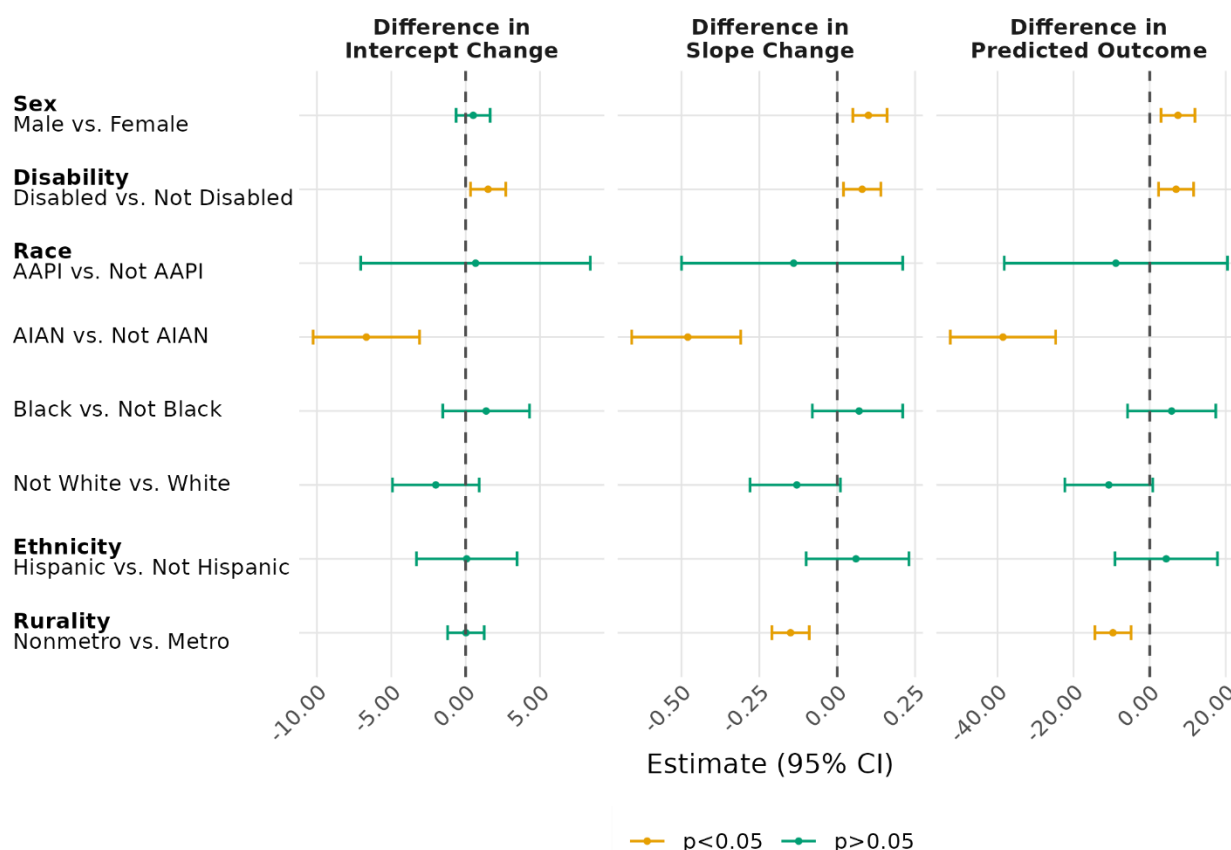
Subgroup analyses show some differential effects across demographic and geographic characteristics. American Indian/Alaska Native beneficiaries and individuals residing in nonmetropolitan counties experienced disproportionately negative effects on treatment initiation rates. For engagement, males and individuals with disabilities had less pronounced declines relative to comparison groups while American Indian/Alaska Native beneficiaries and individuals residing in nonmetropolitan counties had more pronounced declines.

Figure 24: Comparison groups in Initiation of Alcohol and Other Drug Abuse or Dependence Treatment (IET-AD)



Notes: Estimates from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model. Each of the subgroup variables is interacted with the Waiver-specific intercept and slope. The difference in intercept change (for example), is the intercept change for the first subgroup (e.g., 65+) minus the intercept change for the second subgroup (e.g., 18-64).

Figure 25: Comparison groups in Engagement of Alcohol and Other Drug Abuse or Dependence Treatment (IET-AD)



Notes: Estimates from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model. Each of the subgroup variables is interacted with the Waiver-specific intercept and slope. The difference in intercept change (for example), is the intercept change for the first subgroup (e.g., 65+) minus the intercept change for the second subgroup (e.g., 18-64).

Conclusions

The metrics examined here show that North Carolina’s SUD waiver demonstrated substantial progress in expanding access to substance use disorder treatment, achieving more than 13 percentage points higher treatment receipt among diagnosed beneficiaries than would have been expected without the waiver. The waiver also maintained healthcare system integration during periods of significant policy and programmatic changes, including the Public Health Emergency, Medicaid expansion, and the implementation of Tailored Plans.

However, the state struggled with the timeliness of treatment delivery after the implementation of the SUD waiver. Hospital readmission rates for people with SUD diagnoses remained stable at approximately 20% despite expanded treatment access. The

system may have encountered capacity constraints that prevented timely treatment initiation and sustained engagement for newly diagnosed individuals, with initiation and engagement rates falling 34 and 29 percentage points below projected levels, respectively. Follow-up with community providers post-emergency department care similarly deteriorated, with follow-up rates declining 9-12 percentage points below predicted estimates had the pre-waiver trends continued. These findings suggest that while the waiver successfully scaled treatment capacity and reversed declining treatment access trends, system transformation strained care coordination mechanisms and created barriers to achieving the timely, coordinated care pathways essential for optimal treatment outcomes. Addressing these care coordination challenges—particularly during critical transition points such as post-diagnosis and post-emergency department encounters could be a high-yield opportunity to improve treatment quality and outcomes.

Hypothesis 3.2: Expanding coverage of SUD services will increase the use of MOUD and other appropriate opioid treatment services and decrease long-term use of prescription opioids

Hypothesis 3.2 proposed that expanding coverage of SUD services would increase the use of medications for opioid use disorders (MOUD) and other OUD treatment services and decrease the harmful long-term use of prescription opioids among the general Medicaid population. Overall, the effects of the waiver on utilization of treatment services for OUD were small and not statistically significant. Despite increases in the use of MOUD throughout the Demonstration period, our analysis found no overall change in trends due to the SUD waiver implementation. Because many opioid-related metrics are calculated only annually, the limited number of time points means that our evaluation was unable to quantify the effect of the SUD waiver on some opioid-related metrics. For these metrics, we present annual trends and highlight qualitative findings.

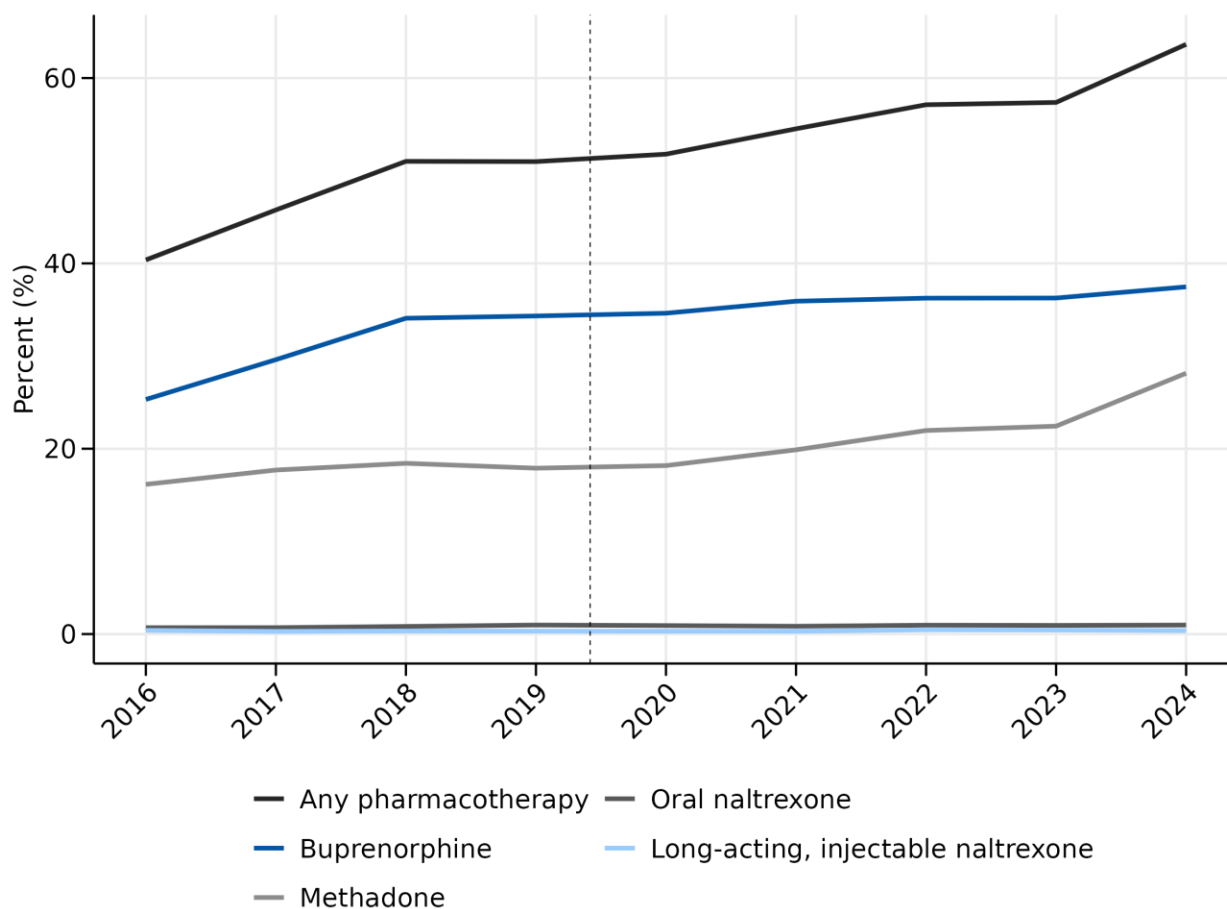
Use of Medications for Opioid Use Disorders (MOUD)

Medications for opioid use disorders, including methadone, buprenorphine, and naltrexone, are considered evidence-based best practices for treatment of OUD. [Figure 26](#) plots the annual unadjusted rates of use of pharmacotherapy for OUD among North Carolina beneficiaries aged 18-64 with an OUD diagnosis. Use of pharmacotherapy for OUD increased steadily throughout the study period, ranging from 40% of beneficiaries with an OUD diagnosis receiving MOUD in 2016 to over 60% of beneficiaries with OUD receiving MOUD in 2024. North Carolina is close to the US median for this measure (60.5%) for 2024.

Over half of North Carolina non-elderly adult beneficiaries receiving MOUD in 2024 were being treated with buprenorphine ([Figure 26](#)). Use of buprenorphine to treat OUD increased from a rate of 25% in 2016 to over 35% in 2024, though much of this increase happened before waiver implementation between 2016 and 2018. Conversely, rates of use of methadone for treating OUD demonstrated large increases in the post period ([Figure 26](#)). Despite rates of methadone use for OUD remaining overall lower than those for buprenorphine, increases in the rate of methadone use far outpaced increases in the rate of

buprenorphine use for treating OUD between 2023 and 2024. Use of injectable and oral naltrexone remained rare throughout the study period, with less than 0.5% and 1% of beneficiaries with OUD being treated with these medications, respectively. We note that the changes in payments and codes in NC that resulted in bundled payments to opioid treatment programs (OTPs) reduce the ability to detect the prevalence of specific medication treatments in OTPs after Oct 2023.

Figure 26: Trends in Use of Pharmacotherapy for Opioid Use Disorder (OUD): Unadjusted

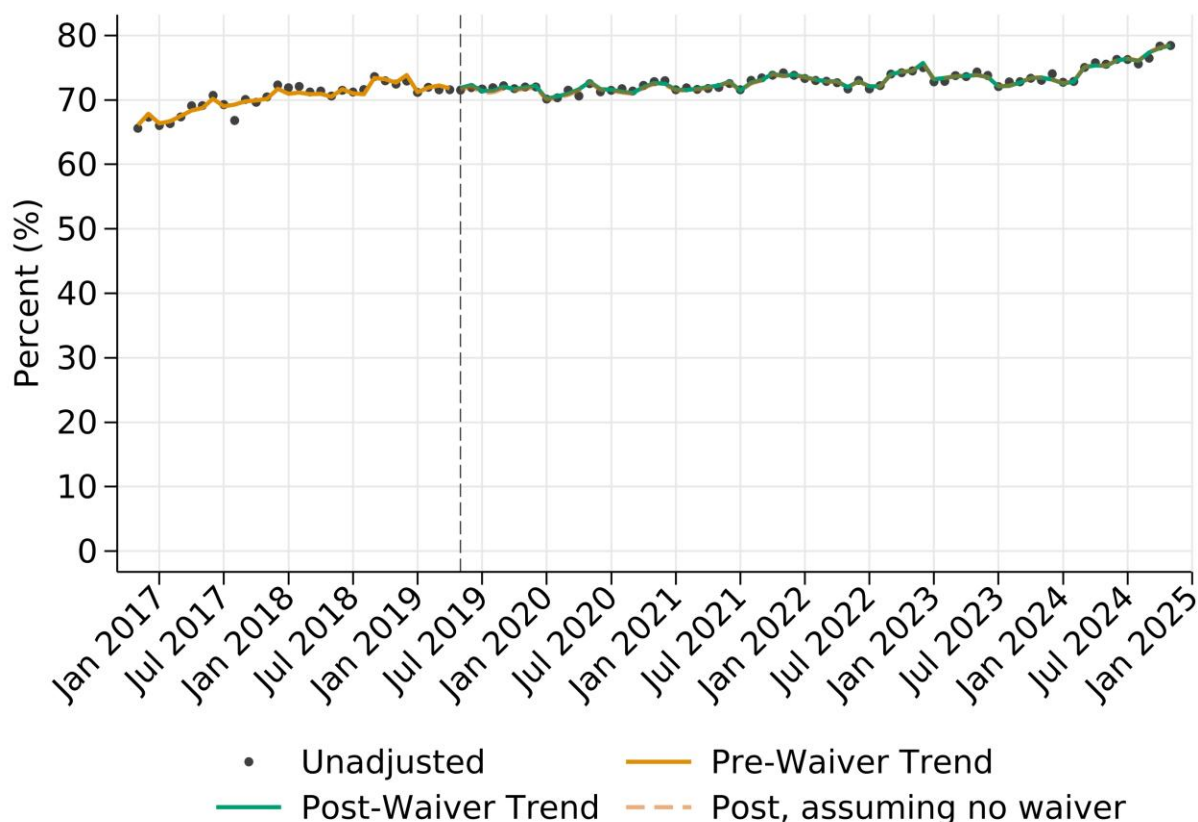


Notes: This figure plots unadjusted rates from the metric population. Estimates were generated from a random 20% sample of individuals (aged 18+) in the NC Medicaid population as determined in the metric specifications.

The appreciable progress in the use of methadone and buprenorphine to treat OUD may be attributed to a quickly changing landscape of state and federal regulations for MOUD. This includes changes to North Carolina's opioid treatment program (OTP) payment approach, North Carolina's Medicaid expansion, and an easing of federal regulations on take-home doses and telehealth for MOUD.

We also examined a monthly indicator of MOUD use among beneficiaries of all ages with an OUD diagnosis. Results from the ITS analysis find a small (<1%-point), but statistically significant increase in MOUD use immediately after SUD waiver implementation, but we found no difference in the monthly trends in MOUD use nor in the percent of beneficiaries with an OUD diagnosis who had received MOUD at the end of the waiver over what would have been expected in the absence of the waiver ([Table 14](#)).

Figure 27: Trends in Medication Assisted Treatment (SUD): OUD population



COVID-19 adjustment: Mar. 2020 to end of study period

Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population with a substance use disorder.

Table 14: Interrupted time series estimates of Medication Assisted Treatment (SUD): OUD population

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	72.36* (71.40, 73.32)	72.91* (71.99, 73.83)	0.55* (0.023, 1.08)
Monthly Change	-0.0042 (-0.061, 0.053)	-0.011 (-0.13, 0.11)	-0.0064 (-0.14, 0.13)
Predicted Average Outcome Nov 2024	73.41* (65.02, 81.79)	73.54* (72.00, 75.07)	0.13 (-8.72, 8.98)
N	1,593,445		

Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population with a substance use disorder.

Rates of medication assisted treatment for people with a SUD diagnosis, including the use of medications for treatment of alcohol use disorders, are reported in the appendix ([Figure 82](#)). Related quality measures, such as the percentage of individuals receiving MAT who are also receiving counseling and behavioral therapies to treat SUD, are also reported in the appendix ([Figure 85](#)).

Continuation of Pharmacotherapy for Opioid Use Disorder

Continuation of pharmacotherapy for OUD measures the percentage of individuals who remain on MOUD for at least 180 days following treatment initiation, an important indicator of treatment retention and medication adherence. Extended pharmacotherapy duration is associated with improved clinical outcomes, reduced overdose risk, and lower rates of treatment discontinuation.²⁰ Sustained engagement with MOUD represents a core component of evidence-based opioid use disorder treatment.²¹

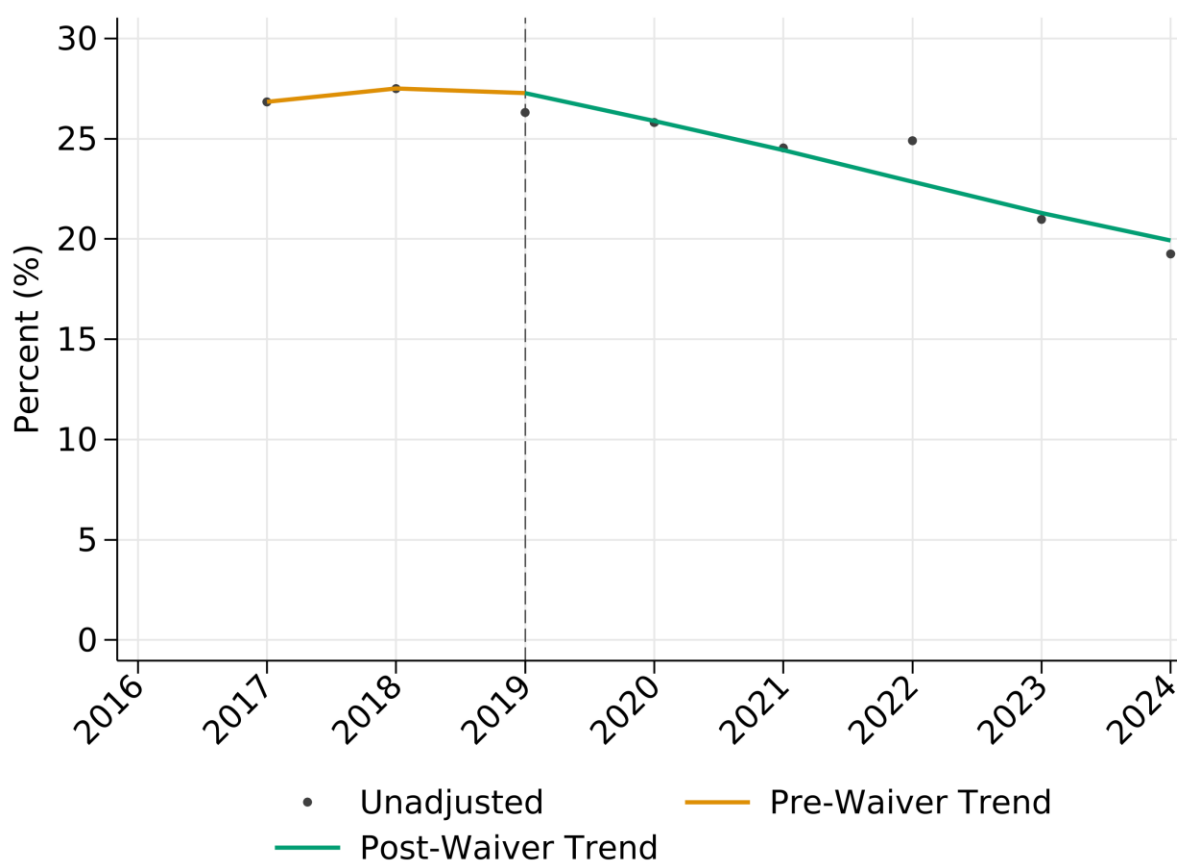
[Figure 28](#) shows a consistent downward trajectory in annual MOUD continuation rates across the study period. Rates exhibited relative stability at approximately 27% during 2017-2019,

²⁰ Burns M, Tang L, Chang C-CH, Kim JY, Ahrens K, Allen L, et al. Duration of medication treatment for opioid-use disorder and risk of overdose among Medicaid enrollees in 11 states: a retrospective cohort study. *Addiction*. 2022 Dec;117(12):3079–88.

²¹ McPheeters M, O'Connor EA, Riley S, et al. Pharmacotherapy for Alcohol Use Disorder: A Systematic Review and Meta-Analysis. *JAMA*. 2023;330(17):1653–1665. doi:10.1001/jama.2023.19761

prior to waiver implementation, followed by a sustained decline through 2024, reaching approximately 20% by the study endpoint. The persistent decline in pharmacotherapy continuation indicates system-level challenges in translating increased service availability into sustained longitudinal engagement.

Figure 28: Trends in Continuation of Pharmacotherapy for Opioid Use Disorder



Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model. Estimates were generated from a random 20% sample of individuals (aged 18+) in the NC Medicaid population as determined in the metric specifications.

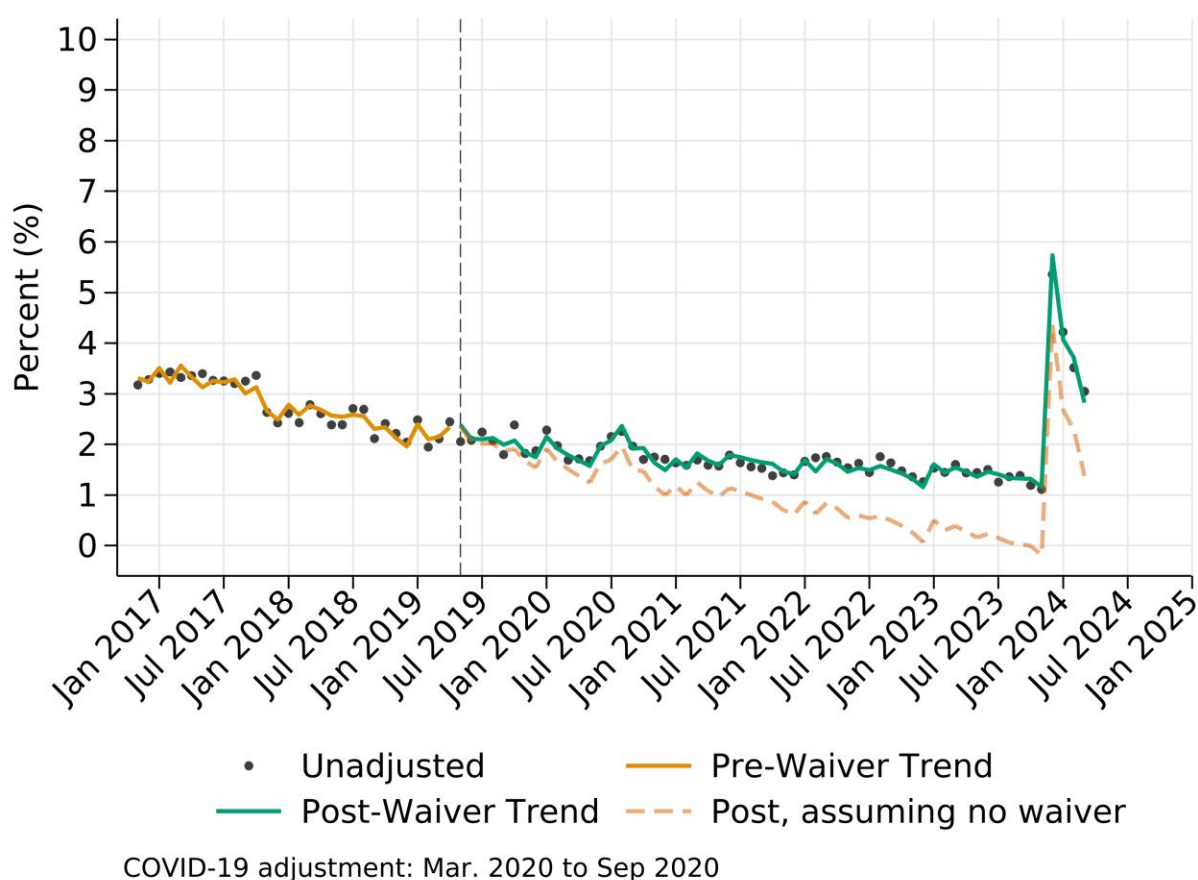
Use of Non-medication Opioid Treatment Services

The use of non-medication opioid treatment services measures the percentage of individuals living with OUD who receive outpatient psychosocial services. The measure defines psychosocial services for OUD following the methods of Busch and colleagues (2020) and includes care such as case management, psychotherapy and counseling, psychosocial

rehabilitation, and supportive behavioral health services.²² The use of these services may be in addition to or in place of medication treatments for OUD.

Use of non-medication opioid treatment services declined throughout the study period, with a jump in service utilization after NC Medicaid expansion in December 2023 (Figure 29). There was no immediate change in the rate of service use after SUD waiver implementation. However, rates declined more slowly after SUD waiver implementation, increasing by 0.024 percentage points each month during the post period (Table 15). This increase in monthly trends resulted in a 1.45 percentage point higher rate of beneficiaries receiving non-medication opioid treatment services at the end of the waiver over what would have been expected in the absence of the waiver.

Figure 29: Trends in Percent of Enrollees Diagnosed with OUD Receiving Non-medication Opioid Treatment Services



²² Busch AB, Greenfield SF, Reif S, Normand S-LT, Huskamp HA. Outpatient care for opioid use disorder among the commercially insured: Use of medication and psychosocial treatment. J Subst Abuse Treat. 2020 Aug;115:108040.

Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population as determined in the metric specifications.

Table 15: Interrupted time series estimates of Percent of Enrollees Diagnosed with OUD Receiving Non-medication Opioid Treatment Services

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	2.03* (1.93, 2.14)	2.07* (1.99, 2.15)	0.036 (-0.084, 0.16)
Monthly Change	-0.031* (-0.036, -0.026)	-0.0064* (-0.012, -0.0013)	0.024* (0.017, 0.032)
Predicted Average Outcome Mar 2024	0.35 (-0.038, 0.74)	1.80* (1.66, 1.94)	1.45* (1.01, 1.89)
N	1,501,790		

Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population as determined in the metric specifications.

Risky Prescribing of Opioids

In order to examine the upstream prescribing of opioids in the Medicaid population, we present annual trends for three national quality measures: use of opioids at high dosage in persons without cancer, use of opioids from multiple providers in persons without cancer, and concurrent use of opioids and benzodiazepines.

Evidence suggests that these types of risky prescribing practices are associated with higher risk of addiction and opioid overdose deaths.²³ In attempts to combat these risks, the state enacted the NC STOP Act of 2017, which made it mandatory for prescribers and dispensers to check a patient's 12-month prescription history in the controlled substances reporting system (CSRS) before prescribing or dispensing Schedule II or III opioids starting on July 7,

²³ Gwira Baumbblatt JA, Wiedeman C, Dunn JR, Schaffner W, Paulozzi LJ, Jones TF. High-risk use by patients prescribed opioids for pain and its role in overdose deaths. JAMA Intern Med. 2014 May;174(5):796–801.

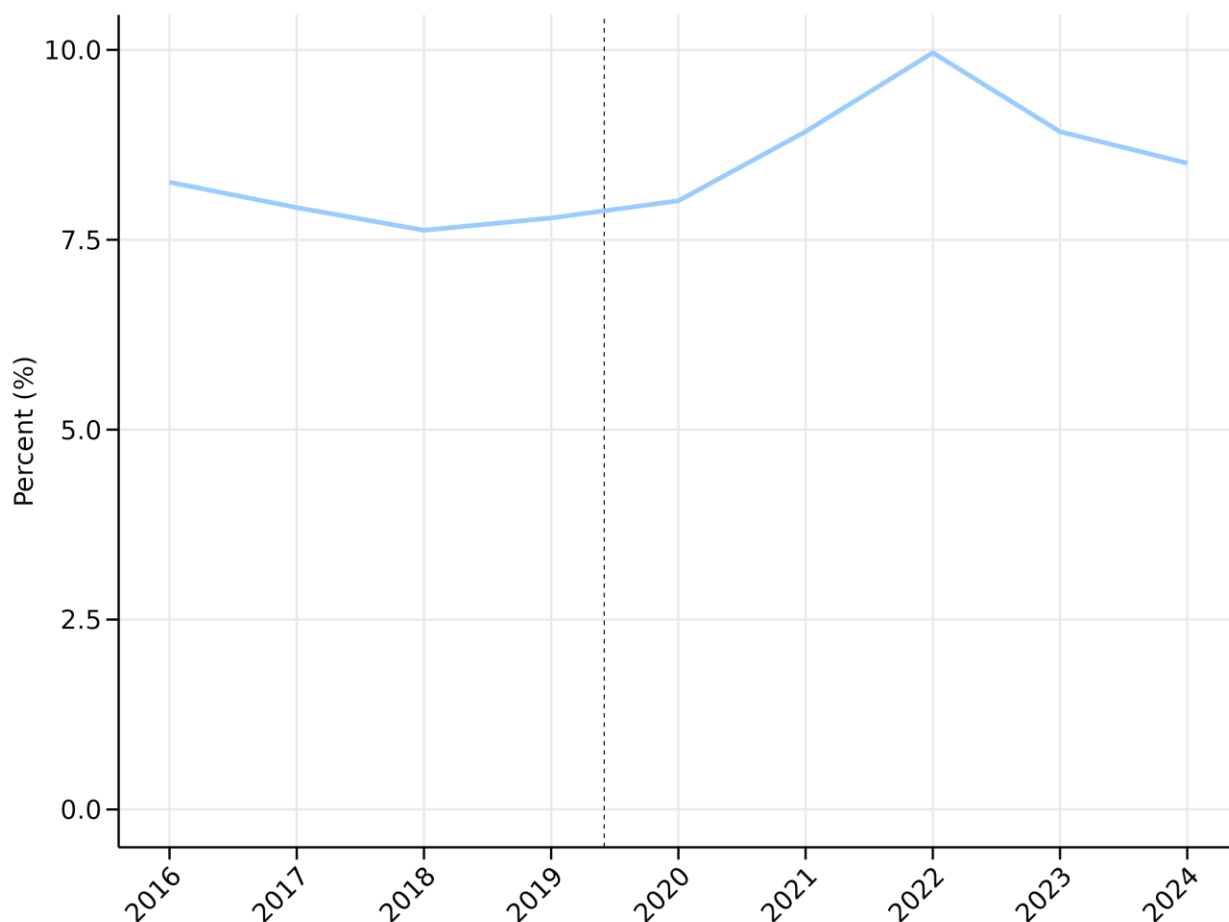
2021. The effects of the STOP Act can be seen throughout the baseline period of our study for each of these measures.

Use of Opioids at High Dosage in Persons without Cancer

This measure is defined as the percentage of beneficiaries aged 18 and older who received prescriptions for opioids with a daily dosage greater than 90 morphine milligram equivalents (MME) over a period of 90 days or more. Beneficiaries with a cancer or sickle cell disease diagnosis, or in hospice or palliative care were excluded.

Use of opioids at high dosage remained largely stable throughout the study period ([Figure 30](#)). The unadjusted rate declined from 8% to 7.5% between 2016 and 2018, before beginning to increase prior to SUD waiver implementation. Unadjusted rates peaked in 2022 at 10% before returning to near baseline levels in 2024. North Carolina is above the national median for this measure (6.4%).

Figure 30: Trends in Use of Opioids at High Dosage in Persons without Cancer (OHD-AD)

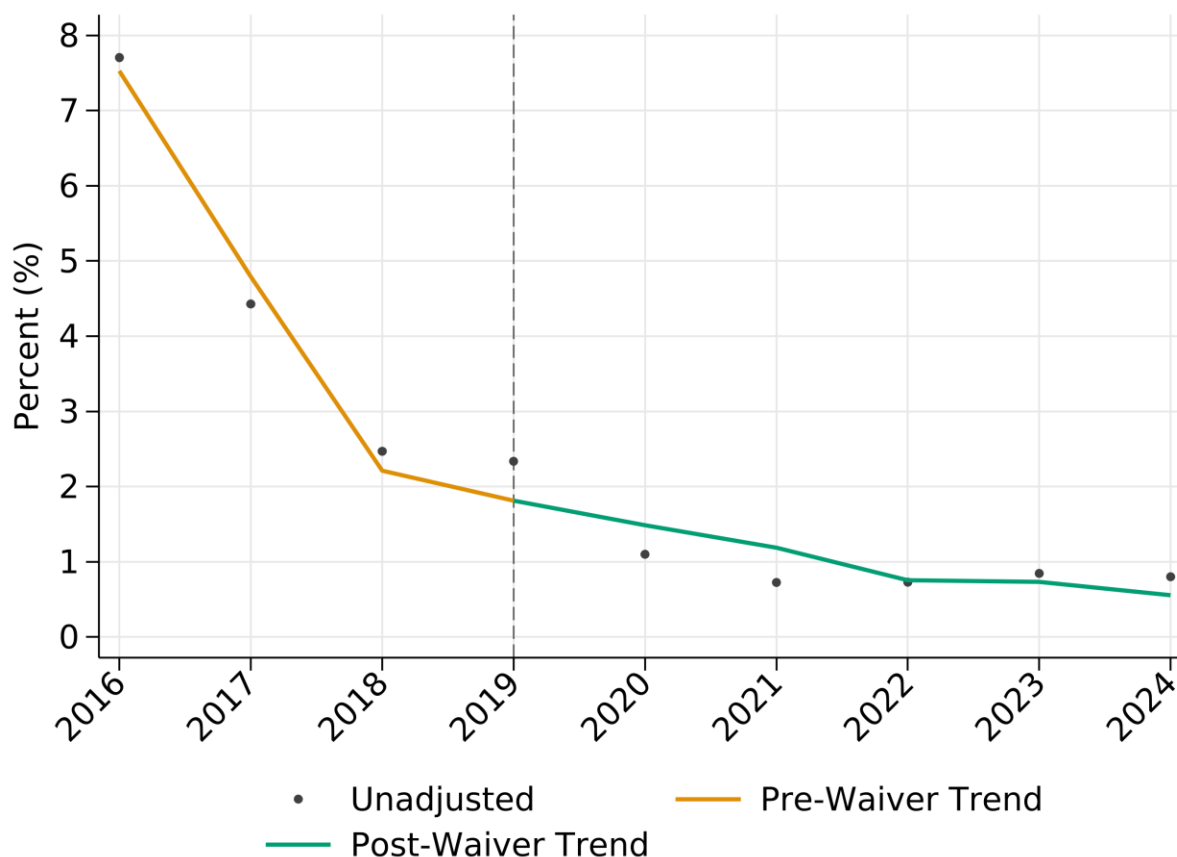


Notes: This figure plots unadjusted rates from the metric population. Estimates were generated from a random 20% sample of individuals (aged 18+) in the NC Medicaid population as determined in the metric specifications.

Use of Opioids from Multiple Providers in Persons without Cancer

This measure tracks the percentage of Medicaid beneficiaries aged 18 and older who received prescriptions for opioids from four or more prescribers and four or more pharmacies within 180 days. Rates for use of opioids from multiple providers declined considerably before SUD waiver implementation, falling from almost 8% in 2016 to 2.5% by 2018. Rates continued to decline after SUD waiver implementation, with another one percentage point drop between 2019 and 2020. Following these declines, rates stabilized at roughly 1% for the remainder of the demonstration period.

Figure 31: Trends in Use of Opioids from Multiple Providers in Persons Without Cancer (OMP)



Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model. Estimates were generated from a random 20% sample of individuals (aged 18+) in the NC Medicaid population as determined in the metric specifications.

Use of opioids at high dosage and from multiple providers fell to near zero before waiver implementation and thus is not reported here (see appendix [Figure 88](#)).

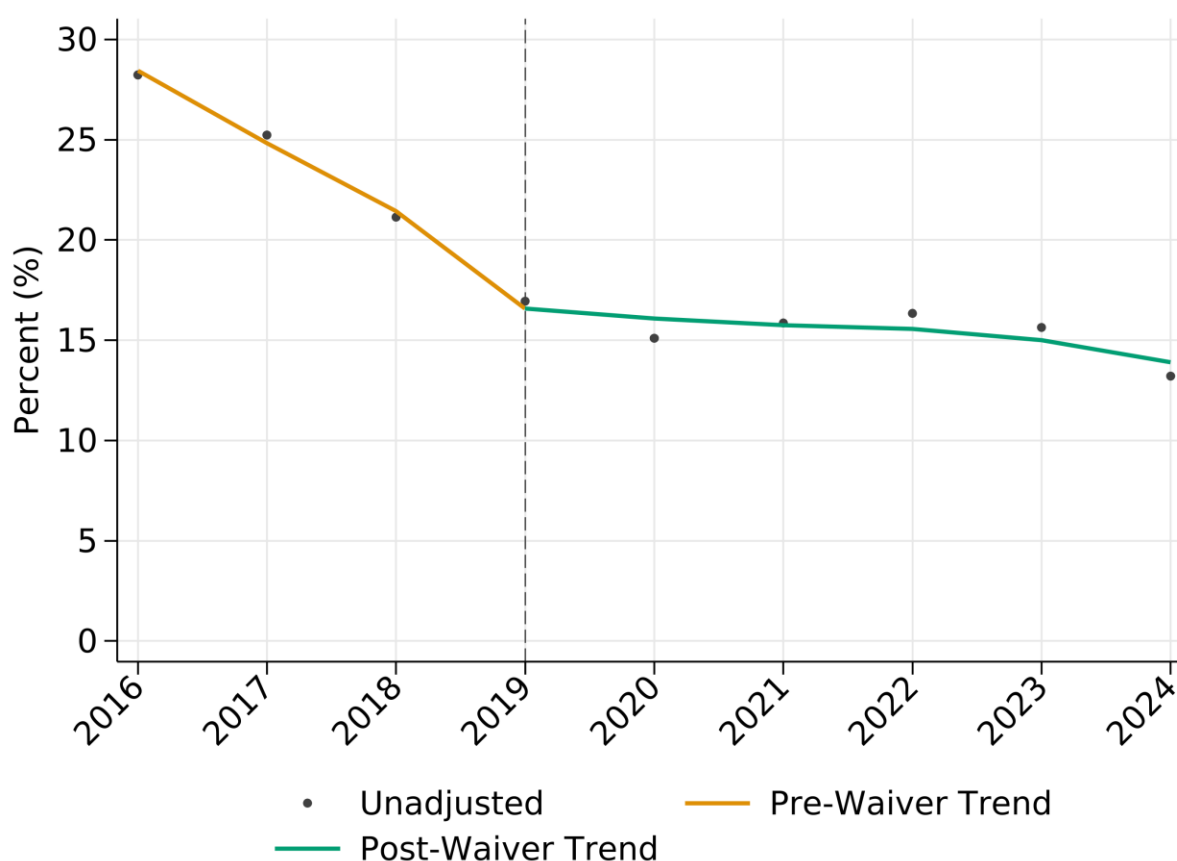
Concurrent prescribing of opioids and benzodiazepines

Concurrent prescribing of opioids and benzodiazepines represents a critical patient safety concern, as this combination substantially increases overdose risk.^{24, 25} Prior to waiver implementation, North Carolina had been making rapid progress in reducing these dangerous prescribing combinations, with rates of beneficiaries using opioids who also received at least 30 days' supply of benzodiazepines declining steeply from approximately 28% in 2016 to 17% by 2019. Following waiver implementation, progress in reducing concurrent opioid and benzodiazepine prescribing slowed considerably compared to pre-waiver trends.

²⁴ Liu S, O'Donnell J, Gladden RM, McGlone L, Chowdhury F. Trends in Nonfatal and Fatal Overdoses Involving Benzodiazepines - 38 States and the District of Columbia, 2019-2020. MMWR Morb Mortal Wkly Rep. 2021 Aug 27;70(34):1136–41.

²⁵ Sun EC, Dixit A, Humphreys K, Darnall BD, Baker LC, Mackey S. Association between concurrent use of prescription opioids and benzodiazepines and overdose: retrospective analysis. BMJ. 2017 Mar 14;356:j760.

Figure 32: Trends in Concurrent Use of Opioids and Benzodiazepines (COB-AD)



Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model. Estimates were generated from a random 20% sample of individuals (aged 18+) in the NC Medicaid population as determined in the metric specifications.

Changes in the rate of concurrent dispensing of opioids and benzodiazepines were very stable from 2019 to 2023, indicating that the STOP Act did not have a strong effect on this measure after 2019, potentially due to higher levels of utilization of CSRS prior to the mandatory reporting date.

Nationally, the median rate of concurrent use was 13.1% in 2024, with state rates ranging from 3.6% to 24.1%. North Carolina was below the national median for this measure in 2024.

Conclusions

In conclusion, we examined thirteen opioid-related metrics reflecting medications and other treatments for OUD and harmful long-term use of opioids to test Hypothesis 3.2. Annual trends showed increases in the use of medication treatments for OUD among non-elderly adults and noted improvements in measures of harmful opioid use, such as reduced co-occurring prescriptions with benzodiazepines and reduced prescribing of high-dosage opioids to people without cancer diagnoses. We also found a modest increase in the rate of MOUD among beneficiaries of all ages with an OUD diagnosis immediately after waiver implementation, but this increase was not sustained; by the end of the Demonstration period, we found no evidence that access to MOUD had increased among the full beneficiary population with a SUD or OUD diagnosis. However, we found evidence that the waiver increased the use of non-medication OUD treatment services, such as case management, support groups, and other psychosocial services. Despite this increase, use of non-medication OUD treatment services lag far behind rates of MOUD use in North Carolina's Medicaid population.

Hypothesis 3.3: Expanding coverage of SUD services will result in no changes in total Medicaid and out-of-pocket costs for people with SUD diagnoses; increases in Medicaid costs on SUD IMD services; increases in SUD pharmacy, outpatient, and rehabilitative costs; and decreases in acute care crisis-oriented, inpatient, ED, long-term care and other SUD costs

To evaluate Hypothesis 3.3, we conducted two types of analyses among the population with a SUD diagnosis. First, we estimated the average per-member-per-month (PMPM) expenditure (including those that had \$0 expenditures in the month) across eleven categories of expenditures. These estimates are presented adjusting for inflation using 2024 US Dollars and in nominal terms (not inflation adjusted). Second, we also analyzed the probability of having each type of expenditure among people with a SUD diagnosis, adjusting for beneficiary characteristics and other competing events using interrupted time series (ITS) analysis as we did in Hypotheses 3.1 and 3.2.

The eleven expenditure categories include: Medicaid spending on SUD treatment services, total Medicaid spending on people with a SUD diagnosis, Outpatient care, Outpatient Evaluation and Management (E&M) (a subset of Outpatient care), Prescription Medication, Behavioral Health, Emergency Department, Inpatient, Institute for Mental Disease (IMD) spending, Acute Care Crisis-Oriented care and spending on non-SUD services.

We tracked total Medicaid expenditures on any type of SUD treatment services including spending on outpatient SUD services, residential treatment, medication-assisted treatment, and other SUD-related care. Between 2017 and 2019, prior to the SUD waiver implementation, overall spending on SUD treatment services was increasing steadily. This increase continued after the waiver implementation. At baseline in May 2019, total monthly SUD spending per beneficiary was \$915.98, and following the SUD waiver implementation at the end of the study period in November 2024 spending was \$1,189.00. In November 2024,

the estimated spending under the waiver was predicted to be \$7.57 more than it would have been at the same time point, had the waiver not been implemented, resulting in no estimated cost difference attributable to the SUD waiver.

Overall, during the baseline period in May 2019, prior to the SUD waiver implementation, 95.72% of Medicaid beneficiaries with a SUD diagnosis had any Medicaid expenditure in a typical month. This high rate of utilization is due to the inclusion of per-member-per-month (PMPM) payments for Advanced Medical Home (and the prior CCNC model) and other value-based payment approaches. In November 2024, following the SUD Waiver, 97.03% of beneficiaries had any expenditures a typical month. This represents a small but statistically significant increase in the percentage of beneficiaries who had any Medicaid expenditure after the SUD waiver was implemented.

Table 16: Interrupted time series estimates of Proportion of beneficiaries with SUD who had any expenditures in the month

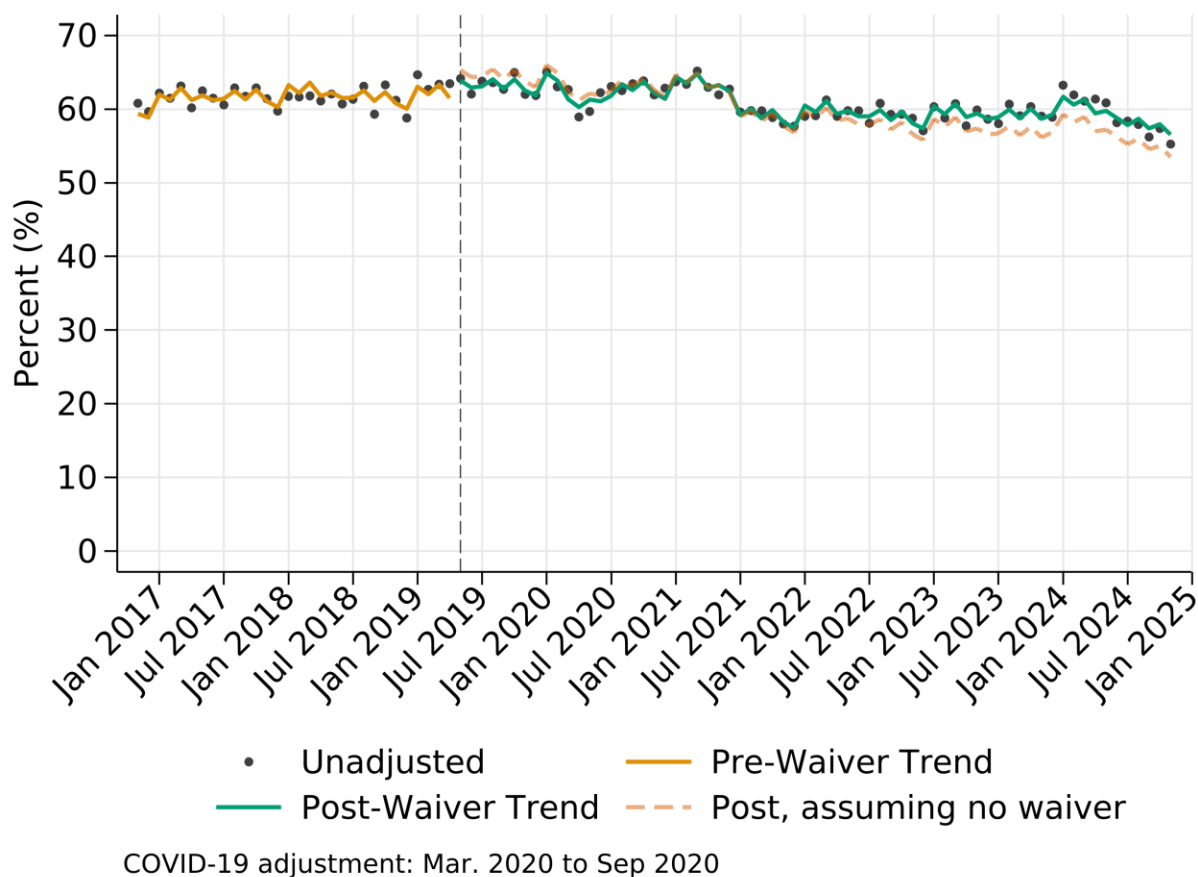
	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	95.72* (95.52, 95.92)	96.13* (95.93, 96.32)	0.41* (0.27, 0.55)
Monthly Change	-0.028* (-0.036, -0.021)	0.022* (0.011, 0.032)	0.050* (0.039, 0.062)
Predicted Average Outcome Nov 2024	93.31* (92.71, 93.90)	97.03* (96.67, 97.38)	3.72* (2.98, 4.46)
N	7,598,315		

*Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population with a substance use disorder.*

Outpatient expenditures for beneficiaries with a SUD diagnosis were assessed overall and separately restricted to evaluation and management (E&M) visits. In May 2019 during the baseline period, an average of 59.51% of beneficiaries had any outpatient expenditures. Under baseline conditions, had pre-waiver trends continued, we would have estimated an average 47.31% of beneficiaries to have an outpatient expenditure at the end of the follow up period in November 2024. However, under the SUD waiver implementation we observed an average of 60.56% of beneficiaries having any outpatient expenditure. This is an estimated

difference of 13.25 percentage points higher probability of having an outpatient visit during the SUD waiver.

Figure 33: Trends in Proportion of beneficiaries with SUD who had an Outpatient encounter



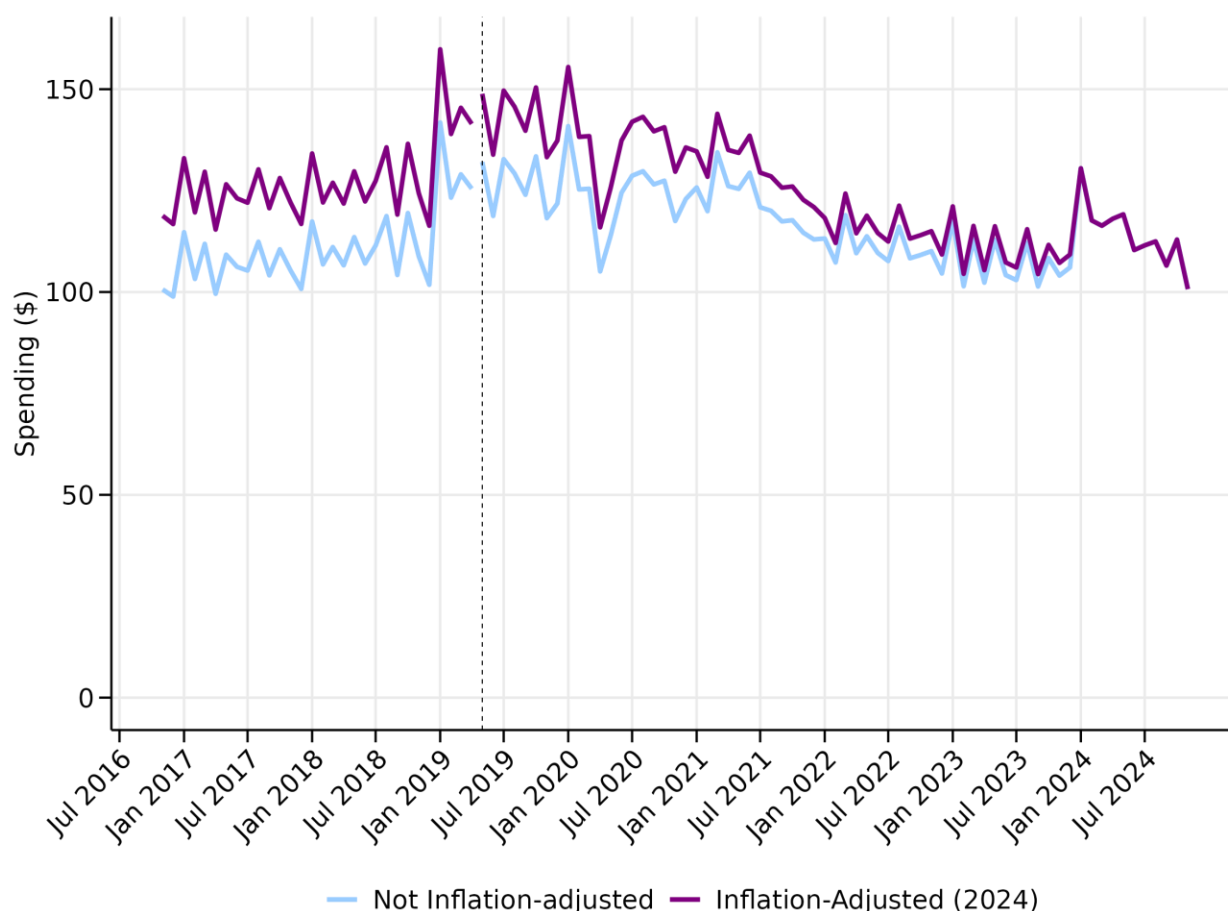
Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population with a substance use disorder.

Between 2017 and 2019, leading up to the implementation of the SUD waiver, outpatient PMPM expenditures were increasing steadily. This was followed by periods of changing trends in outpatient expenditures following the waiver implementation. PMPM outpatient expenditures remained relatively stable from July 2019 to January 2020, at which point they rose until Fall 2020. From Fall 2020 until July 2022, outpatient costs declined, followed by an increase until the end of the follow up period in November 2024.

Specifically for outpatient E&M expenditures, at baseline in May 2019 an estimated 47.64% of people had an outpatient E&M expenditure. At the end of the study period in November 2024,

this decreased to 41.90% with an outpatient E&M expenditure. The projected percentage of people with an outpatient E&M expenditure had the SUD waiver not occurred was 36.20% representing a difference of 5.70 points between the intervention and non-intervention conditions. At the beginning of the SUD waiver in 2019, outpatient E&M PMPM expenditures were approximately \$150. This spending steadily decreased until the end of the follow up period to approximately \$100 per-member-per month.

Figure 34: Trends in Per Member Per Month Medicaid Service Outpatient E&M Expenditures for beneficiaries with SUD

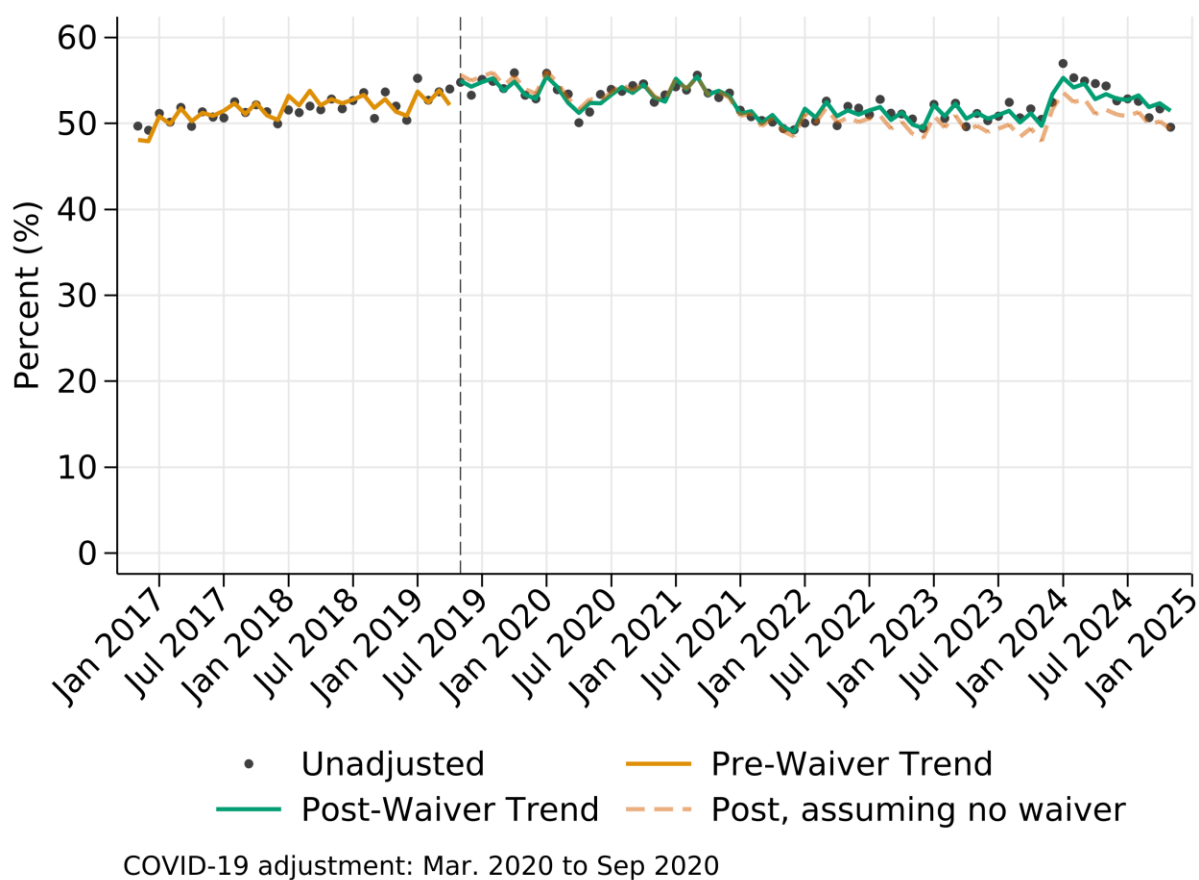


In the pre-SUD waiver period the percentage of beneficiaries with SUD who had an expenditure for behavioral health²⁶ services in the month increased from 2017 until the waiver implementation in 2019 where the percentage of beneficiaries with a behavioral health expenditure was 51.56%. Following the waiver implementation, the percentage of beneficiaries with behavioral health expenditures decreased until January 2024. In January 2024, there was a sharp increase in the percentage of beneficiaries with an expenditure followed by a marginal decrease until the end of the follow up period in November 2024,

²⁶ Behavioral health services refer to any service use where a mental health or substance use diagnosis was coded.

when the estimated percentage of beneficiaries with an expenditure was 49.80%. This is a greater percentage with an expenditure than was predicted had the SUD waiver not been implemented.

Figure 35: Trends in Proportion of beneficiaries with SUD who had Behavioral Health expenditures

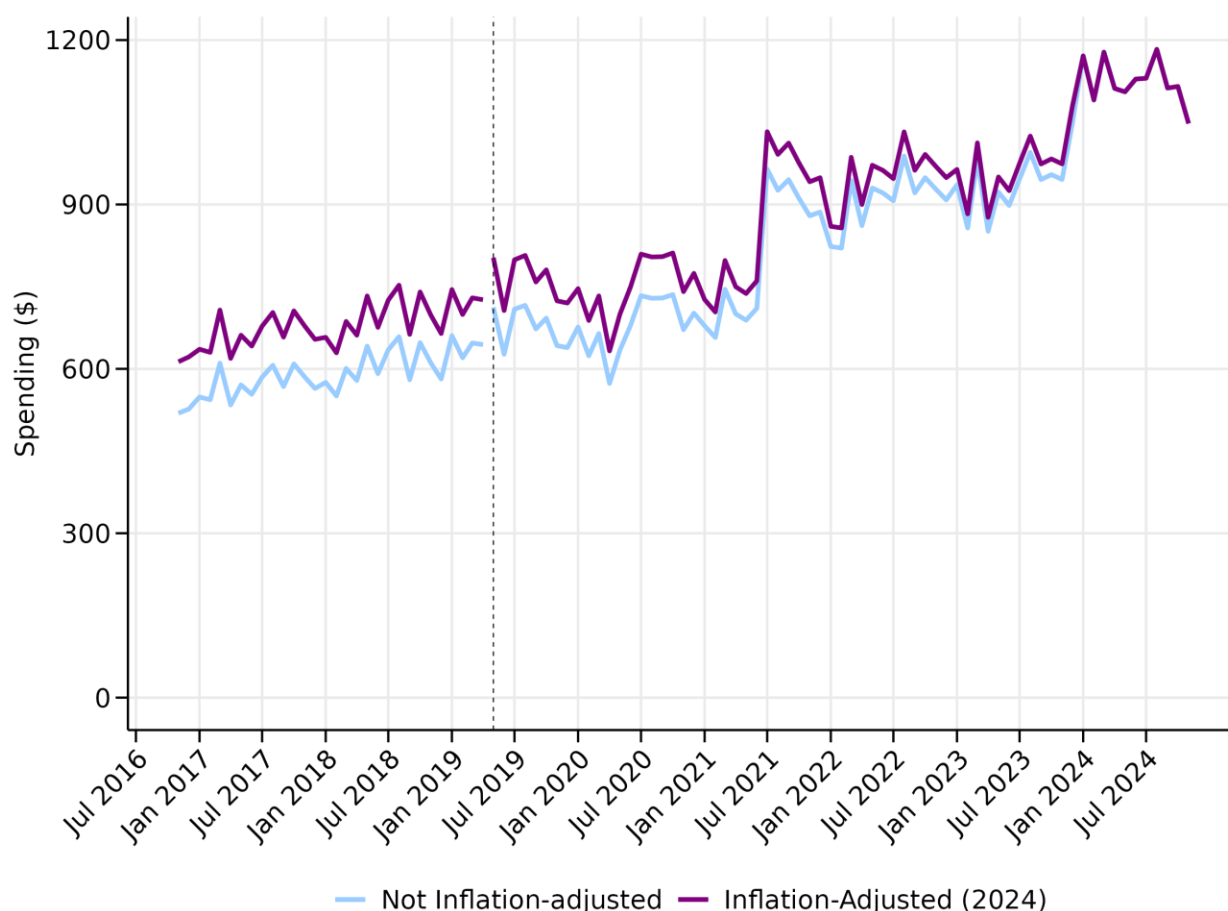


Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population with a substance use disorder.

Overall, we observe a steady increase in inflation-adjusted behavioral health spending PMPM leading up to and beyond the implementation of the SUD waiver. At the start of the baseline period in January 2016, behavioral health expenditures were approximately \$600 per member per month, rising to approximately \$700 per member per month at the time of the SUD waiver implementation in 2019. We observe a large increase in PMPM spending after the initiation of SPs on July 2021, then a flattening out until Medicaid expansion occurred in December 2023. By the end of the study period, spending on behavioral health services among those with a

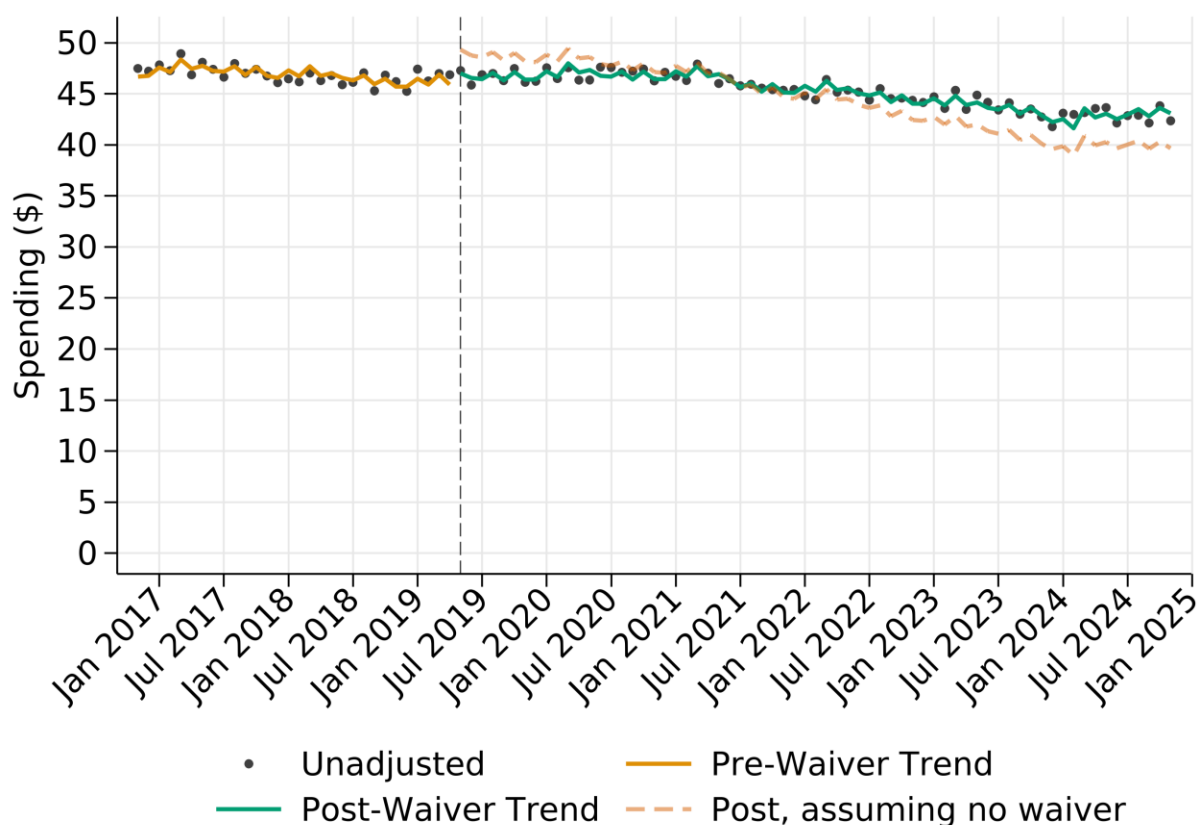
SUD diagnosis was just under \$1200 per member per month by the end of the follow up period in November 2024.

Figure 36: Trends in Per Member Per Month Medicaid Behavioral Health Expenditures for beneficiaries with SUD



In May 2019 during the baseline period, an estimated 46.33% of beneficiaries with SUD had any prescription expenditure. The percentage of beneficiaries with a prescription expenditure remained stable from May 2019 until approximately Spring 2021 where it began to decline. At the end of the follow up period in November 2024, an estimated 41.86% of beneficiaries had a prescription expenditure. These trends in the percentage of beneficiaries with an Rx expenditure mirror the trends in inflation-adjusted PMPM Rx spending, where we see a slight decline from January 2022 until the end of the follow up period in November 2024 to approximately \$300 per-member-per month.

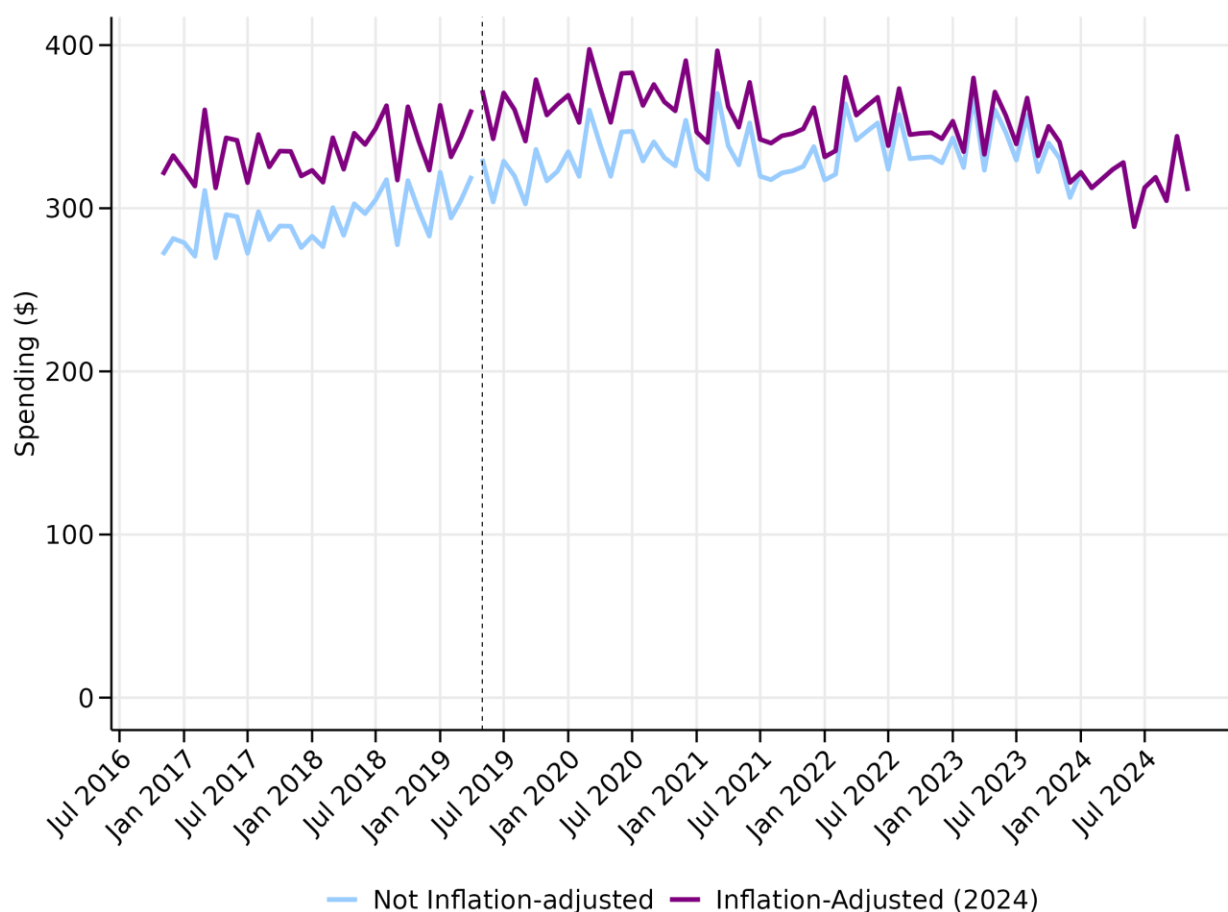
Figure 37: Trends in Proportion of beneficiaries with SUD who had a prescription



COVID-19 adjustment: Mar. 2020 to end of study period

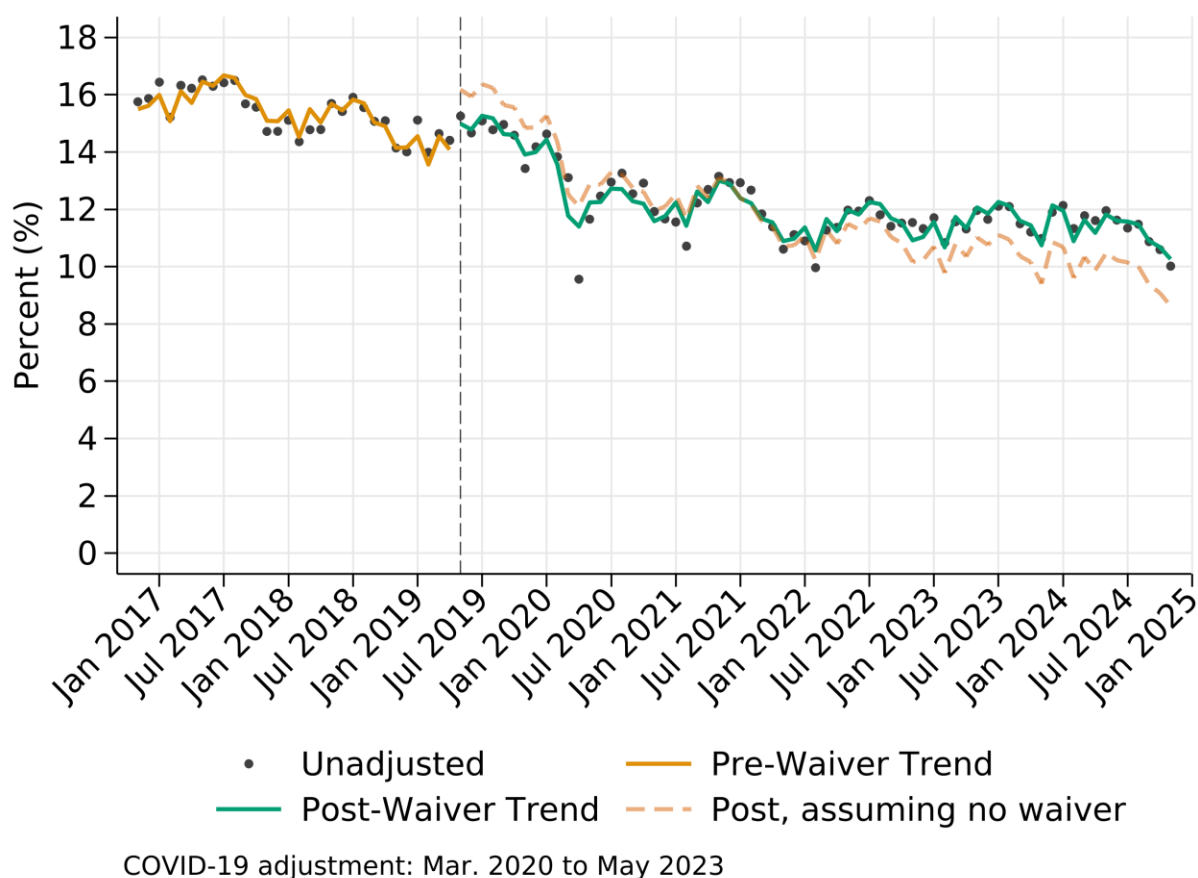
Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population with a substance use disorder.

Figure 38: Trends in Per Member Per Month Medicaid Service Pharmacy Expenditures for beneficiaries with SUD



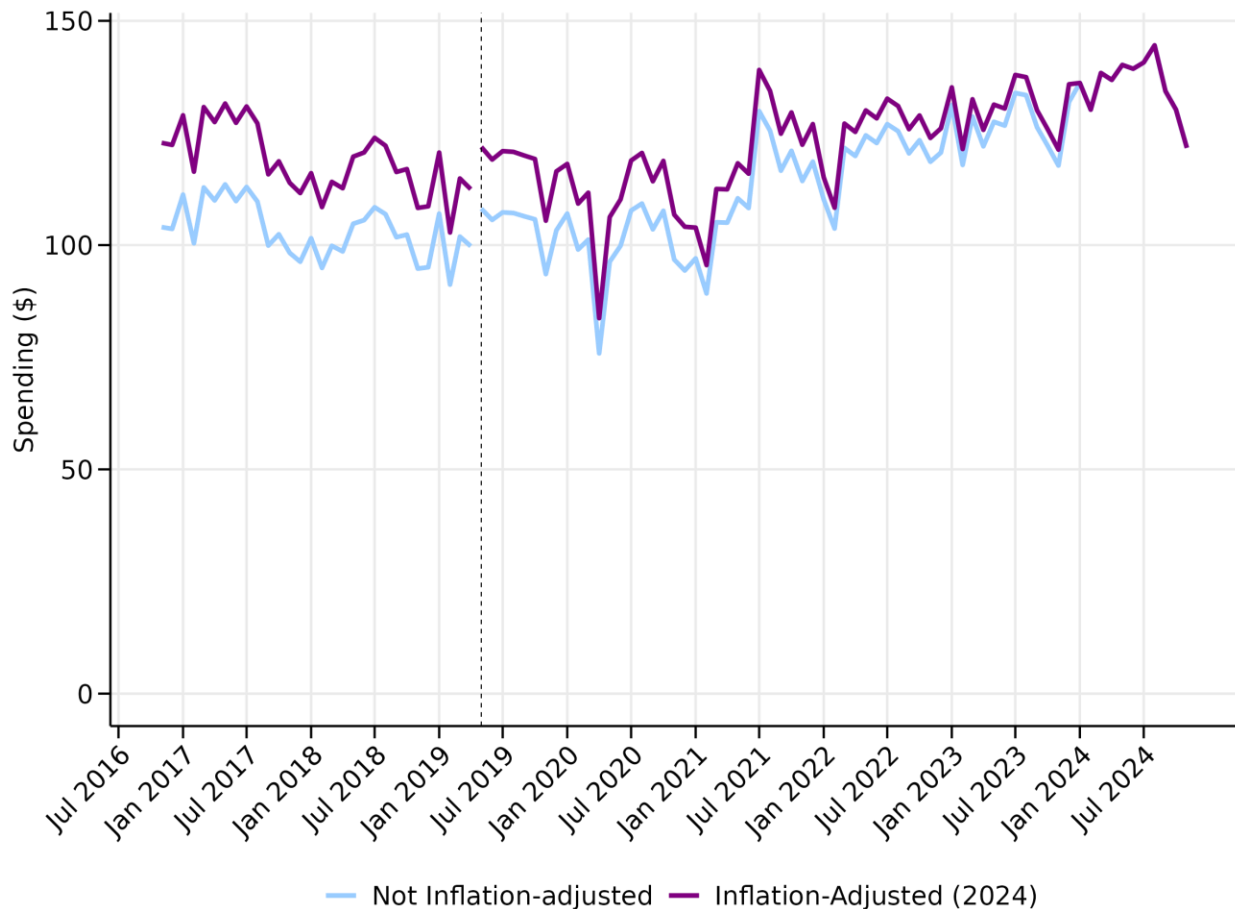
There were important differences in the percentage of beneficiaries who had emergency department related expenditures over the study period. During the baseline period in May 2019 prior to the SUD waiver implementation, an estimated 14.57% of beneficiaries with a SUD had any emergency department expenditure in a typical month. Following the implementation of the SUD waiver, the percentage with an Emergency Department expenditure was initially lower than what would have been expected in the absence of a SUD waiver, until sometime in 2021. From the fall of 2021 until the end of the study period, the percent of the population with ER spending increased over what would have been expected in the absence of the SUD waiver.

Figure 39: Trends in Proportion of beneficiaries with SUD who had an ER encounter



Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population with a substance use disorder.

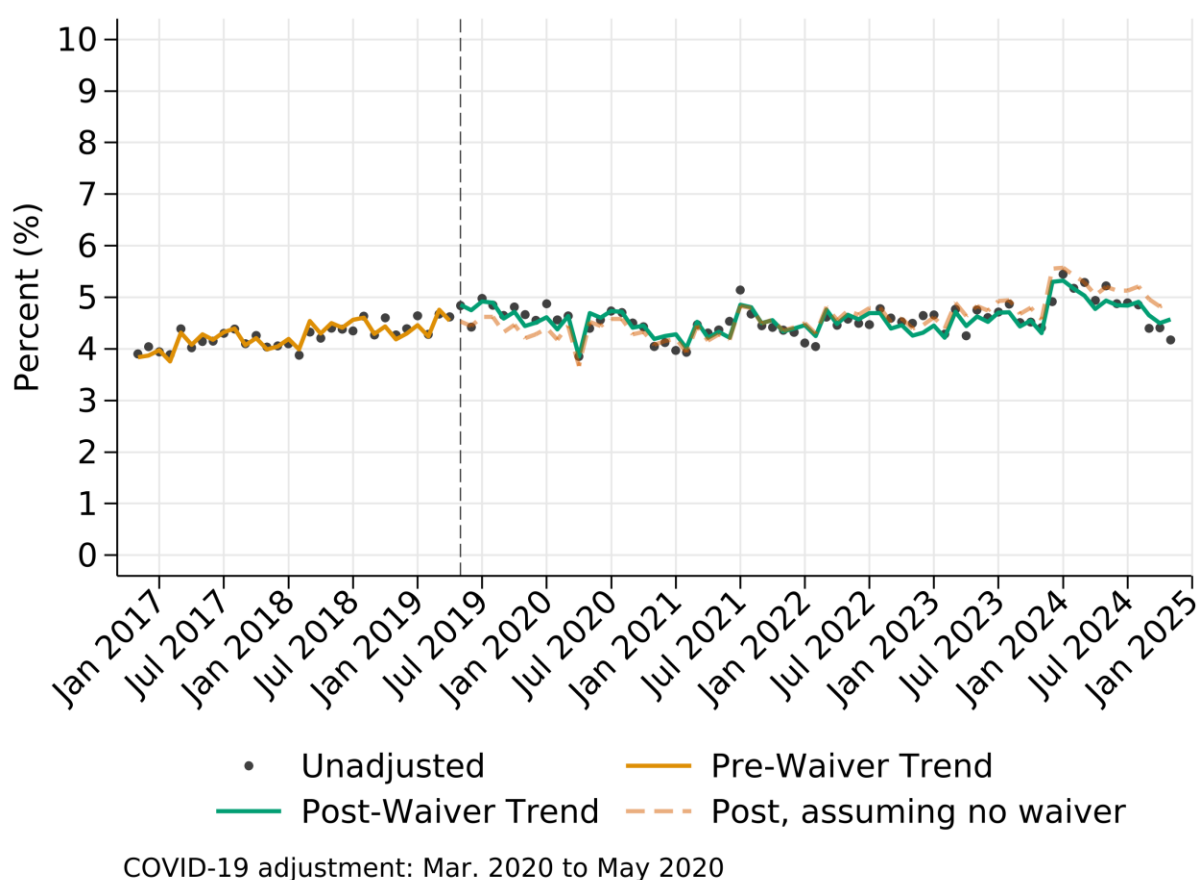
Figure 40: Trends in Per Member Per Month Medicaid Service ER Expenditures for beneficiaries with SUD



Averaging over all beneficiaries with a SUD diagnosis, inflation-adjusted PMPM ER expenditures appeared relatively level between January 2016 and January 2021, other than a sharp decrease during the start of COVID-19. From January 2021 onwards ER spending steadily rose from approximately \$100 PMPM to near \$150 PMPM near the end of the study period in 2024. However, the decline in PMPM ER spending at the end of 2024 brought this value back to the level noted at the start of the SUD waiver.

During the baseline period, an estimated 4.48% of beneficiaries with a SUD diagnosis had any inpatient expenditure in a typical month. This percentage remained stable from May 2019 until approximately January 2024 after Medicaid Expansion when the percentage increased followed by a subsequent decline. At the end of the follow up period in November 2024, an estimated 4.32% of beneficiaries had an inpatient expenditure. This is a slightly lower percentage with an inpatient expenditure than predicted had the SUD waiver not been implemented.

Figure 41: Trends in the proportion of beneficiaries with SUD who had expenditures for inpatient services



Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population with a substance use disorder.

Averaging over all beneficiaries with a SUD diagnosis in the baseline period from 2017 to 2019, inflation-adjusted per-member per month inpatient costs marginally increased. After the implementation of the SUD waiver the inflation adjusted PMPM expenditures leveled off from July 2019 to July 2020 at a cost of just under \$400 PMPM. In July 2020 there was a slight increase followed by another steep increase to approximately \$750 PMPM in July 2021 when Standard Plans were implemented; expenditures then remained relatively level at approximately \$700 PMPM until the end of the follow up period in November 2024.

A large portion of this is a result of the significant changes to the inpatient payment rate methodology that occurred simultaneously with the launch of SPs. The State provided this context: At Standard Plan launch the new hospital base rate methodology included cost

factors as cost settlements were eliminated, traditional hospital supplemental payments paid outside of the base rates were eliminated and are now included in the base rates to determine the DRG inpatient service base rates, and GME [Graduate Medical Education] is now paid outside of the IP claims payment process. Hospital rates are also indexed annually by the market basket inflationary percentage. In consideration of those factors rates for inpatient services base rates increased from the \$2,704.50 statewide average to individual hospital base rates ranging from \$8k up to \$14K.

Figure 42: Trends in Per Member Per Month Medicaid Service Inpatient Expenditures for beneficiaries with SUD



There was no significant difference between the pre- and post-SUD Waiver periods on the percentage of beneficiaries with acute care crisis-oriented expenditures. Prior to the SUD waiver implementation, an average of 0.68% of Medicaid beneficiaries with a SUD diagnosis had any acute care crisis-oriented expenditures. In November 2024, under the SUD waiver an average 0.66% of beneficiaries had an expenditure in this category.

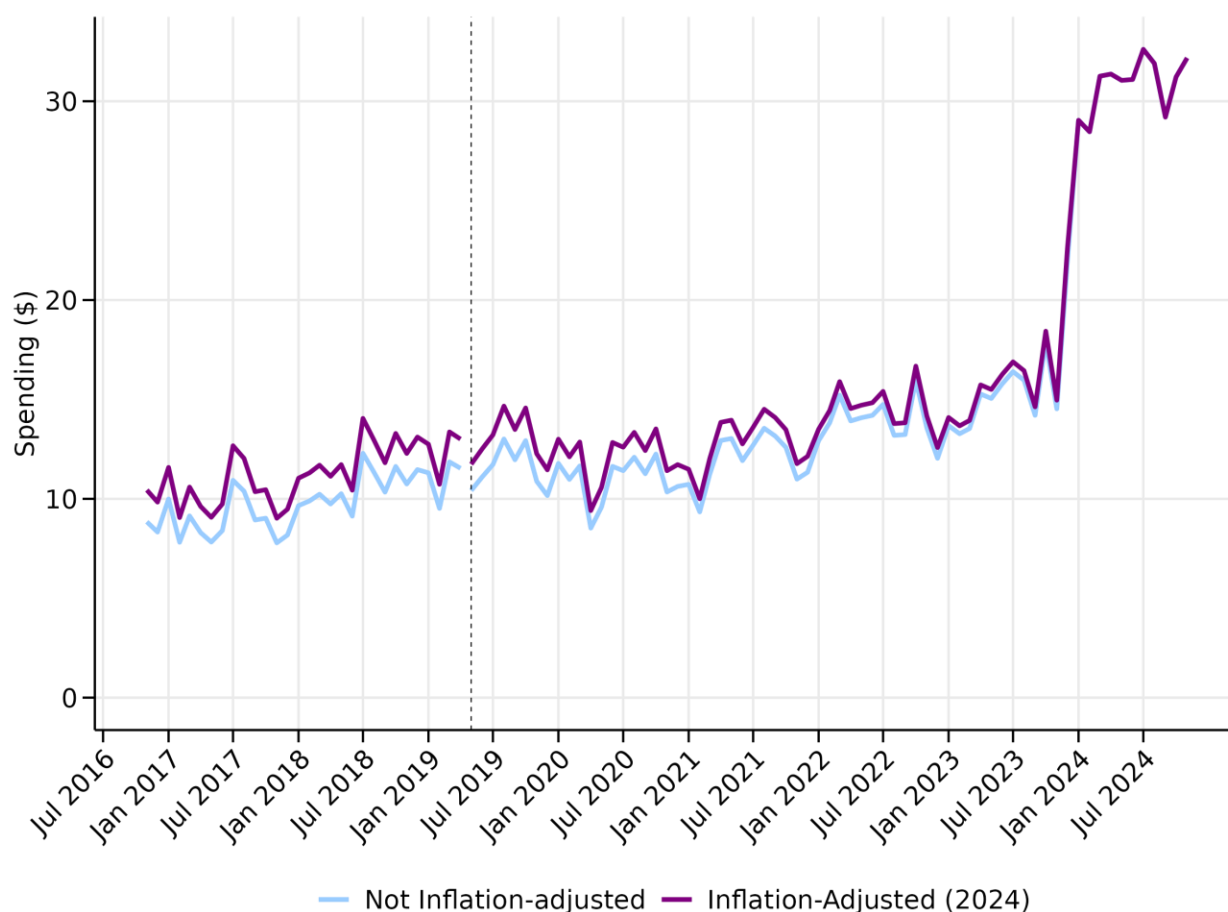
In the baseline period from 2017 to 2019, inflation-adjusted PMPM acute care crisis-oriented expenditures increased marginally. After the implementation of the SUD waiver, the inflation adjusted PMPM expenditures continued to steadily increase until December 2023 when Medicaid expansion was implemented, at which point acute care expenditures rose sharply from approximately \$15 PMPM to over \$30 PMPM. PMPM expenditures remained at that level until the end of the follow up period in November 2024.

Table 17: Interrupted time series estimates of Proportion of beneficiaries with SUD who had an Acute Care Crisis Oriented encounter

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	0.68* (0.58, 0.78)	0.65* (0.58, 0.73)	-0.028 (-0.11, 0.058)
Monthly Change	-0.0002 (-0.0045, 0.0041)	-0.0024 (-0.0064, 0.0016)	-0.0022 (-0.0073, 0.0030)
Predicted Average Outcome Nov 2024	0.83* (0.49, 1.17)	0.66* (0.52, 0.79)	-0.17 (-0.55, 0.20)
N	7,656,186		

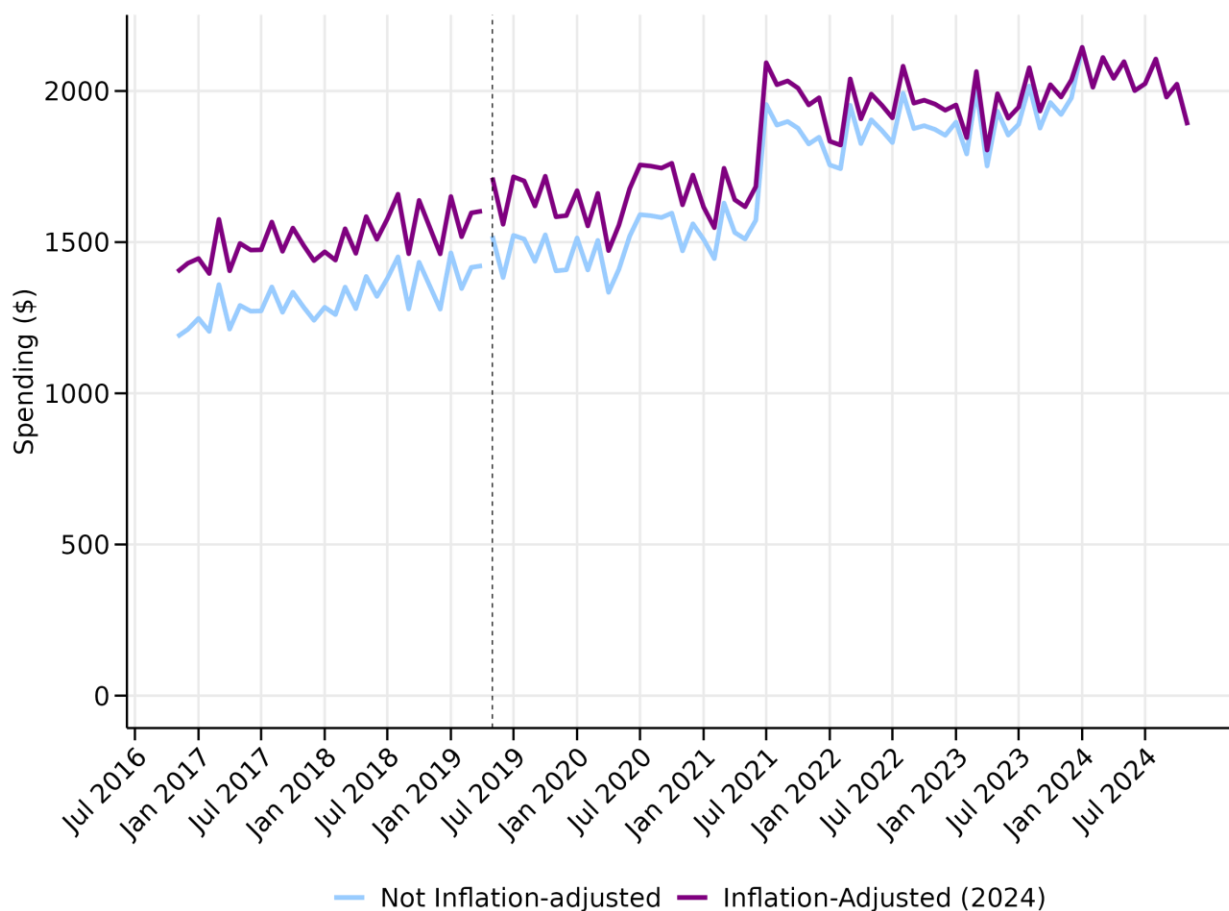
*Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population with a substance use disorder.*

Figure 43: Trends in Per Member Per Month Medicaid Service Acute Care Crisis Oriented Expenditures for beneficiaries with SUD



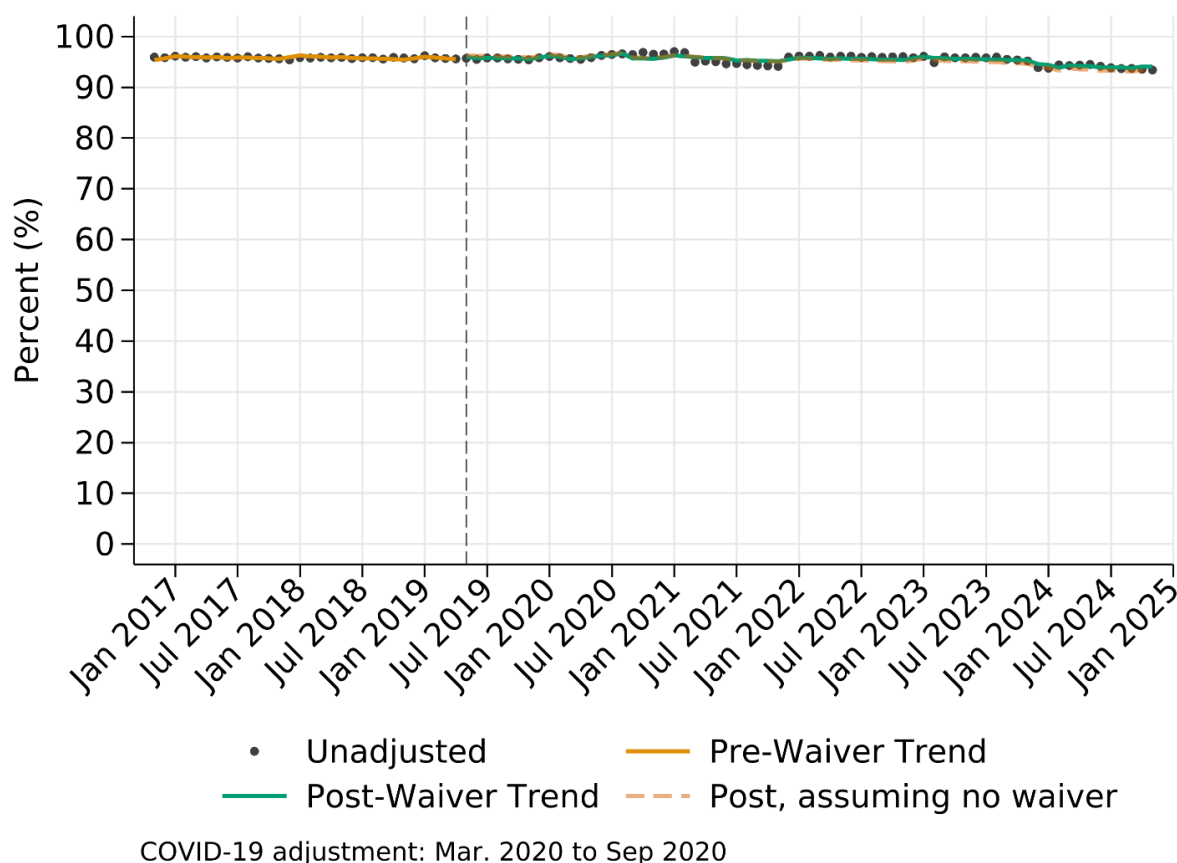
One hypothesis was that the expanded set of substance use services would lead to increased Medicaid expenditures for SUD services. Of course, it is possible that a more comprehensive set of services could also *decrease* expenditures due to addressing substance use disorder in a more cost-effective manner. The following figure charts average (i.e., per member per month) Medicaid expenditures for beneficiaries with diagnosed substance use disorder. There is no visible change in the trend at SUD Waiver implementation, and there may be a small decrease in trend. Average expenditure increases at the time of managed care implementation – largely due to the change in inpatient payment rate methodology discussed earlier. At the end of the study period, the average expenditure is comparable to the pre-SUD values trended forward, even accounting for the inpatient payment rate increase.

Figure 92: Trends in Per Member Per Month Medicaid Service Expenditures for beneficiaries with SUD



We examined whether there were changes in Medicaid spending on non-SUD services for people with a SUD diagnosis as a result of the implementation of the SUD waiver. We found a high rate of use of non-SUD services each month (Figure 117), averaging around 95% per month. This high level of use is due in part to the spending on capitated services, such as AMH payments, as noted for total spending above. Nonetheless, we find a small increase in the rate of non-SUD expenditures per month as a result of the SUD waiver over what we would have expected based on pre-period trends of about 0.44% points at implementation and a very small increase in the growth of non-SUD expenditures per month (0.04% points per month (Table 117). By the end of the first Demonstration period, this led to a 3.21% point higher probability of having any non-SUD expenditures in the month over what was expected based on baseline trends, controlling for changes in the Medicaid population over this time period.

Figure 117 Trends in Medicaid spending on non-SUD services for people with a SUD diagnosis



Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from the population of individuals with a substance use disorder in the NC Medicaid population.

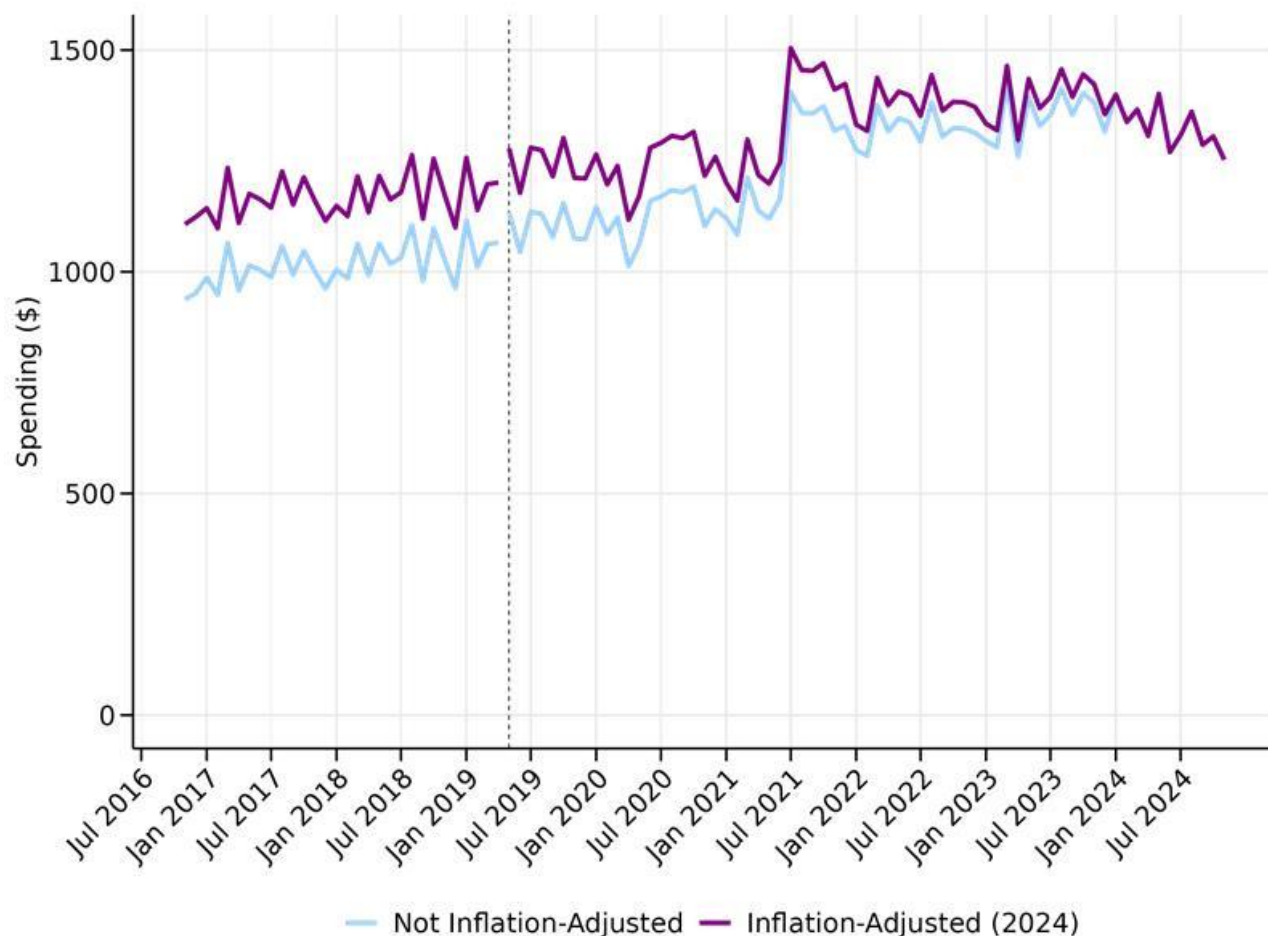
Table 117 Interrupted time series estimates of Proportion of beneficiaries with SUD who had a non-SUD service expenditure in the month

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	94.90* (94.66, 95.13)	95.34* (95.12, 95.55)	0.44* (0.29, 0.59)
Monthly Change	-0.032* (-0.041, -0.023)	0.0098 (-0.0017, 0.0212)	0.042* (0.029, 0.055)
Predicted Average Outcome Nov 2024	92.55* (91.88, 93.22)	95.76* (95.37, 96.14)	3.21* (2.40, 4.02)
N	7,656,186		

Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from the population of individuals with a substance use disorder in the NC Medicaid population.

In terms of PMPM spending on non-SUD services for people with a SUD diagnosis (Figure 118), we see a slight increase from the baseline period through the spring of 2021, ranging from approximately \$1100-\$1200 PMPM, then a substantial jump on July 2021 to just over \$1500 PMPM, likely due to the large increase in inpatient hospital payments. Since that time, expenditures on non-SUD services have been decreasing, ending at just over \$1250 PMPM.

Figure 118 Trends in Per Member Per Month Medicaid Service Expenditures on non-SUD services for people with a SUD diagnosis



Conclusions

In summary, implementation of the SUD waiver in North Carolina's Medicaid program was associated with a greater percentage of beneficiaries with a SUD diagnosis that have expenditures in six of nine categories, including outpatient and behavioral health services. The probability of having inpatient expenditures declined, while the percentage of beneficiaries with acute care crisis-oriented expenditures did not meaningfully change during the study period. Inflation-adjusted measures of PMPM spending increased for five expenditure categories, including total SUD spending, behavioral health, inpatient, and acute crisis care. PMPM spending on outpatient E&M care and prescription drug spending declined, and overall outpatient and ER PMPM spending remained constant.

Supplement 1: Comparative Interrupted Time Series (CITS)

Background and Purpose

The primary analytic method used for the NC Medicaid 1115 Evaluation, as was originally proposed to the Centers for Medicare & Medicaid Services (CMS), is an interrupted time series (ITS) design. The major reason for relying on ITS is the difficulty in identifying an appropriate control population: a population or state that could credibly account for national trends unrelated to the SUD Waiver implementation in North Carolina. Consistent with best practices published by CMS²⁷, we explored several potential control states and populations. Initially, we examined commercial claims within North Carolina and also considered Oklahoma’s Medicaid program as a potential control state, since OK initially modeled its Primary Care Case Management program after NC’s program. These approaches were ultimately unsuccessful: Oklahoma’s Medicaid program enacted some key policy changes during the study period that were coincident with the changes in NC’s program, and the within-North Carolina commercial control sample had too few children and, generally too small of a sample size to serve as a credible control. Other, nationally available datasets (e.g., via CMS and other federal systems) are substantially less timely than the Medicaid data available directly from states. As a result, these sources posed challenges in establishing an adequate study period aligned with the implementation timeline.

Late in the evaluation period, we began exploring the use of Arizona’s Medicaid program as a potential control state. Arizona experienced no major changes in Medicaid program design during the study period, and the co-lead of the external evaluator study team directs a research center with access to Arizona Medicaid data, offering an appealing strategy for identifying a control population. After reviewing data use agreements, we determined that the traditional analytic method – combining the data on one server and running a “classic” difference-in-difference – was less viable than an identified alternative strategy – a federated difference-in-differences-type approach.²⁸ Sheps Center analysts estimated models using North Carolina data on Sheps servers, in accordance with the data use agreement. Separately, Arizona-based study team members estimated analogous models using Arizona Medicaid claims. Parameters of interest were then pooled to generate comparative conclusions across the two states. Importantly, no data were transferred outside their authorized servers.

A subset of metrics was identified for Arizona to conduct their estimates. There are a number of reasons for using this smaller set of outcome variables, but the primary one is resources. The two states have different data designs, and so each metric had to be recoded using Arizona structure and values. This required considerable effort from data scientists at

²⁷ Bradley Katharine, Jessica Heeringa, R. Vincent Pohl, James D. Reschovsky, and Maggie Samra. Selecting the Best Comparison Group and Evaluation Design: A Guidance Document for State Section 1115 Demonstration Evaluations. October 2020.

²⁸ Sunny Karim, Matthew D. Webb, Nichole Austin, Erin Strumpf. Difference-in-Differences with Unpoolable Data. arXiv:2403.15910 [econ.EM]. <https://doi.org/10.48550/arXiv.2403.15910>

Arizona State University's Center for Health Information and Research (CHIR) to program the metrics, econometricians and statisticians to identify the proper statistical method to combine the results (the "UNDID" command in Stata)²⁹, and data scientists at both CHIR and Sheps to ensure fidelity to estimation procedures to ensure comparability.

The purpose of this chapter is not to replace or re-adjudicate the primary ITS findings, but rather to serve as a robustness analysis assessing whether conclusions drawn from the primary ITS approach appear qualitatively robust to the inclusion of an external comparison state for a small number of high-priority metrics. Given data and resource constraints, CITS analyses were conducted for a limited set of outcomes only, and results should be interpreted accordingly.

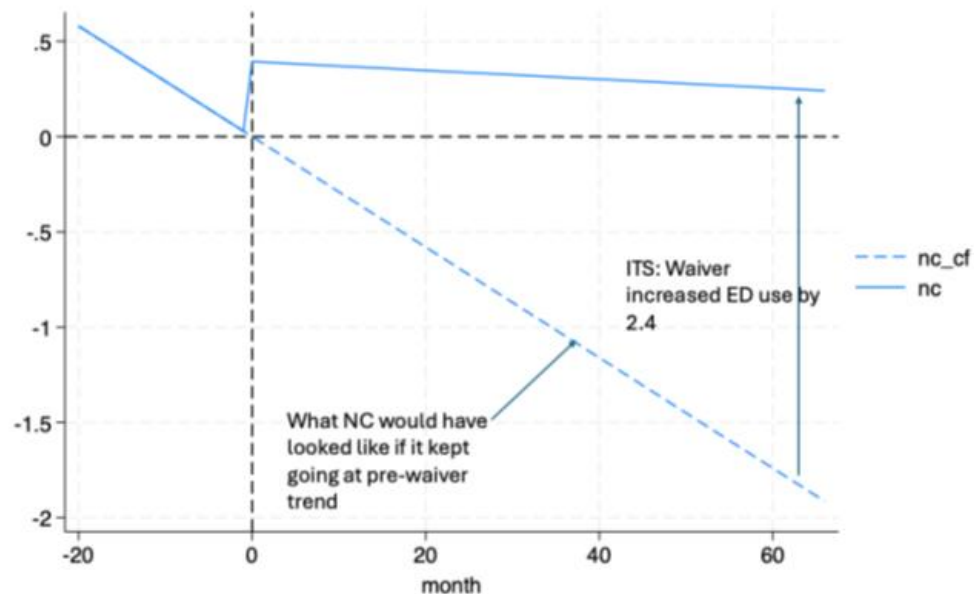
General Analytic Approach

ITS analysis uses trends within a single group -- here, Medicaid beneficiaries in North Carolina -- to estimate the treatment effect. Specifically, this method compares the pre-intervention trend to the post-intervention trend and interprets changes in level and slope as evidence of the intervention's impact.

Under ITS, the treatment effect is estimated by comparing observed post-intervention outcomes in North Carolina to predicted outcomes based on pre-intervention trends within North Carolina alone: **"How did the averages within North Carolina change after implementation, allowing a "jump" and trend shift?"** In Figure S1.1, the solid blue lines represent observed data from North Carolina pre-waiver (downward sloping line segment left of the vertical dotted line) and post-waiver (jump up and less steep downward line segment right of the vertical dotted line). The dotted blue line represents North Carolina's counterfactual trend if it continued along the pre-waiver trend. The gap between the observed outcome (solid line) and modeled counterfactual (dotted line) at the end of the analysis period represents the ITS estimate of the waiver's effect (e.g., an increase in ED use by 2.4).

²⁹ Eric Jamieson, 2025. "UNDID: Stata module to compute Difference-in-differences with unpoolable data," Statistical Software Components S459516, Boston College Department of Economics, revised 17 Feb 2026.

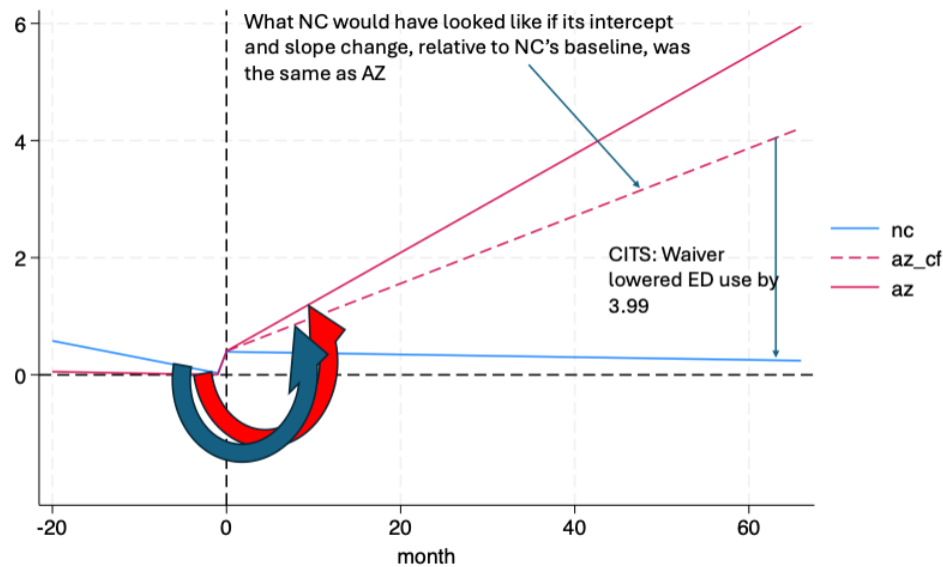
Figure S1.1. Example Interpretation of ITS



Under CITS, the treatment effect is derived from four trends: the 1) pre- and 2) post-intervention trends in the control state; 3) the pre-intervention trend in North Carolina; and 4) the observed post-intervention trend in North Carolina. Changes observed in Arizona are used to estimate what the post-intervention trend in North Carolina would have been in the absence of the SUD Waiver, which is then compared to the observed trend in North Carolina. Thus, this analysis asks **“How did the averages change at implementation, allowing a “jump” and trend shift, compared to another state that was not affected by SUD waiver and faced similar “national” trends (e.g. SUD epidemic)?”**

In Figure S1.2, the solid blue lines still represent observed North Carolina trends pre- and post-waiver. The solid red line represents observed Arizona trends. The dotted red line represents the key counterfactual – what trends in North Carolina would have been had North Carolina experienced the same intercept and slope change as Arizona experienced. The gap between the observed outcome (solid blue line) and modeled counterfactual (dotted red line) at the end of the analysis period represents the CITS estimate of the waiver’s effect (e.g., an decrease in ED use by 3.99).

Figure S1.2. Example Interpretation of CITS



Results Overview

We analyzed seven metrics under both ITS and CITS approaches: SUD diagnosis (for two age groups: ages 12-17 and 18+), any SUD treatment, emergency department use, inpatient admissions, hospital readmissions within 30 days for people with a SUD diagnosis, and follow-up care after an emergency department admission with a SUD diagnosis. These were selected because of their importance and relatively straightforward coding for the Arizona data. These were the only seven SUD metrics coded for Arizona. The following table summarizes the findings. Green shading denotes results consistent with improvement, while red shading denotes results inconsistent with improvement. No shading denotes no (statistically significant) change identified at the end of the study period.

Table S1.1: Key findings from SUD metrics for NC Medicaid from SUD waiver component implementation by the end of the first demonstration period

Metric	CITS Takeaway (NC vs. AZ)	ITS Takeaway (NC post vs. pre)
M3: SUD Diagnoses (12-17) rate	Increase 2.39* (2.18,2.60)	No Change 0.0035 (-0.18, 0.19)
M3 SUD Diagnoses (18+) rate	Increase 5.09* (4.43,5.75)	No Change -0.37 (-1.02, 0.29)
M6 Any SUD Treatment rate in diagnosed population (M3=1)	No Change 1.49 (-3.80,6.78)	Increase 13.15* (7.99, 18.31)
M17 7 Day Follow Up Visit for SUD ED Visit	Increase 5.42* (0.04,10.81)	Decrease -8.73* (-14.02, -3.44)
M17 30 Day Follow Up Visit for SUD ED Visit	No Change 0.63 (-5.56,6.82)	Decrease -12.14* (-18.23, -6.04)
M23: ED use for Beneficiaries with SUD	Decrease -9.97* (-10.83,-9.10)	Increase 2.14* (1.31, 2.96)
M24: IP use for Beneficiaries with SUD	Decrease -2.60* (-3.09,-2.10)	Decrease -0.42* (-0.83, -0.013)
M25 Readmissions Among Beneficiaries with SUD	Decrease -8.40* (-12.56,-4.24)	No Change -0.60 (-4.64, 3.45)

Results from the CITS analyses require a different interpretation, since the comparison group is different. For example, the ITS models indicate that by the end of the first demonstration period, there was no difference in the percent of adolescents or adults beneficiaries that were diagnosed with a SUD compared to what we would have projected without the implementation of a SUD waiver. However, comparing to trends in Arizona Medicaid beneficiaries, we would conclude that compared to trends in Arizona, we see a relative increase in SUD diagnoses in both age groups (indicating that there was a decline in the SUD diagnostic rate in AZ over this time period).

Other results point to increase in the treatment rate for people with SUD in NC being positive compared to the pre-implementation period, but similar to the increasing rate in AZ. The 7-day follow-up rate decreased in NC, but was still greater than the decrease in AZ, leading to a relative increase. The decrease in follow ups with in 30 days from an ED visit for someone with a SUD diagnosis in NC is consistent with the decline observed in AZ. ED visits among people with a SUD diagnosis increased in NC over the Demonstration period, but this was a comparative decline compared to AZ. Finally, IP admissions and readmissions among beneficiaries with SUD also declined compared to AZ rates during the same study period.

Importantly, these findings should not be interpreted as evidence that CITS would yield systematically more favorable results if applied to the full set of evaluation metrics. The outcomes examined here represent a limited, non-representative subset selected based on policy relevance and analytic feasibility, and no inference can be drawn regarding how other measures would perform under a similar analytic approach. Moreover, the validity of the CITS estimates depends on assumptions regarding the absence of unobserved, state-specific policy or programmatic changes in the comparison state during the study period.

Taken together, this alternative analysis suggests that, for certain high-level utilization and diagnostic measures, conclusions drawn from the primary ITS analyses may differ when broader national trends are explicitly accounted for using an external comparison state. However, given the limited scope of the CITS analyses and the methodological constraints described above, ITS remains the primary and CMS-approved analytic method for this evaluation, and overall evaluation conclusions are based on the full set of ITS results presented elsewhere in this report.

Chapter 7. Conclusions, Recommendations, Policy Implications, and Lessons Learned

The SUD waiver may be the most challenging component of the 1115 waiver to evaluate because it is not a discrete event, like managed care launch, but comprised of multitudes of policy changes and approvals, including some that had delayed implementation – meaning there may have been some anticipatory response prior to the actual implementation. Many of the clinical coverage policies in behavioral health had some revisions during the SUD implementation period. Other SUD policy changes expanded the types of providers who can bill for services and aligned many SUD services with the American Society of Addiction Medicine (ASAM)'s Levels of Care.

There are a number of bright spots in this report.

One of the most visible successes of the waiver was the overall increase in the rate of treatment for people with SUD diagnoses. Improvement in this metric began in early 2022, with a notable increase observed at the end of the analysis period. We also observed an increase in the use of non-medication opioid treatment services. In addition, we find compelling evidence of an increased supply of providers available to Medicaid beneficiaries with SUD diagnoses. The number of total providers and providers who provide behavioral health, treat SUD patients, and offer MOUD have all increased. In the case of behavioral health providers, this reversed a negative trend observed in the SUD Interim Evaluation Report. Even use of non-SUD services among those with SUD also increased; preventable/ambulatory health services increased.

When examining the patterns of expenditures for NC Medicaid beneficiaries with SUD diagnoses, there is evidence of a **transition to lower cost settings** – the proportion of beneficiaries who used either inpatient care or Institutions for Mental Disease fell, and the proportion using outpatient, behavioral health providers and all types of prescription medications increased. The proportion seeking care in the emergency room also increased – the exception to the overall trend toward lower cost settings. Because overall treatment increased, total expenditures among those with SUD increased. The major takeaway, however, is that **beneficiaries with SUD are getting more care generally in lower intensity settings**. The pattern in PMPM expenditures for inpatient services in particular is notable and is largely due to the changes in payment rate methodology.

In a few cases, the regression-based conclusions differ from those based on inspection of simple trends – i.e. comparing the rate in May 2019 to Nov 2024. One example is the monthly rate of MOUD receipt among people with an OUD diagnosis. The observed rate in Nov 2024 is a couple of percentage points higher than the observed rate in May 2019, and so it is natural to say that the rate went up during the waiver. However, all our conclusions are based on comparisons to how the rate *would have changed in the absence of the waiver*, and we predict that the observed rate is no different than it would have been. Another example is most of the initiation and engagement (IET) metrics, where a sustained increase during the pre-waiver period suggests a sustained improvement would have continued. Thus, although,

generally, the observed IET values decreased for a few months and then began increasing near the end of the post-waiver period, showing generally little change during the post-waiver period, the pre-waiver trend suggests a remarkably higher rate would have occurred in the absence of the waiver. Indeed, these estimated “counter-factual” values are much higher than that observed among, for example, for cannabis users in seven major health systems.³⁰

As a specific example, the calculated rate for November 2024 for North Carolina was 37.03 — considerably lower than both the national average in 2023 (42.6) and the baseline rate (44.35).³¹ But the counterfactual projection of 58.28 is much higher than the national rate, which suggests that the trend observed pre-waiver is unlikely to have continued. In other words, consistent with CMS evaluation design principles, we are always comparing the observed rates to the best estimate of the counterfactual – and sometimes this may mean that an observed improvement was consistent with the pre-waiver trend, and sometimes this should be interpreted in the context of a counterfactual that is based on a trend that may not have occurred in the absence of the waiver.

Although not technically part of the SUD waiver, there is considerable evidence that **Medicaid expansion disproportionately benefitted those with SUD diagnoses**. The proportion of beneficiaries with SUD began increasing considerably in December 2023 (the first month of expansion) at the same time we see a notable increase in Trends in Any SUD Treatment. This is a strong indicator that the expansion population were likely to have SUD – and were highly likely to receive treatment.

However, we have also identified challenges to access to many essential services for people with substance use disorders, even after the implementation of the SUD waiver. Many of the SUD metrics required by CMS for SUD 1115 waivers remained flat or worsened rather than improved during the waiver implementation. The percent of beneficiaries with a diagnosed SUD condition remained flat during the waiver period (other than an increase during expansion), and the percent of beneficiaries with a SUD diagnosis who have accessed any type of SUD service, inpatient or outpatient, rose to just about 40%, but still indicates that in any given month, almost 60% of people with SUD did not access any type of treatment service. Two notable families of metrics – initiation and engagement with treatment and follow up after hospitalization – decreased, although the counterfactual for the IET metrics in particular are notably, probably unreasonably, high.

Our definition of progress was that metrics had to improve relative to counterfactual trends in the absence of SUD implementation. The ITS approach we used compares trends during the entire baseline (pre-SUD implementation) period to trends after implementation, controlling

³⁰ Lapham GT, Campbell CI, Yarborough BJH, Hechter RC, Ahmedani BK, Haller IV, Kline-Simon AH, Satre DD, Loree AM, Weisner C, Binswanger IA. The prevalence of Healthcare Effectiveness Data and Information Set (HEDIS) initiation and engagement in treatment among patients with cannabis use disorders in 7 US health systems. *Subst Abuse*. 2019;40(3):268-277. doi: 10.1080/08897077.2018.1544964. Epub 2019 Jan 18. PMID: 30657438; PMCID: PMC6639163.)

³¹ <https://www.ncqa.org/report-cards/health-plans/state-of-health-care-quality-report/initiation-and-engagement-of-substance-use-disorder-treatment-iet/>

for many observable characteristics, such as burden of chronic disease in beneficiaries, demographic factors, seasonal trends, the COVID PHE, Medicaid expansion, Standard and Tailored Plan implementation, and other characteristics and events. Even if a metric is improving, if its improvement is at a slower rate than before the beginning of the SUD waiver, we note this as a deficiency, since the waiver was designed to escalate improvements in care for people with SUD. As can be seen below ([Table 18](#)), only a minority of metrics demonstrate progress by this standard. Those were the percent of Medicaid beneficiaries with SUD diagnosis seeking services; the number of total providers who provide behavioral health services, treat SUD patients, and offer MOUD; and access to ambulatory and preventative services.

Context is important for all of these metrics, of course. While these declines appear modest in some measures, they raise important concerns about treatment accessibility and system capacity. The counterfactual analysis suggests some trends may have occurred regardless of waiver implementation, though the COVID-19 pandemic significantly disrupted healthcare utilization patterns during this period and likely contributed to reduced treatment engagement. These findings underscore the ongoing challenge of ensuring that SUD diagnoses translate into timely, appropriate treatment engagement, regardless of coverage expansion efforts.

The Concurrent Use of Opioids and Benzodiazepines continued its decline but at a slower rate after SUD waiver implementation. Rapid system expansion and ongoing public health emergencies may have created challenges in maintaining the intensive medication management and safety monitoring that had previously driven improvements in healthcare. While progress toward safer prescribing practices continued, the substantial reduction in the pace of improvement may reflect competing priorities or capacity constraints during the implementation phase. Likewise, there may be “floor effects” at issue here – the rate fell from 25% to 15% pre-implementation, a 40 percent relative decline; post-implementation, it fell roughly 30 percent on a relative basis, and it may be harder to have the same absolute decline as the rate gets smaller.

While the small (<1%) observed increased use of MOUD among those with an OUD diagnosis at waiver implementation is a net positive, our data show a steady decrease in trends for continuity of pharmacotherapy for OUD, indicating that beneficiaries who are newly treated with MOUD are not being retained in treatment. Without continuous use, the effects of MOUD are severely limited. For context, the literature shows reduced risk ratios for negative health outcomes only after 60 days of continuous use of MOUD (the national continuity measure examined here uses a 180-day benchmark). Nevertheless, increasing use of MOUD indicates expanded access to/utilization of a higher standard of care, which is an important first step.

The recent decline in deaths from overdose has received a lot of attention, and justifiably so – we observe a decline in deaths from overdose in the Medicaid beneficiary population since 2022. For context, the post-waiver period saw a period of considerable increase in the overdose rate during the global pandemic, with rates remaining above the 2019 pre-waiver, pre-pandemic values. Because death rate is an annual metric, we do not apply the ITS analyses we apply to monthly data. Thus, we make no formal conclusion about changes in

mortality rates, but this does not dismiss the progress over the last three years – it is just that the decline is outside our billet.

North Carolina providers, beneficiaries, policymakers, and agency staff, like all states, had to make a number of daily pivots, adjustments, and refinements to substance use disorder care-seeking and treatment design during the COVID-19 PHE. The SUD components of the waiver were only beginning to gain traction as the PHE started. Our task was to evaluate the effect of the SUD waiver as a whole, *relative to it not being implemented*. The findings in this report do not in any way detract from the dedication of the thousands of dedicated public health professionals that accomplished daily miracles during this time. Likewise, the co-occurrence of the global pandemic and the multiple implementation periods, among other factors mentioned throughout this report, complicate the analyses considerably. This is not a “textbook” case of a program evaluation, where a program begins on a date certain and there are no additional confounding events.

Table 18: Summary of SUD Metric Results

Measure (Metric abbreviation)	State's demonstration target	Adjusted waiver effects at SUD IER (Sep 2022)	Adjusted waiver effects at SUD SER (Nov 2024)	Progress (Yes/No)	Methods
Hypothesis 3.1: Expanding coverage of SUD services will result in improved care quality and outcomes for patients with SUD					
Medicaid Beneficiaries with SUD Diagnosis, monthly (M3)	Increase then decrease	Increase	No change	No	ITS
Any SUD treatment (M6)	Increase	Decrease	Increase	Yes	ITS
Outpatient Services for SUD (M8)	Increase	Decrease	No change	No	ITS
Access to Preventive/Ambulatory Health Services for Adult Medicaid Beneficiaries with SUD (M32)	Increase	Increase	No change	Yes	ITS
Access to Additional Services Using Provider Resource Directory - Connecting Primary Care to SUD Service Offerings (Q2)	Increase	--	No change	No	ITS
Intensive Outpatient and Partial Hospitalization Services (M9)	Increase	Decrease	Decrease	No	ITS
Withdrawal Management (M11)	Increase	Decrease	No change	No	ITS
Residential and Inpatient Services (M10)	Increase	Decrease	No change	No	ITS
Emergency Department Utilization for SUD (M23)	Decrease	Increase	Increase	No	ITS
Inpatient Stays for SUD (M24)	Decrease	No change	Decrease	Yes	ITS

Readmissions Among Beneficiaries with SUD (M25)	Decrease	No change	No change	No	ITS
Follow-Up After Emergency Department Visit for Alcohol and Other Drug Abuse or Dependence (M17.1)	Increase	30-day: Decrease	30-day: Decrease	No	ITS
Initiation and Engagement of Alcohol Abuse or Dependence Treatment (IET/M15)	Increase	Initiation: Decrease Engagement : Decrease	Initiation: Decrease Engagement: Decrease	No	ITS
Overdose Deaths (M26)	Decrease	--	Increase	No	Unadjusted Trends
OUD Overdose Deaths (M27)	Decrease	--	Increase	No	Unadjusted Trends
Death Rate from Overdose Post-prison Release	Decrease	--	Increase until 2022, then decrease	Yes since 2022	Unadjusted Trends
SUD Provider availability (M13)	Increase	Increase	Increase	Yes	Unadjusted Trends
SUD Provider availability for MAT (M14)	Increase	Increase	Increase	Yes	Unadjusted Trends
Hypothesis 3.2: Expanding coverage of SUD services will increase the use of MAT and other appropriate opioid treatment services and decrease the long-term use of prescription opioids					
Medication-Assisted Treatment (M12)	Increase	Decrease	No change	No	ITS
Medication-Assisted Treatment for Beneficiaries with OUD (M12_oud)	Increase	Decrease	No change	No	ITS
Use of Pharmacotherapy for Opioid Use Disorder (OUD) by Medication Type					
Buprenorphine	Increase	Increase	Increase	Yes	Unadjusted Trends
Methadone	Increase	Increase	Increase	Yes	Unadjusted Trends
Injectable Naltrexone	Increase	No change	No change	No	Unadjusted Trends
Oral Naltrexone	Increase	No change	No change	No	Unadjusted Trends

Continuation of Pharmacotherapy for Opioid Use Disorder (M22)	Increase	Increase	Decrease	No	Adjusted Trends
<i>Percent of individuals initiating MAT who receive psychosocial services within the first 12 months (Q3)</i>	Increase	Decrease	Decrease	No	ITS
Percent of Enrollees Diagnosed with OUD Receiving Non-medication Opioid Treatment Services	--	--	Increase	Yes	ITS
Use of Opioids at High Dosage in Persons without Cancer (M18)	Decrease	Increase	Increase	No	Unadjusted Trends
Use of Opioids from Multiple Providers in Persons Without Cancer (M19)	Decrease	Decrease	Decrease	Yes	Adjusted Trends
Use of Opioids at High Dosage and from Multiple Providers in Persons Without Cancer (M20)	Decrease	Decrease	Decrease	Yes	Adjusted Trends
Concurrent Use of Opioids and Benzodiazepines (M21/COB)	Decrease	Decrease	Decrease	Yes	Adjusted Trends
Hypothesis 3.3: Expanding coverage of SUD services will result in no changes in total Medicaid and out-of-pocket costs for people with SUD diagnoses; increases in Medicaid costs on SUD IMD services; increases in SUD pharmacy, outpatient, and rehabilitative costs; and decreases in acute care crisis-oriented, inpatient, ED, long-term care and other SUD costs					
Percent of beneficiaries with any SUD treatment expenditure in month	--	--	Increase	--	ITS
Total spending on SUD treatments PMPM (M28)	Increase	Increase	Increase	No	Inflation-adjusted Trends
Percent of beneficiaries with a SUD diagnosis with any Medicaid expenditures	--	--	Increase	--	ITS

Total Medicaid spending for people with a SUD diagnosis	--	--	Increase	--	ITS
Percent of beneficiaries with any outpatient expenditure in month	--	--	Increase	--	ITS
Outpatient Expenditures PMPM	--	--	No change	--	Inflation-adjusted Trends
Percent of beneficiaries with any outpatient E&M expenditure in month	--	--	Increase	--	ITS
Outpatient E&M Expenditures PMPM	--	--	Decrease	--	Inflation-adjusted Trends
Percent of beneficiaries with BH expenditures in month	Increase	--	Increase	Yes	ITS
Behavioral health expenditures PMPM	Increase	--	Increase	Yes	Inflation-adjusted Trends
Percent of beneficiaries with pharmacy expenditures in month	--	--	Increase	--	ITS
Pharmacy expenditures PMPM	--	--	Decrease	--	Inflation-adjusted Trends
Percent of beneficiaries with any emergency room expenditure in month	Decrease	--	Increase	No	ITS
Emergency room Expenditures PMPM	Decrease	--	No change	No	Inflation-adjusted Trends
Percent of beneficiaries with any inpatient expenditures in month	--	--	Decrease	--	ITS
Inpatient expenditures PMPM	--	--	Increase	--	Inflation-adjusted Trends
Percent of beneficiaries with any acute crisis expenditure in month	--	--	No change	--	ITS

Acute crisis service expenditures PMPM	--	--	Increase	--	Inflation-adjusted Trends
Percent of beneficiaries with a Medicaid-funded IMD expenditure in the month	Increase	--	Decrease	No	ITS
IMD expenditures PMPM	--	--	Increase		Inflation-adjusted Trends
Percent of beneficiaries with any non-SUD expenditure in the month	--	--	Increase	--	ITS
Non-SUD expenditures PMPM	--	--	Increase	--	Inflation-adjusted trends

We offer some new suggestions and reinforce others made previously in the SUD IER.

1. ***Allow competition for Tailored Plans***

The delayed implementation of the Tailored Plans was a big setback of the SUD waiver implementation. By re-integrating medical and behavioral care back into a single capitated health plan, the state has the opportunity to improve behavioral health and medical care for a population that has considerable unmet needs. However, the design of Tailored Plans contrasts dramatically with Standard Plans in that TPs are set up to be regional monopolies. Allowing managed competition across health plans for TP eligible beneficiaries could potentially improve outcomes for beneficiaries for both medical and behavioral health, as has been shown in some research studies. We will more fully examine the impact of TPs and SPs in the Managed Care Summative Report.

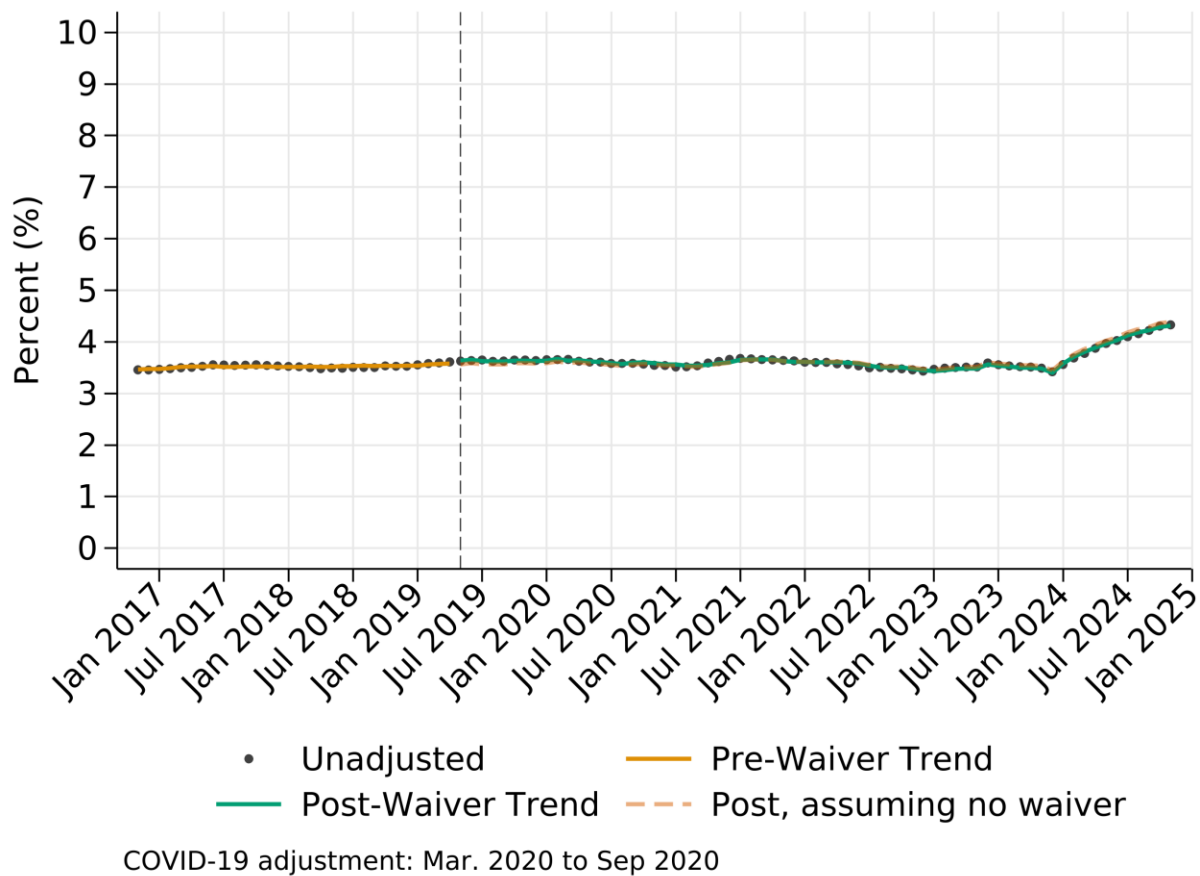
2. ***Use the metrics to mount an adaptive response:*** We reiterate the importance of careful monitoring of these metrics and assigning accountability for improvements. Many of the behavioral health metrics demonstrated here are in one of the dashboards that the Sheps Center provides to DHHS and are updated quarterly. Identifying the metrics most in need of improvement, in the places and populations most in need of improvement, can help prioritize spending and service expansions.

3. ***Identify opportunities to engage beneficiaries in treatment at critical moments:*** Follow up after hospital and emergency department use remain low, despite tremendous advances in infrastructure through EHRs and other platforms. Initiation in treatment after a diagnosis and engagement in treatment after initiation are on the decline for all four types of substance use disorders examined here. Incentivizing providers to achieve improvements in care at these critical moments could help move the needle on many of these metrics.

Appendix: Complete List of Measures

Medicaid Beneficiaries with SUD Diagnosis (monthly)

Figure 9: Trends in Medicaid Beneficiaries with SUD Diagnosis (monthly)



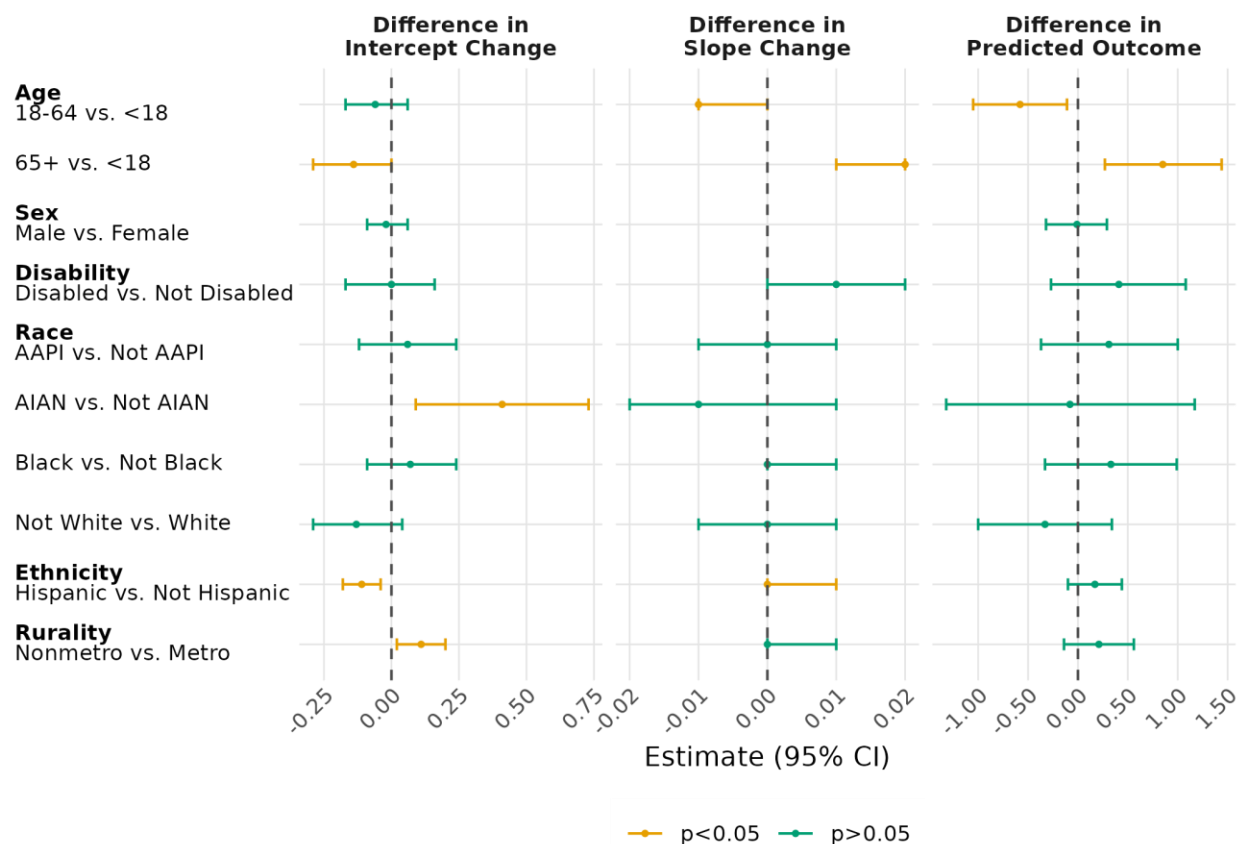
Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from the population of individuals in the NC Medicaid population as determined in the metric specifications.

Table 5: Interrupted time series estimates of Medicaid Beneficiaries with SUD Diagnosis (monthly)

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	3.64* (3.55, 3.72)	3.68* (3.63, 3.72)	0.039 (-0.048, 0.13)
Monthly Change	0.0009 (-0.0020, 0.0039)	-0.0017 (-0.0047, 0.0014)	-0.0026 (-0.0064, 0.0013)
Predicted Average Outcome Nov 2024	3.70* (3.47, 3.93)	3.57* (3.48, 3.66)	-0.13 (-0.39, 0.13)
N	42,254,887		

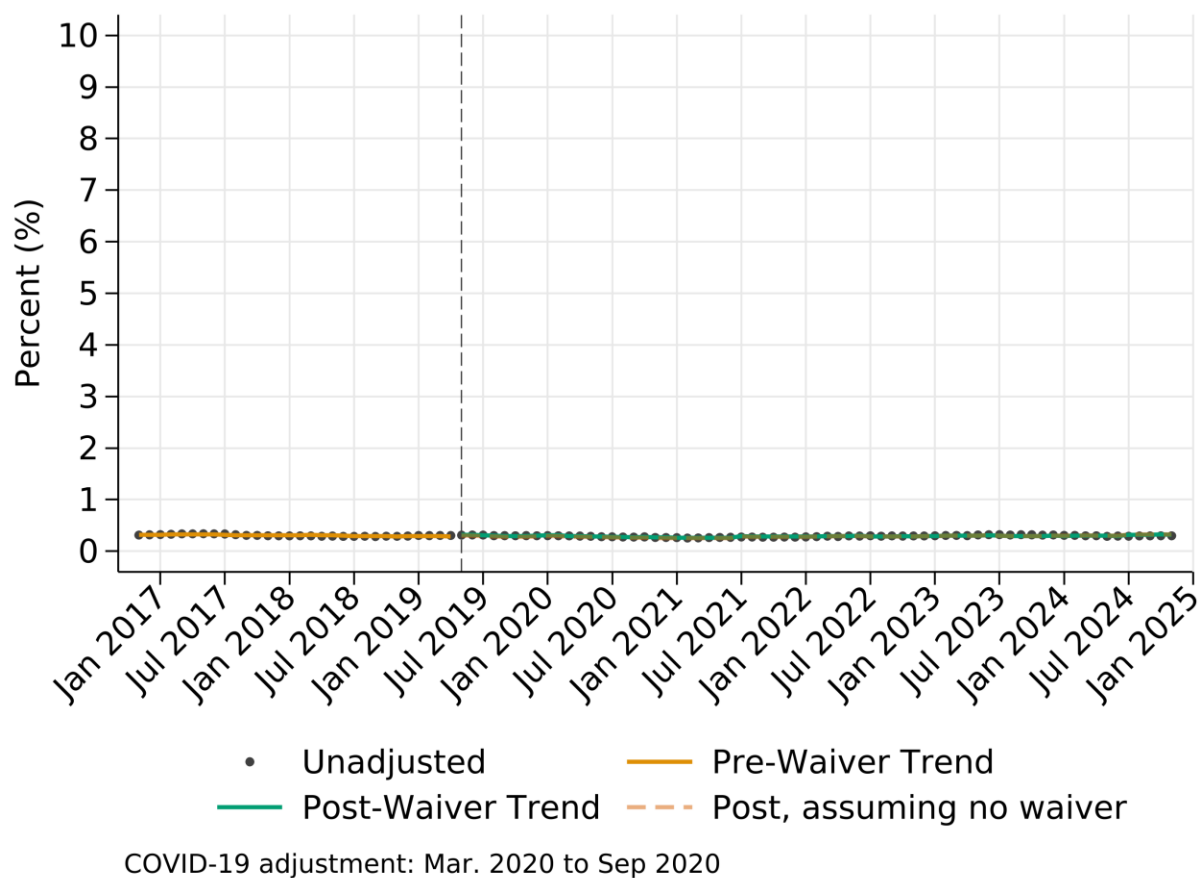
*Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from the population of individuals in the NC Medicaid population as determined in the metric specifications.*

Figure 10: Comparison groups in Medicaid Beneficiaries with SUD Diagnosis (monthly)



Notes: Estimates from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Each of the subgroup variables is interacted with the Waiver-specific intercept and slope. The difference in intercept change (for example), is the intercept change for the first subgroup (e.g., 65+) minus the intercept change for the second subgroup (e.g., 18-64).

Figure 11: Trends in Medicaid Beneficiaries with SUD Diagnosis (monthly): Ages 12-17



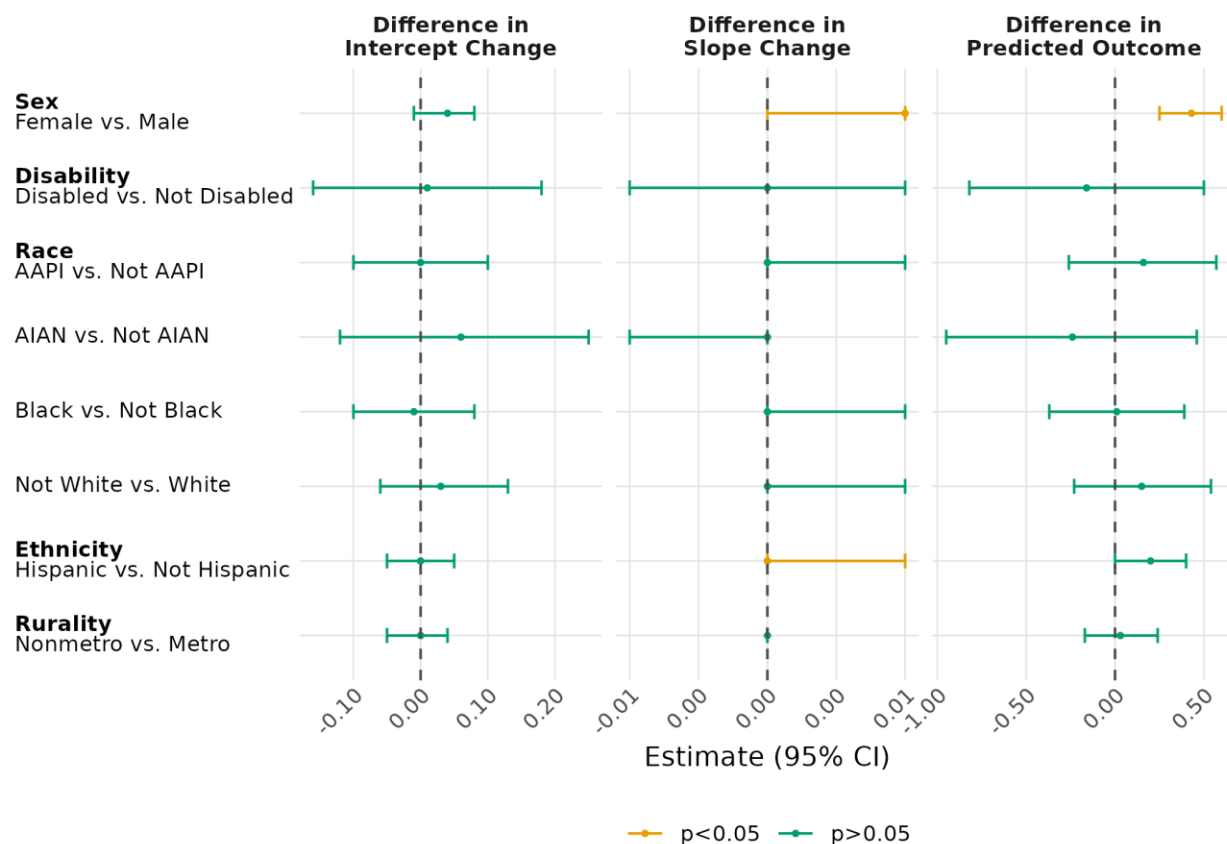
Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from the population of individuals in the NC Medicaid population as determined in the metric specifications.

Table 6: Interrupted time series estimates of Medicaid Beneficiaries with SUD Diagnosis (monthly): Ages 12-17

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	0.20* (0.16, 0.24)	0.23* (0.21, 0.25)	0.031 (-0.0025, 0.065)
Monthly Change	0.0043* (0.0024, 0.0063)	0.0039* (0.0024, 0.0055)	-0.0004 (-0.0030, 0.0022)
Predicted Average Outcome Nov 2024	0.49* (0.33, 0.65)	0.49* (0.44, 0.54)	0.0035 (-0.18, 0.19)
N	24,029,681		

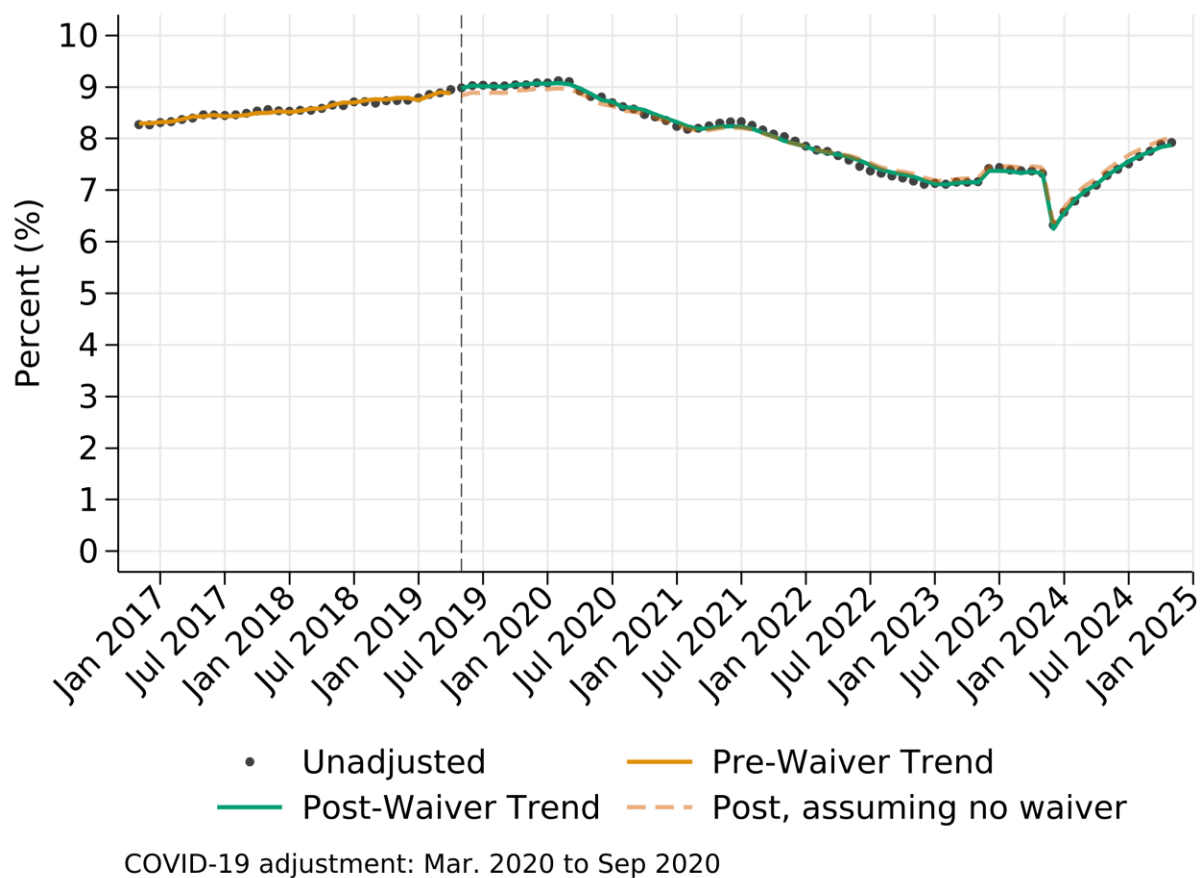
*Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from the population of individuals in the NC Medicaid population as determined in the metric specifications.*

Figure 12: Comparison groups in Medicaid Beneficiaries with SUD Diagnosis (monthly): Ages 12-17



Notes: Estimates from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Each of the subgroup variables is interacted with the Waiver-specific intercept and slope. The difference in intercept change (for example), is the intercept change for the first subgroup (e.g., 65+) minus the intercept change for the second subgroup (e.g., 18-64).

Figure 13: Trends in Medicaid Beneficiaries with SUD Diagnosis (monthly): Ages 18+



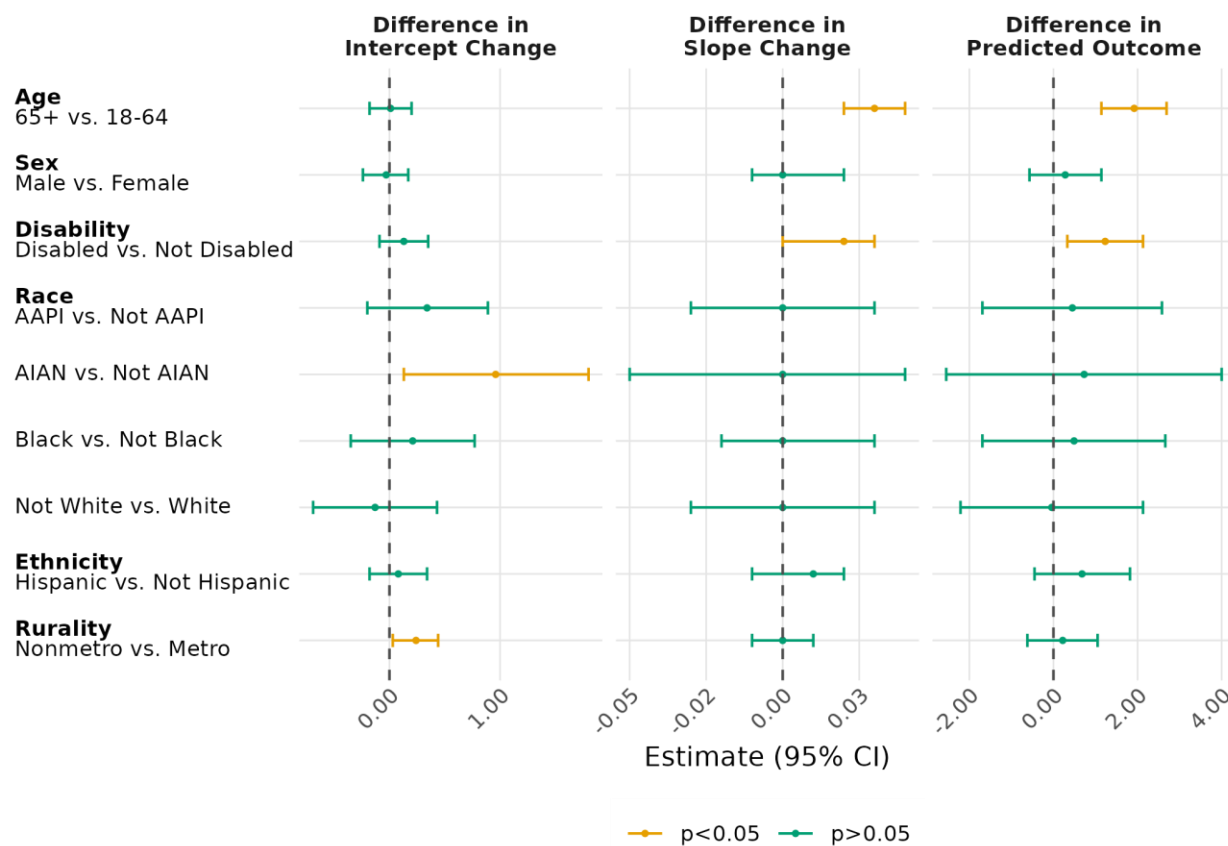
Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from the population of individuals in the NC Medicaid population as determined in the metric specifications.

Table 7: Interrupted time series estimates of Medicaid Beneficiaries with SUD Diagnosis (monthly): Ages 18+

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	8.08* (7.91, 8.26)	8.13* (8.03, 8.24)	0.052 (-0.14, 0.25)
Monthly Change	0.0005 (-0.0059, 0.0068)	-0.0059 (-0.015, 0.0034)	-0.0063 (-0.018, 0.0053)
Predicted Average Outcome Nov 2024	8.17* (7.64, 8.71)	7.81* (7.60, 8.02)	-0.37 (-1.02, 0.29)
N	18,208,653		

*Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from the population of individuals in the NC Medicaid population as determined in the metric specifications.*

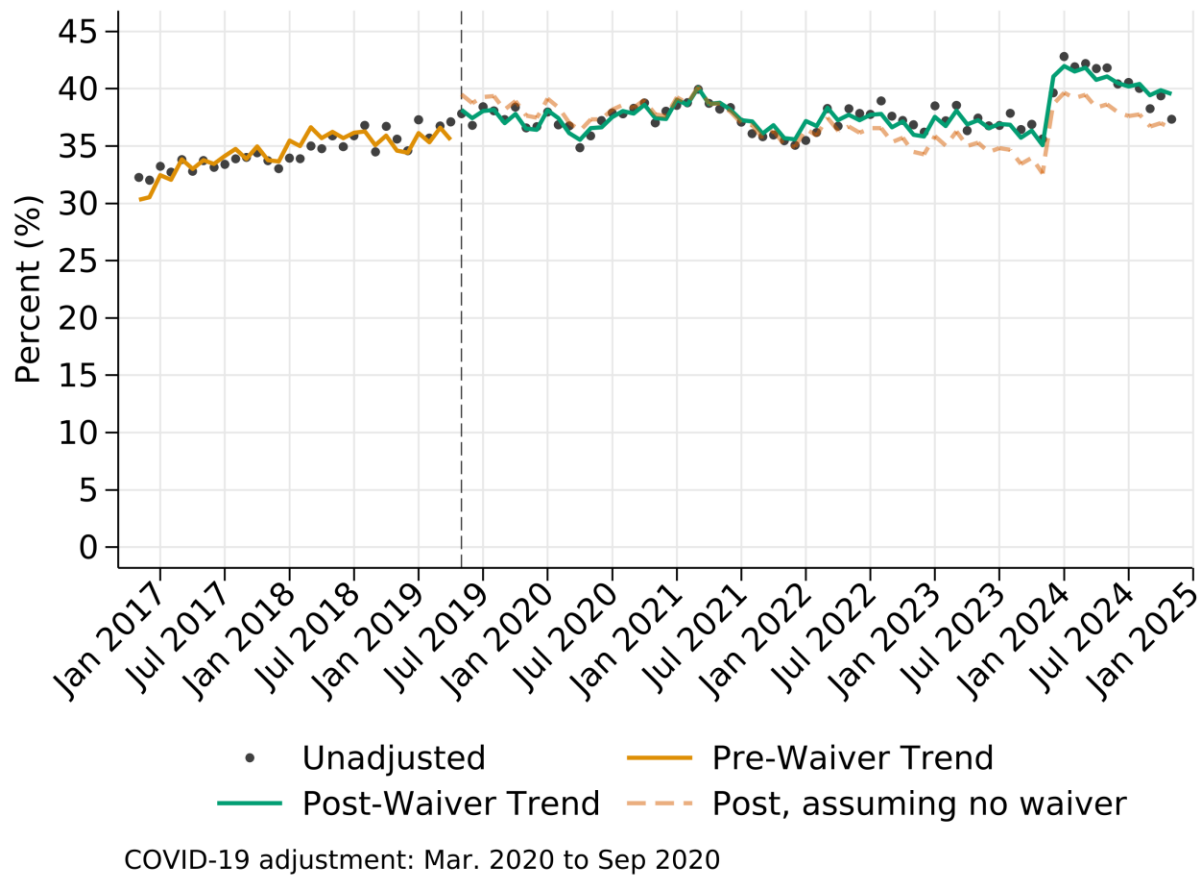
Figure 14: Comparison groups in Medicaid Beneficiaries with SUD Diagnosis (monthly): Ages 18+



Notes: Estimates from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Each of the subgroup variables is interacted with the Waiver-specific intercept and slope. The difference in intercept change (for example), is the intercept change for the first subgroup (e.g., 65+) minus the intercept change for the second subgroup (e.g., 18-64).

Any SUD Treatment (Percent of SUD diagnosed beneficiaries who receive a SUD treatment service)

Figure 15: Trends in Any SUD Treatment (Percent of SUD diagnosed beneficiaries who receive a SUD treatment service)



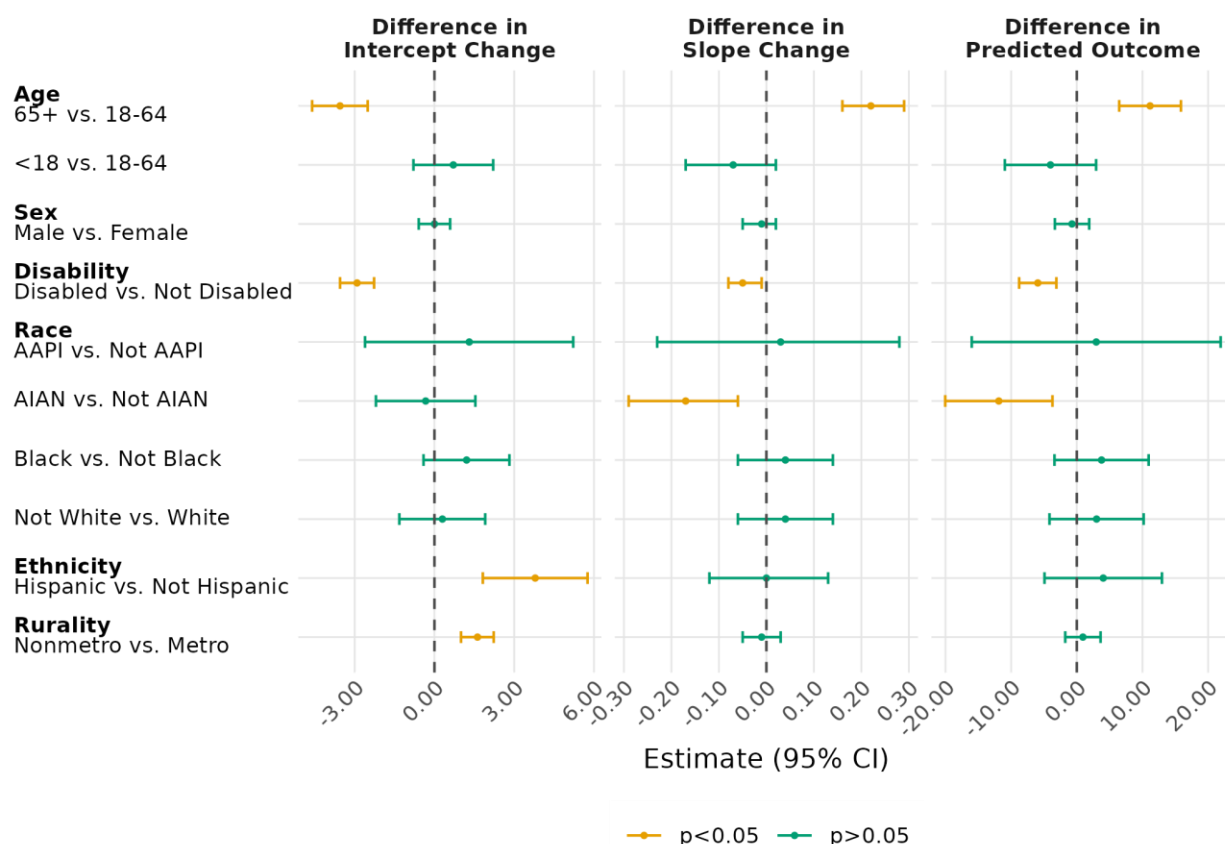
Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population with a substance use disorder.

Table 8: Interrupted time series estimates of Any SUD Treatment (Percent of SUD diagnosed beneficiaries who receive a SUD treatment service)

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	36.52* (35.67, 37.37)	38.81* (38.22, 39.39)	2.29* (1.53, 3.05)
Monthly Change	-0.14* (-0.19, -0.099)	0.022 (-0.031, 0.076)	0.16* (0.087, 0.24)
Predicted Average Outcome Nov 2024	24.05* (19.89, 28.21)	37.20* (35.71, 38.70)	13.15* (7.99, 18.31)
N	7,656,186		

*Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population with a substance use disorder.*

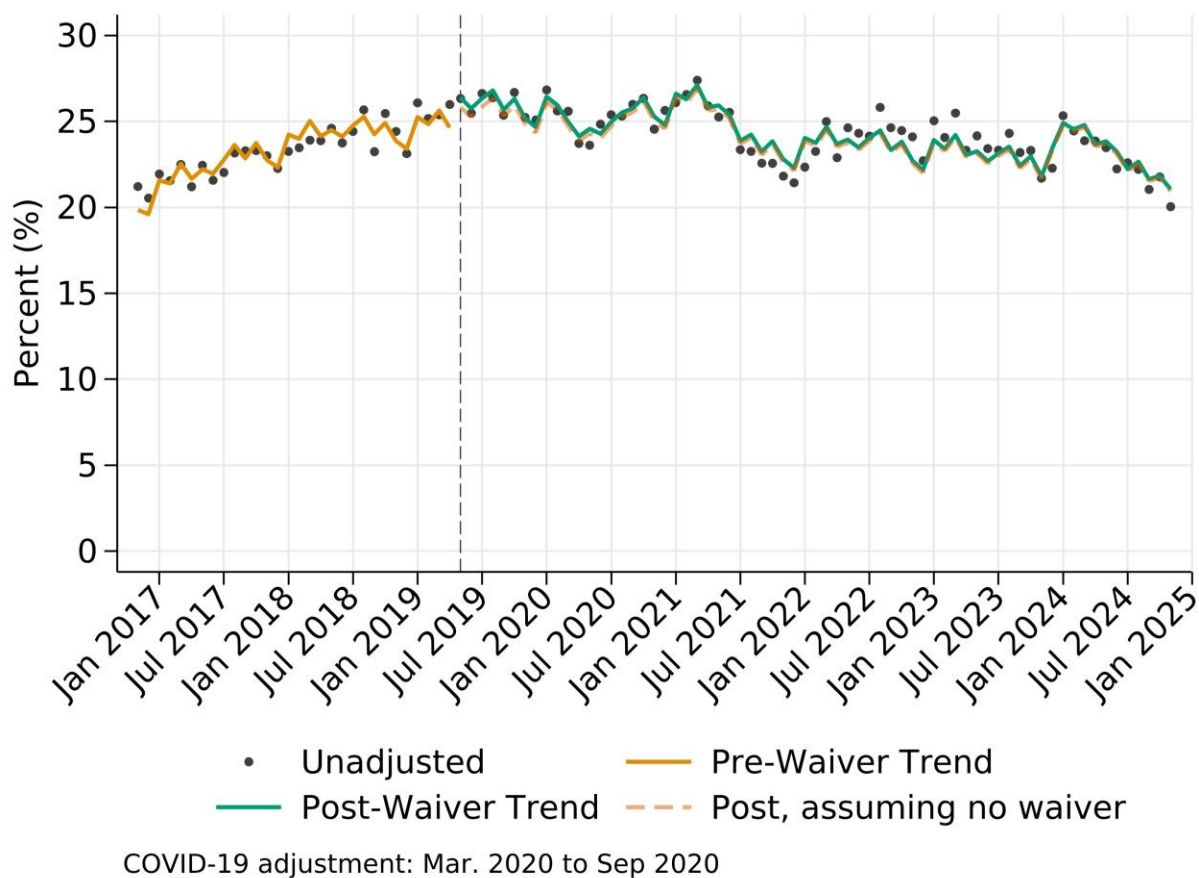
Figure 44: Comparison groups in Any SUD Treatment (Percent of SUD diagnosed beneficiaries who receive a SUD treatment service)



Notes: Estimates from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Each of the subgroup variables is interacted with the Waiver-specific intercept and slope. The difference in intercept change (for example), is the intercept change for the first subgroup (e.g., 65+) minus the intercept change for the second subgroup (e.g., 18-64).

Outpatient Services for SUD

Figure 45: Trends in Outpatient Services for SUD



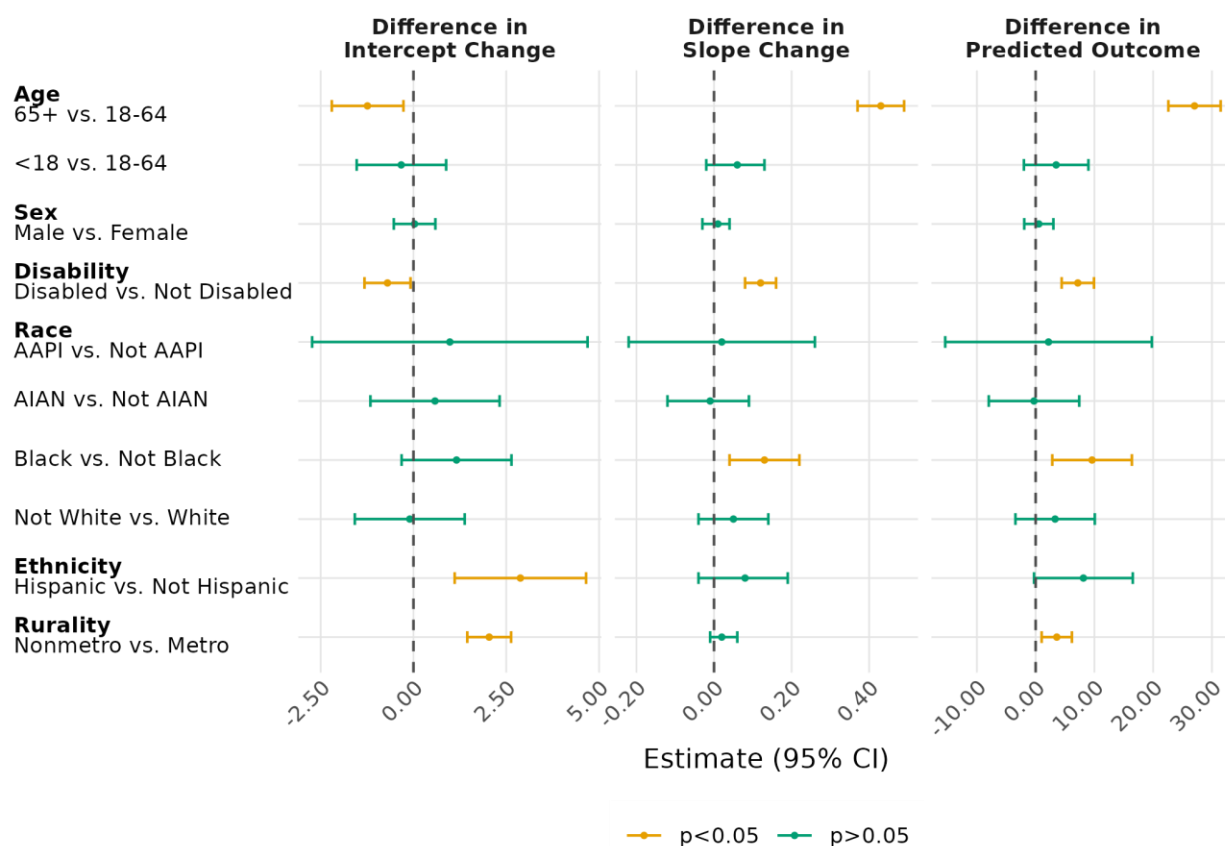
Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population with a substance use disorder.

Table 19: Interrupted time series estimates of Outpatient Services for SUD

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	25.17* (24.06, 26.27)	26.59* (25.76, 27.43)	1.43* (0.60, 2.25)
Monthly Change	-0.058* (-0.11, -0.0058)	-0.059 (-0.14, 0.018)	-0.0001 (-0.094, 0.094)
Predicted Average Outcome Nov 2024	19.98* (15.30, 24.67)	21.40* (19.14, 23.67)	1.42 (-4.65, 7.49)
N	7,656,186		

Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population with a substance use disorder.

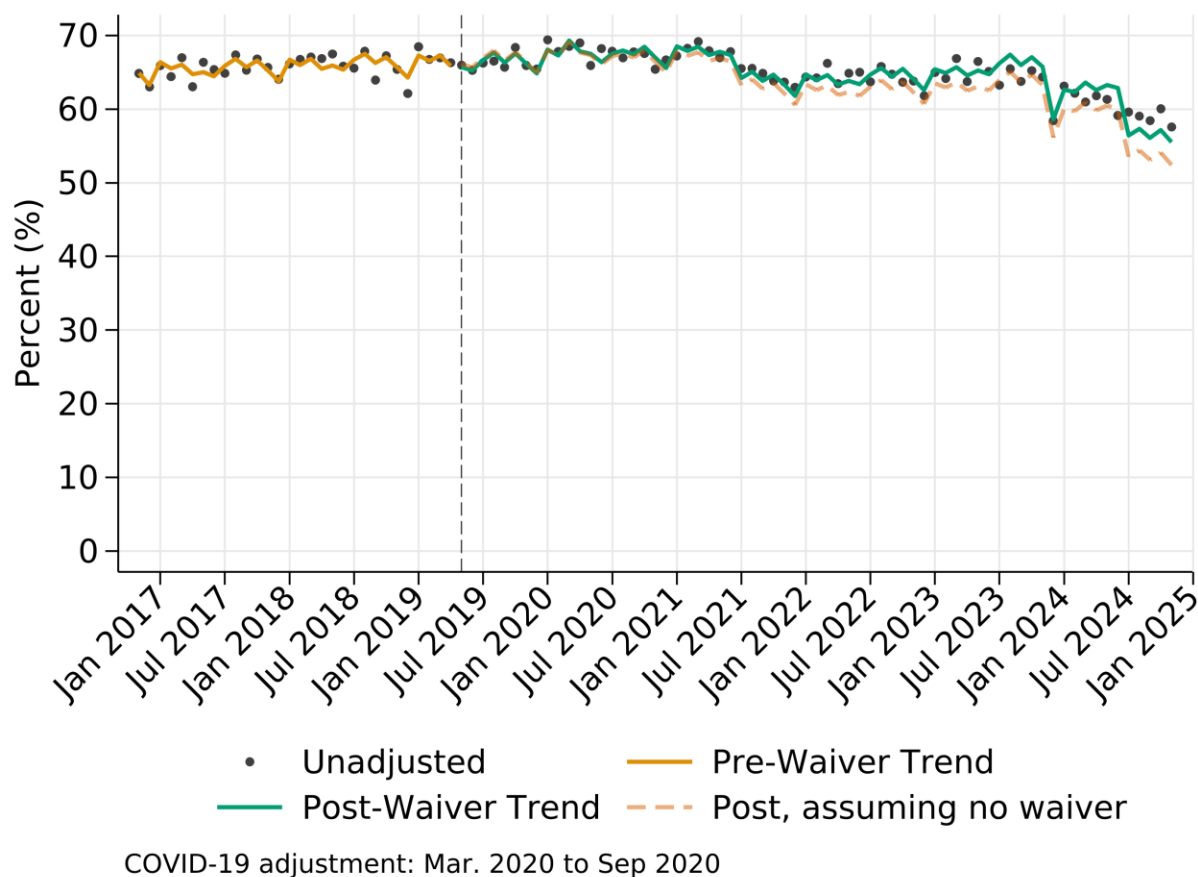
Figure 46: Comparison groups in Outpatient Services for SUD



Notes: Estimates from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Each of the subgroup variables is interacted with the Waiver-specific intercept and slope. The difference in intercept change (for example), is the intercept change for the first subgroup (e.g., 65+) minus the intercept change for the second subgroup (e.g., 18-64).

Access to Preventive/Ambulatory Health Services for Adult Medicaid Beneficiaries with SUD

Figure 16: Trends in Access to Preventive/Ambulatory Health Services for Adult Medicaid Beneficiaries with SUD



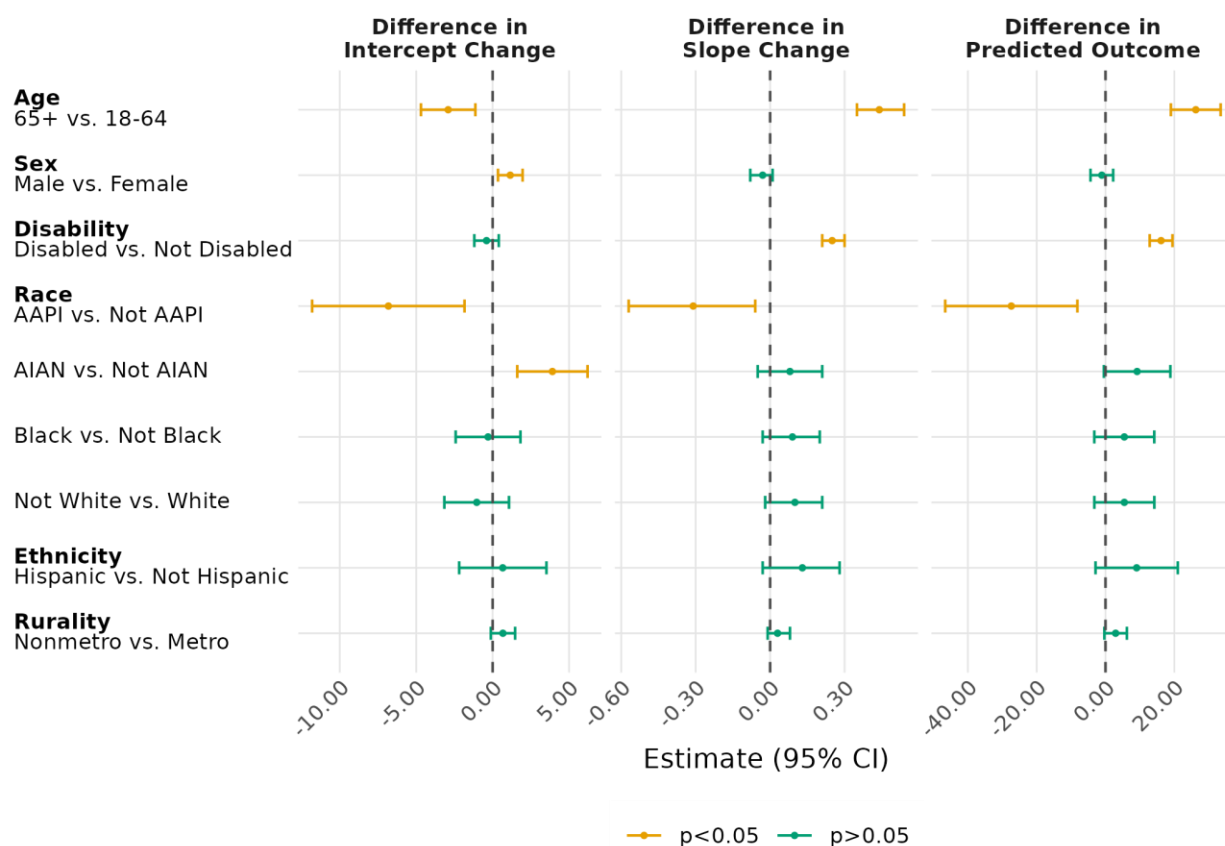
Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population as determined in the metric specifications.

Table 9: Interrupted time series estimates of Access to Preventive/Ambulatory Health Services for Adult Medicaid Beneficiaries with SUD

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	62.76* (62.30, 63.22)	62.33* (61.96, 62.71)	-0.43* (-0.81, -0.054)
Monthly Change	0.032* (0.015, 0.050)	0.086* (0.066, 0.11)	0.054* (0.025, 0.082)
Predicted Average Outcome Nov 2024	65.16* (63.54, 66.78)	68.26* (67.68, 68.84)	3.10* (1.19, 5.00)
N	2,825,540		

*Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population as determined in the metric specifications.*

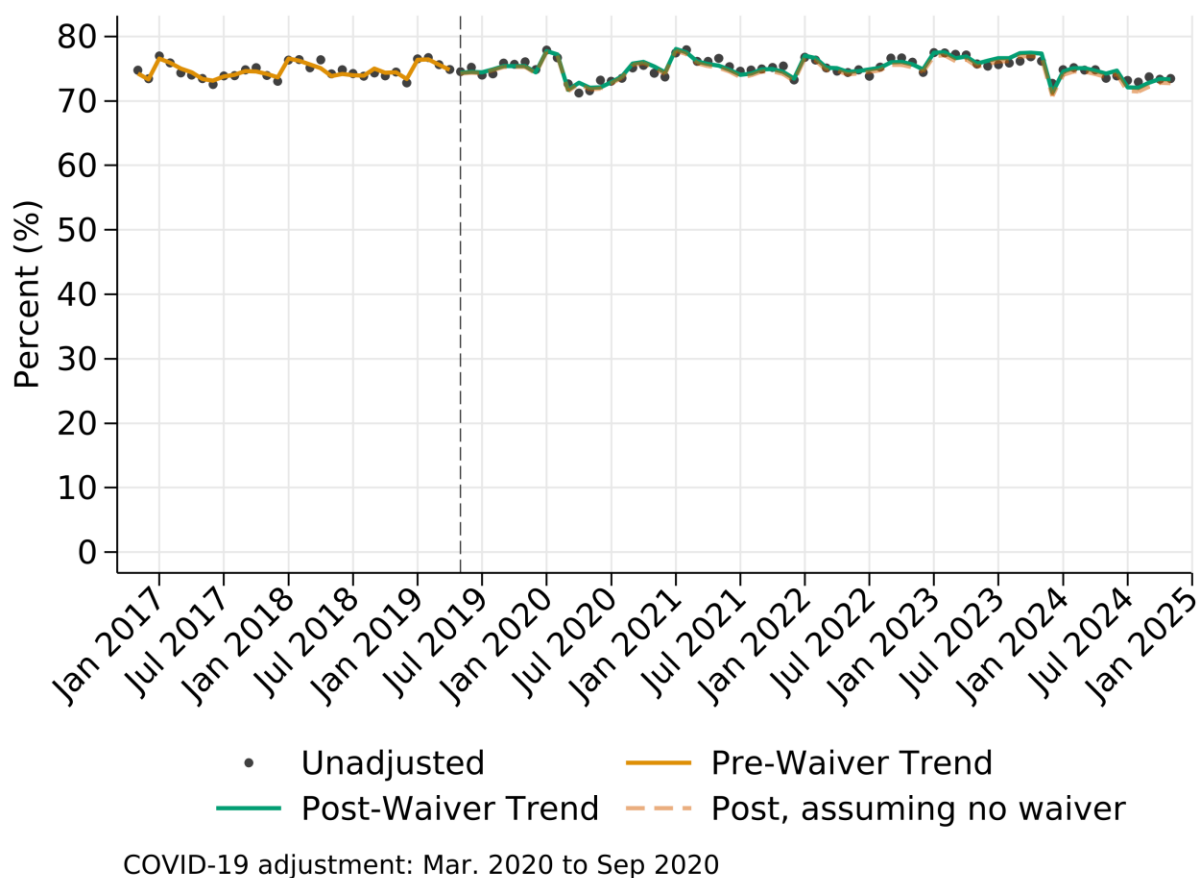
Figure 47: Comparison groups in Access to Preventive/Ambulatory Health Services for Adult Medicaid Beneficiaries with SUD



Notes: Estimates from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model. Each of the subgroup variables is interacted with the Waiver-specific intercept and slope. The difference in intercept change (for example), is the intercept change for the first subgroup (e.g., 65+) minus the intercept change for the second subgroup (e.g., 18-64).

Access to Additional Services Using Provider Resource Directory - Connecting Primary Care to SUD Service Offerings

Figure 48: Trends in Access to Additional Services Using Provider Resource Directory - Connecting Primary Care to SUD Service Offerings



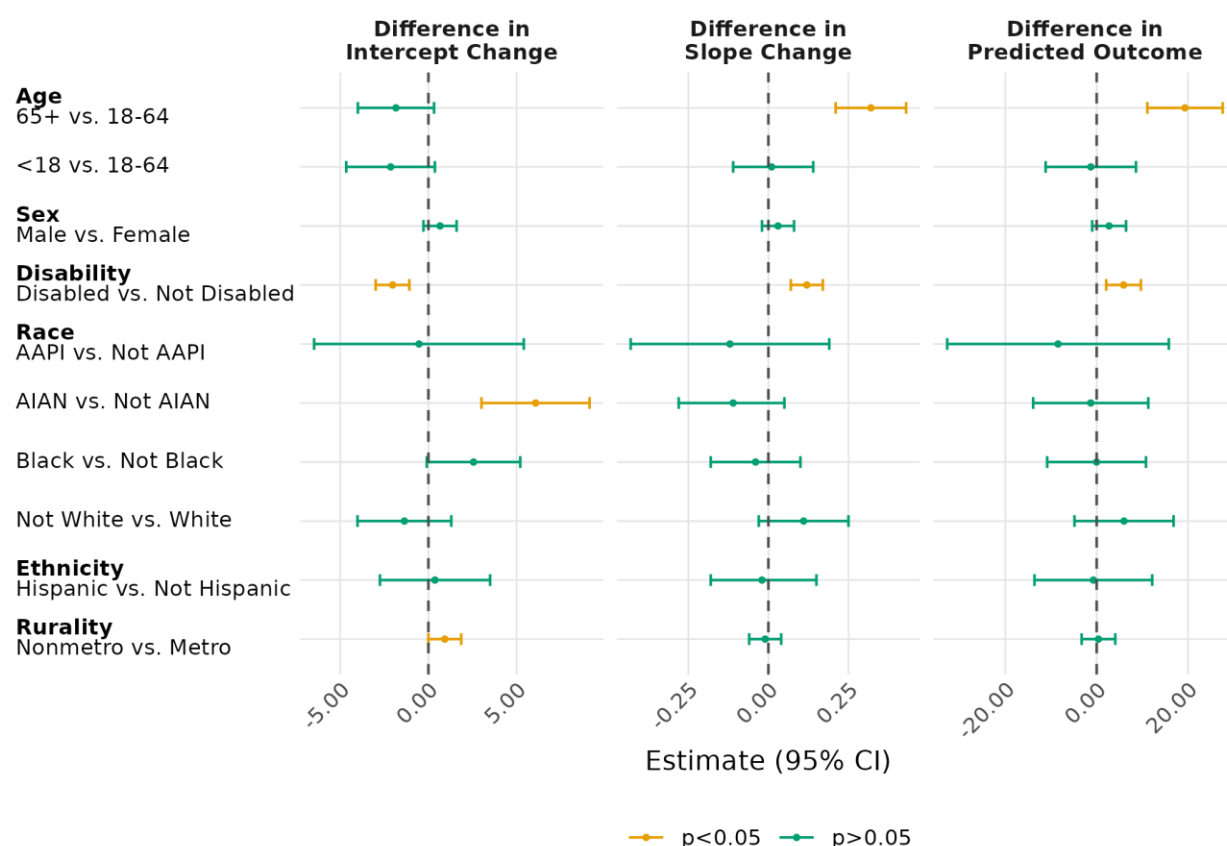
Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population as determined in the metric specifications.

Table 20: Interrupted time series estimates of Access to Additional Services Using Provider Resource Directory - Connecting Primary Care to SUD Service Offerings

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	73.10* (72.57, 73.63)	73.22* (72.82, 73.62)	0.12 (-0.37, 0.61)
Monthly Change	0.012 (-0.0088, 0.032)	0.019 (-0.0051, 0.043)	0.0071 (-0.026, 0.040)
Predicted Average Outcome Nov 2024	75.88* (74.02, 77.74)	76.47* (75.80, 77.14)	0.59 (-1.61, 2.79)
N	1,162,647		

Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population as determined in the metric specifications.

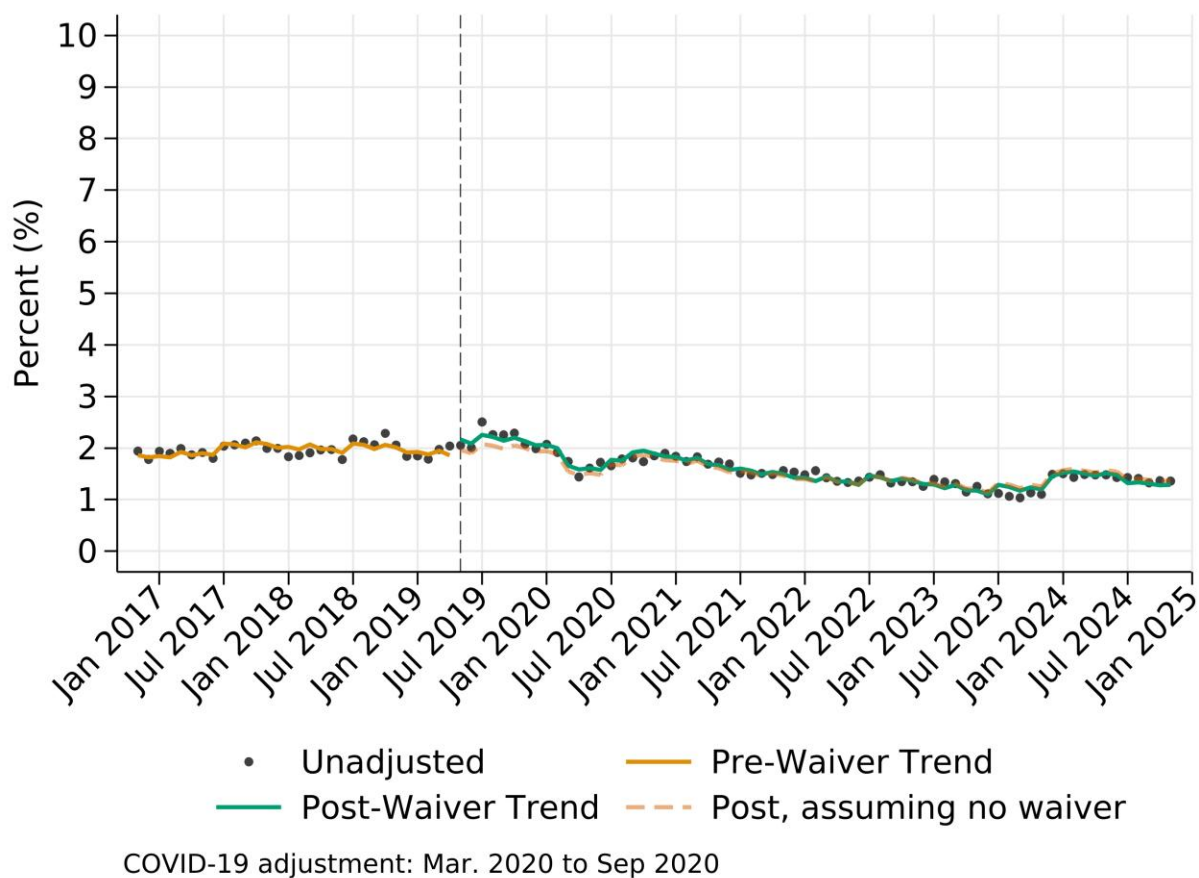
Figure 49: Comparison groups in Access to Additional Services Using Provider Resource Directory - Connecting Primary Care to SUD Service Offerings



Notes: Estimates from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model. Each of the subgroup variables is interacted with the Waiver-specific intercept and slope. The difference in intercept change (for example), is the intercept change for the first subgroup (e.g., 65+) minus the intercept change for the second subgroup (e.g., 18-64).

Intensive Outpatient and Partial Hospitalization Services (SUD)

Figure 50: Trends in Intensive Outpatient and Partial Hospitalization Services (SUD)



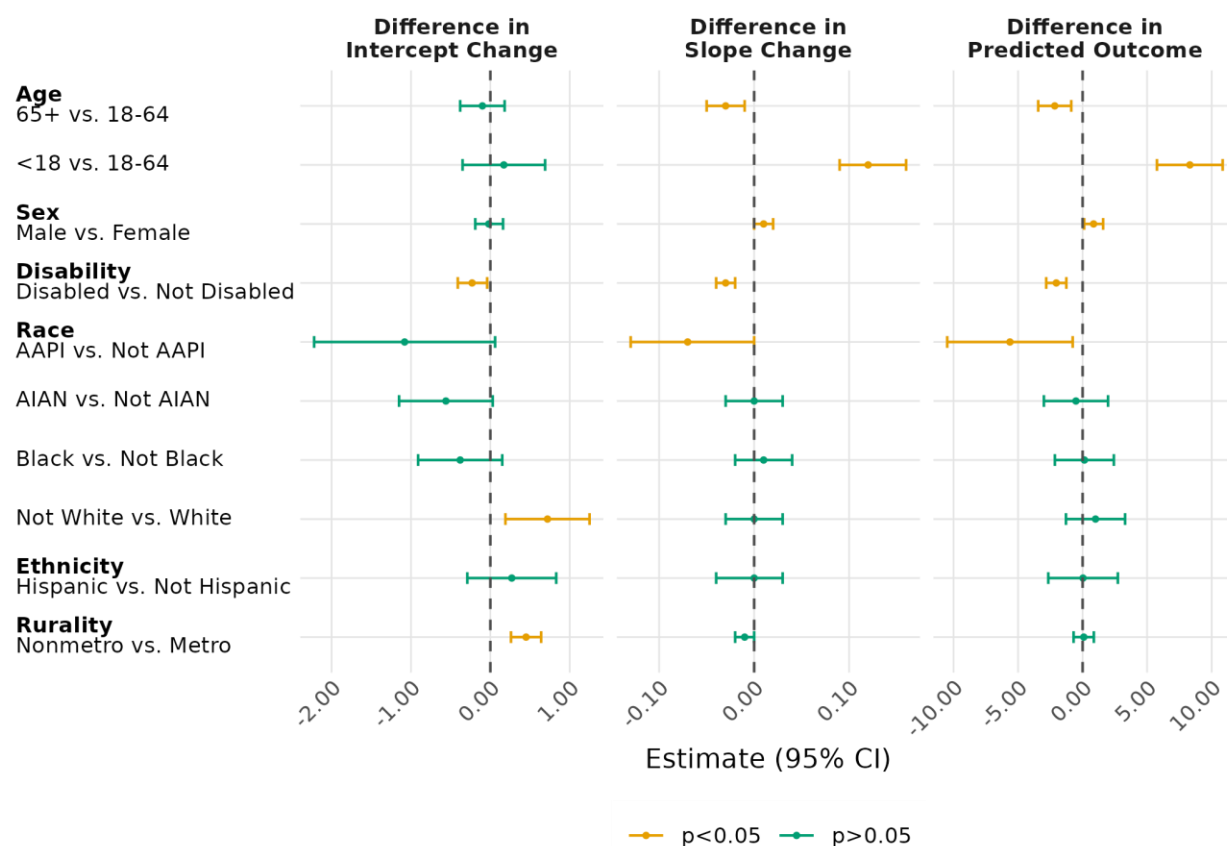
Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population with a substance use disorder.

Table 21: Interrupted time series estimates of Intensive Outpatient and Partial Hospitalization Services (SUD)

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	1.80* (1.50, 2.10)	2.10* (1.85, 2.34)	0.30* (0.040, 0.56)
Monthly Change	-0.022* (-0.032, -0.013)	-0.029* (-0.048, -0.0097)	-0.0063 (-0.030, 0.018)
Predicted Average Outcome Nov 2024	0.75 (-0.32, 1.82)	0.64* (0.14, 1.13)	-0.11 (-1.56, 1.33)
N	7,656,186		

Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population with a substance use disorder.

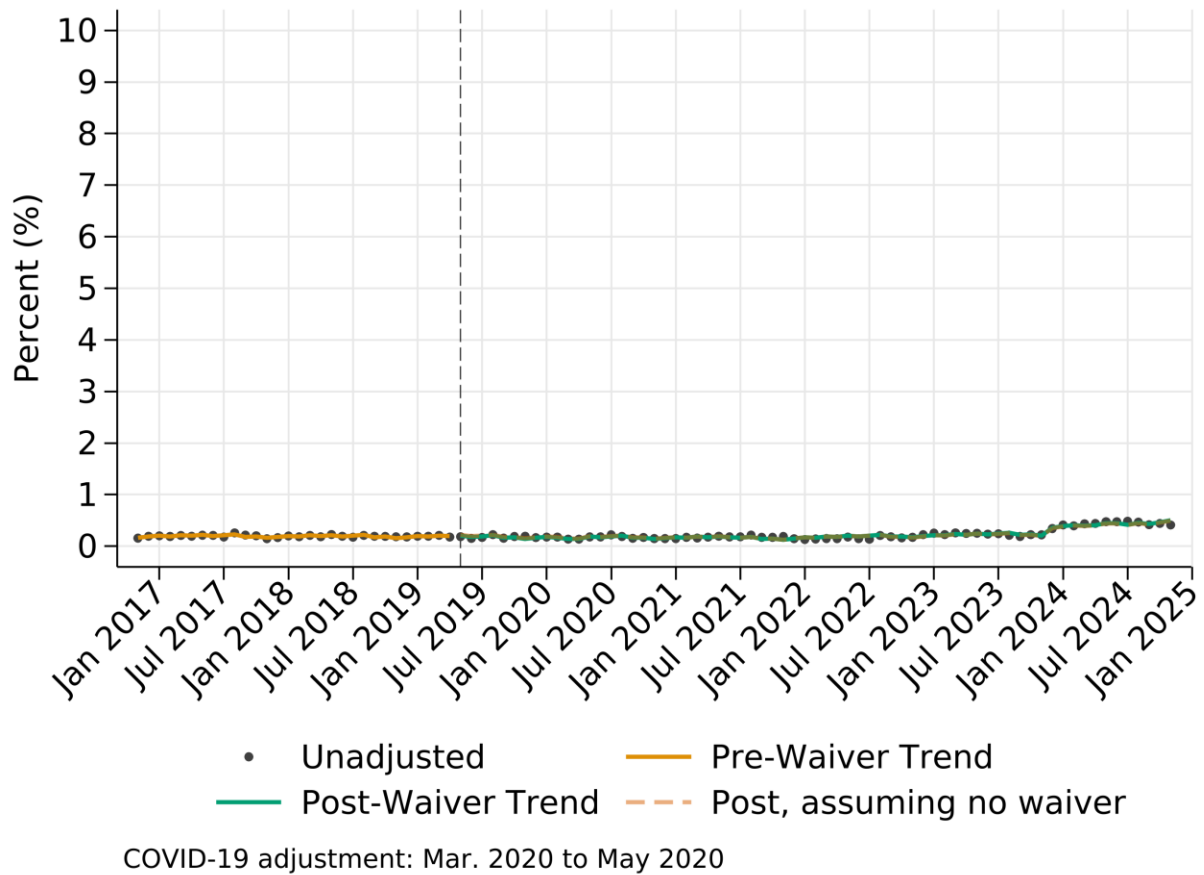
Figure 51: Comparison groups in Intensive Outpatient and Partial Hospitalization Services (SUD)



Notes: Estimates from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Each of the subgroup variables is interacted with the Waiver-specific intercept and slope. The difference in intercept change (for example), is the intercept change for the first subgroup (e.g., 65+) minus the intercept change for the second subgroup (e.g., 18-64).

Withdrawal Management (SUD)

Figure 52: Trends in Withdrawal Management (SUD)



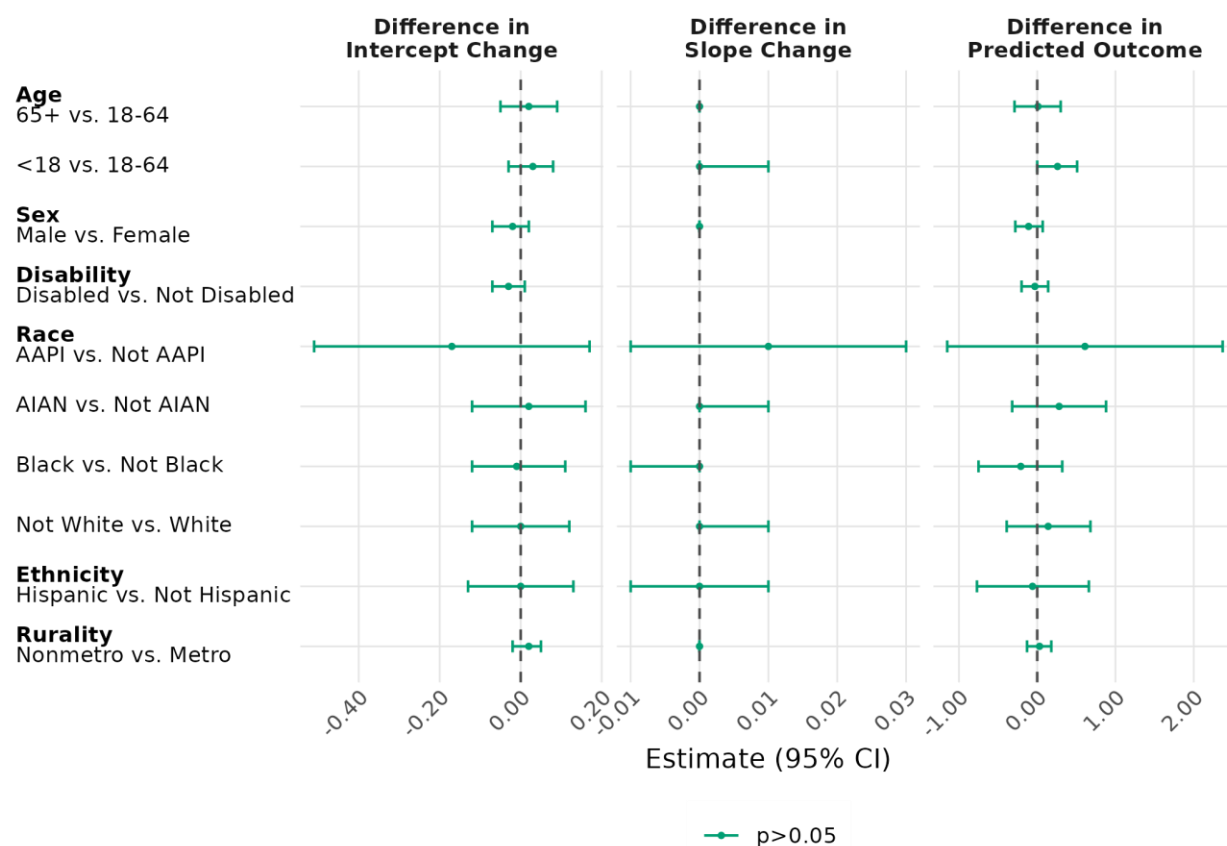
Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population with a substance use disorder.

Table 22: Interrupted time series estimates of Withdrawal Management (SUD)

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	0.18* (0.11, 0.25)	0.16* (0.10, 0.22)	-0.018 (-0.078, 0.043)
Monthly Change	-0.0014 (-0.0031, 0.0004)	-0.0007 (-0.0026, 0.0012)	0.0007 (-0.0014, 0.0028)
Predicted Average Outcome Nov 2024	0.19* (0.075, 0.31)	0.22* (0.15, 0.29)	0.028 (-0.10, 0.16)
N	7,656,186		

Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population with a substance use disorder.

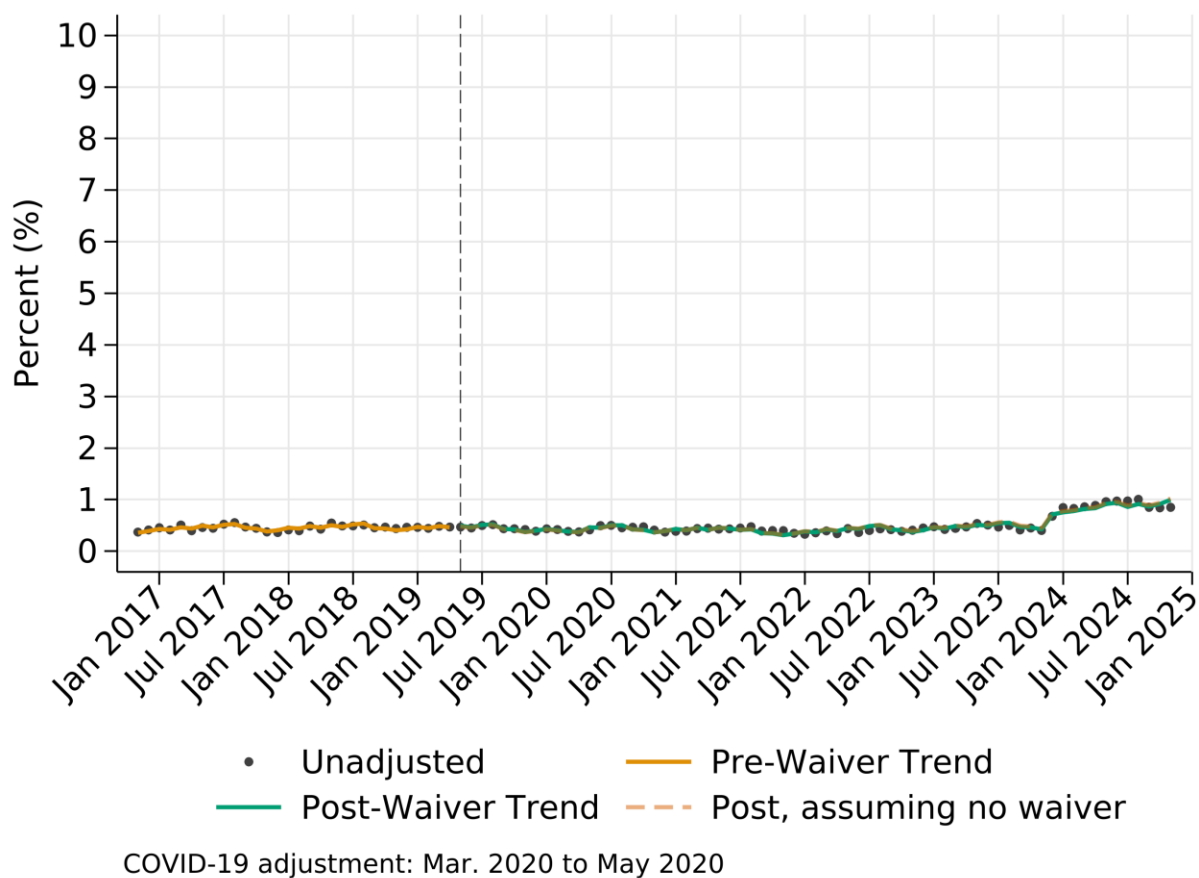
Figure 53: Comparison groups in Withdrawal Management (SUD)



Notes: Estimates from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Each of the subgroup variables is interacted with the Waiver-specific intercept and slope. The difference in intercept change (for example), is the intercept change for the first subgroup (e.g., 65+) minus the intercept change for the second subgroup (e.g., 18-64).

Residential and Inpatient Services (SUD)

Figure 54: Trends in Residential and Inpatient Services (SUD)



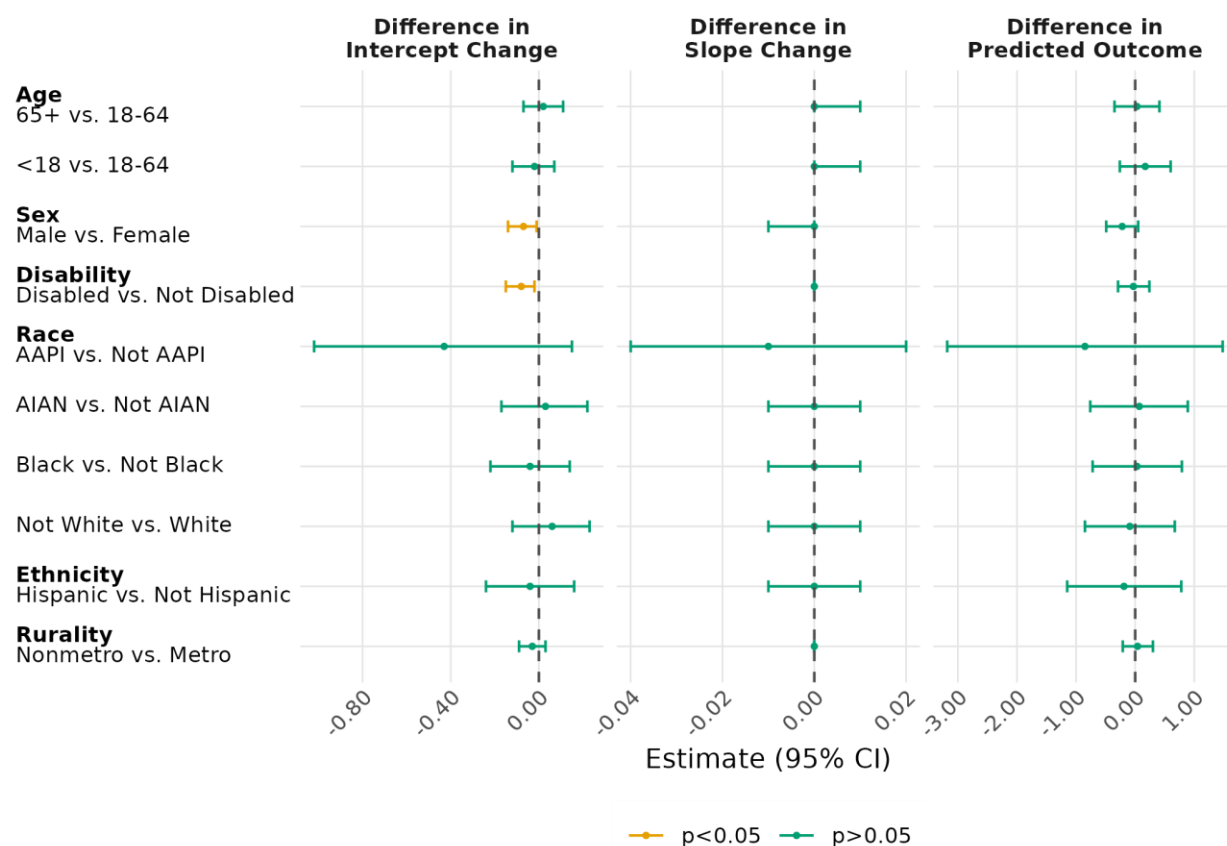
Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population with a substance use disorder.

Table 23: Interrupted time series estimates of Residential and Inpatient Services (SUD)

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	0.43* (0.35, 0.52)	0.41* (0.34, 0.49)	-0.020 (-0.085, 0.044)
Monthly Change	-0.0016 (-0.0050, 0.0019)	-0.0029 (-0.0067, 0.0009)	-0.0014 (-0.0050, 0.0023)
Predicted Average Outcome Nov 2024	0.56* (0.34, 0.78)	0.45* (0.32, 0.57)	-0.11 (-0.32, 0.10)
N	7,656,186		

Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population with a substance use disorder.

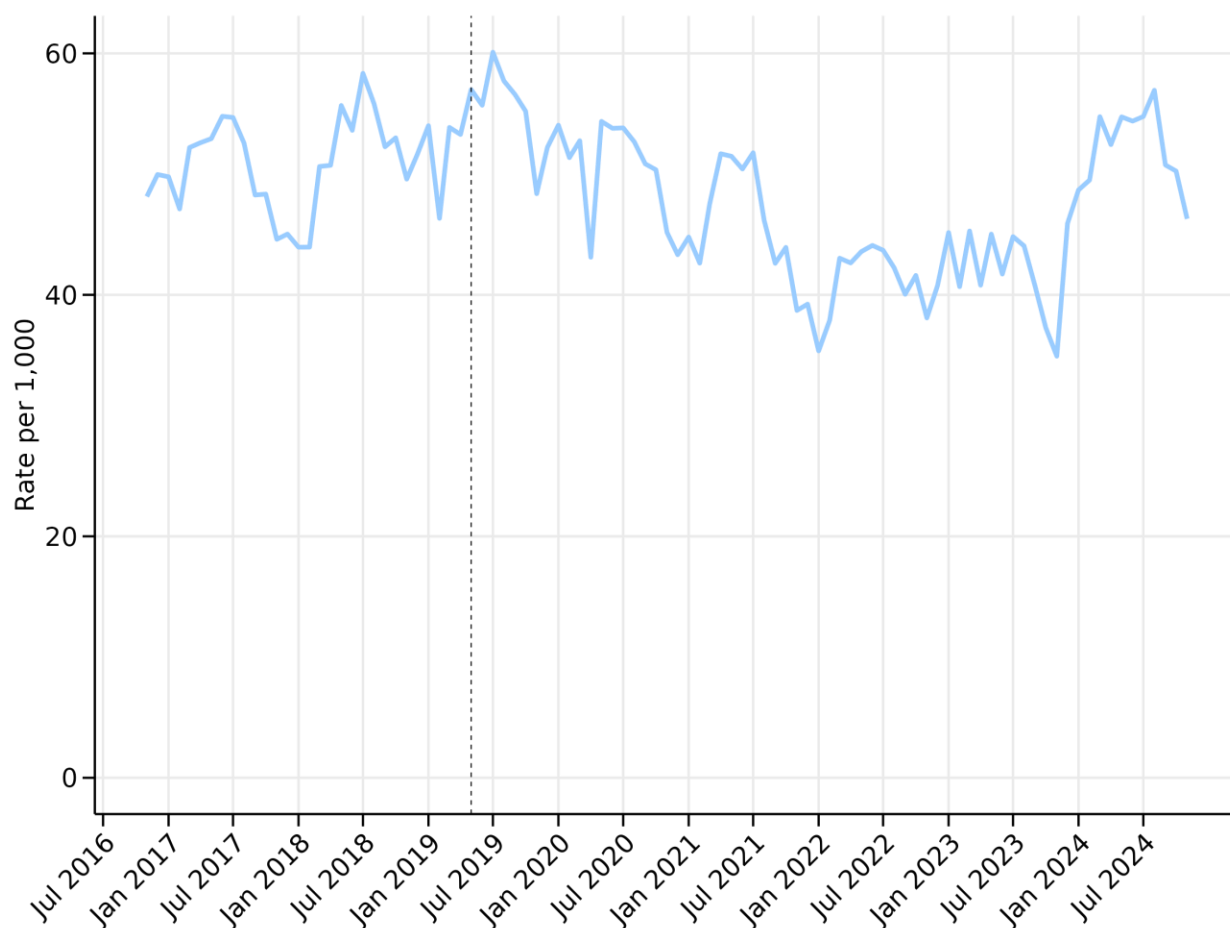
Figure 55: Comparison groups in Residential and Inpatient Services (SUD)



Notes: Estimates from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Each of the subgroup variables is interacted with the Waiver-specific intercept and slope. The difference in intercept change (for example), is the intercept change for the first subgroup (e.g., 65+) minus the intercept change for the second subgroup (e.g., 18-64).

Unadjusted Emergency Department Utilization for SUD per 1000 Beneficiaries

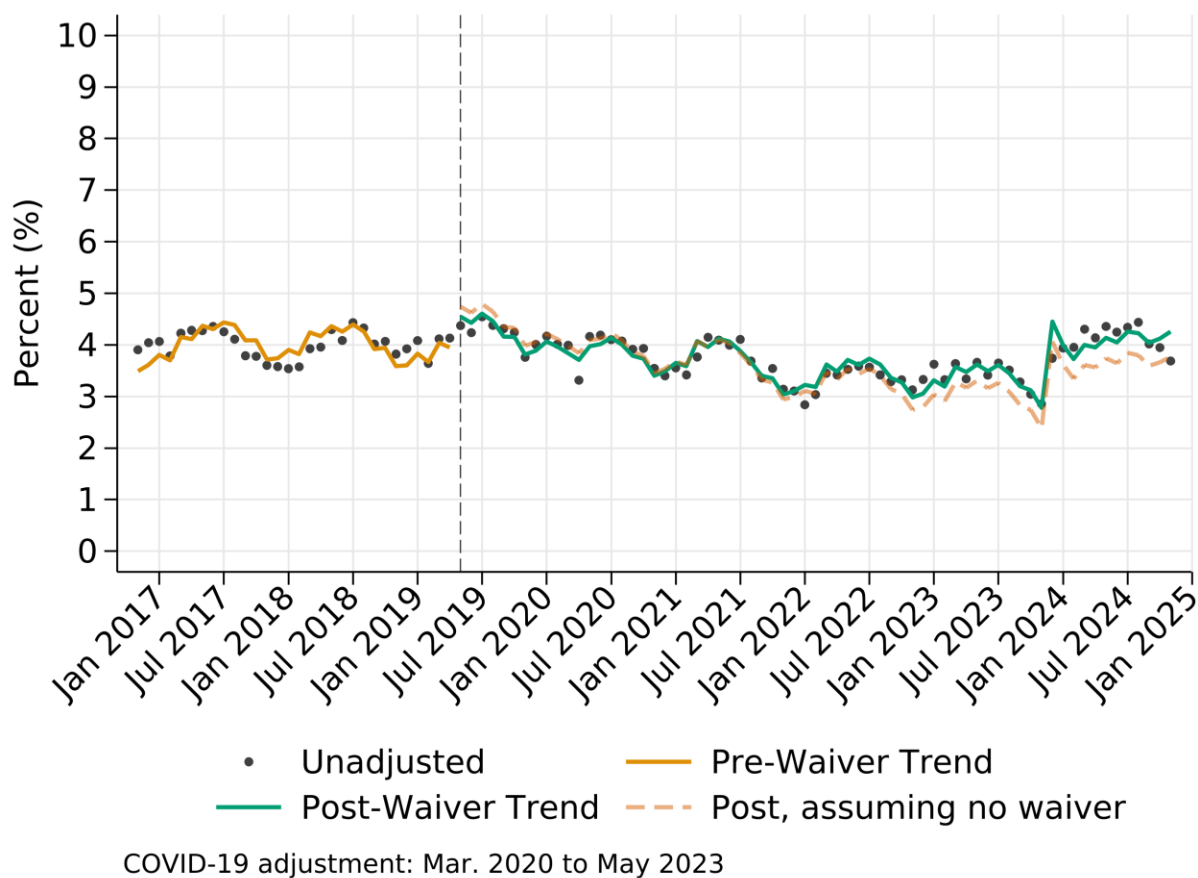
Figure 56: Trends in Unadjusted Emergency Department Utilization for SUD per 1000 Beneficiaries



Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a This figure plots unadjusted rates from the metric population. with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population with a substance use disorder.

Emergency Department Utilization for SUD

Figure 57: Trends in Emergency Department Utilization for SUD



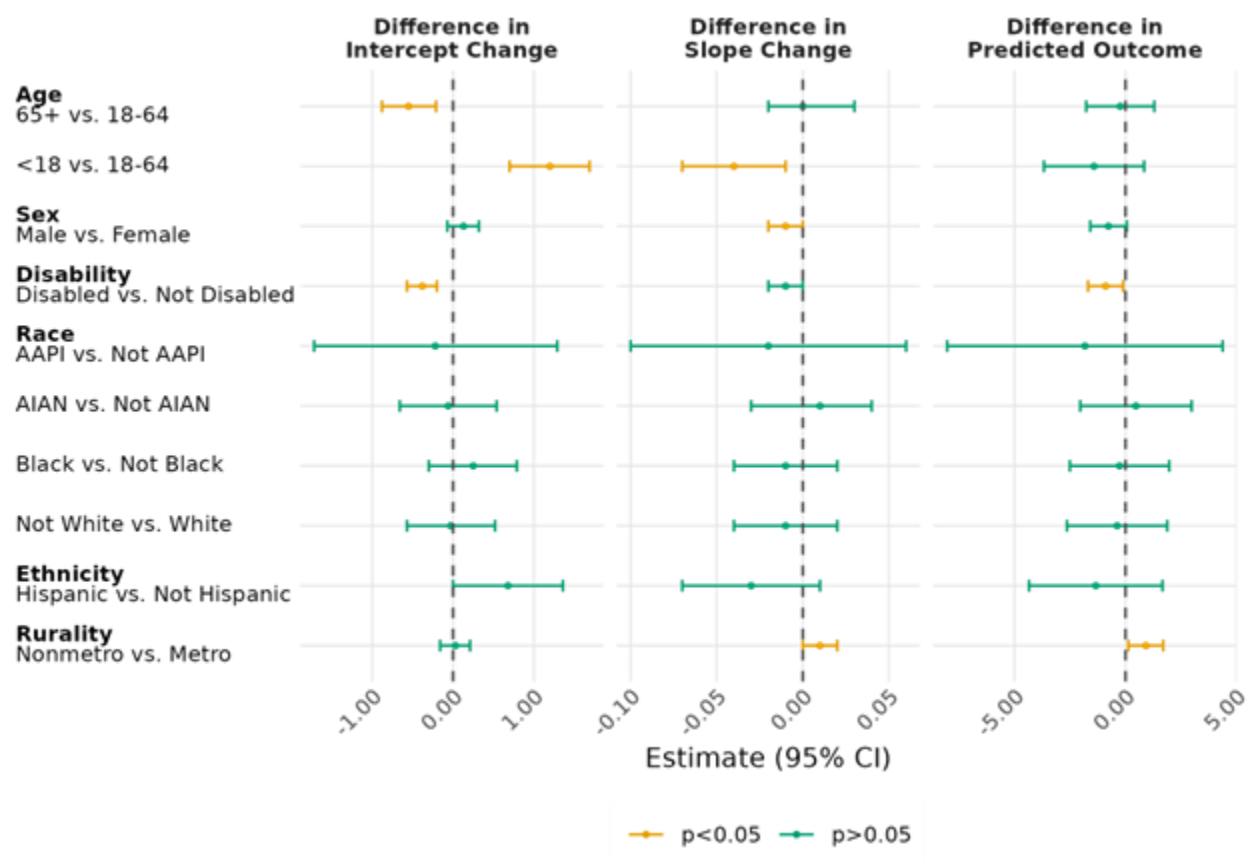
Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model. Estimates were generated from a random 20% sample of individuals (aged 18+) in the NC Medicaid population as determined in the metric specifications and with a substance use disorder.

Table 24: Interrupted time series estimates of Emergency Department Utilization for SUD

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	4.05* (3.74, 4.35)	4.44* (4.17, 4.71)	0.39* (0.24, 0.55)
Monthly Change	-0.029* (-0.036, -0.021)	-0.0023 (-0.014, 0.0089)	0.026* (0.013, 0.040)
Predicted Average Outcome Nov 2024	1.45* (0.80, 2.09)	3.58* (3.24, 3.93)	2.14* (1.31, 2.96)
N	7,656,186		

Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model. Estimates were generated from a random 20% sample of individuals (aged 18+) in the NC Medicaid population as determined in the metric specifications and with a substance use disorder.

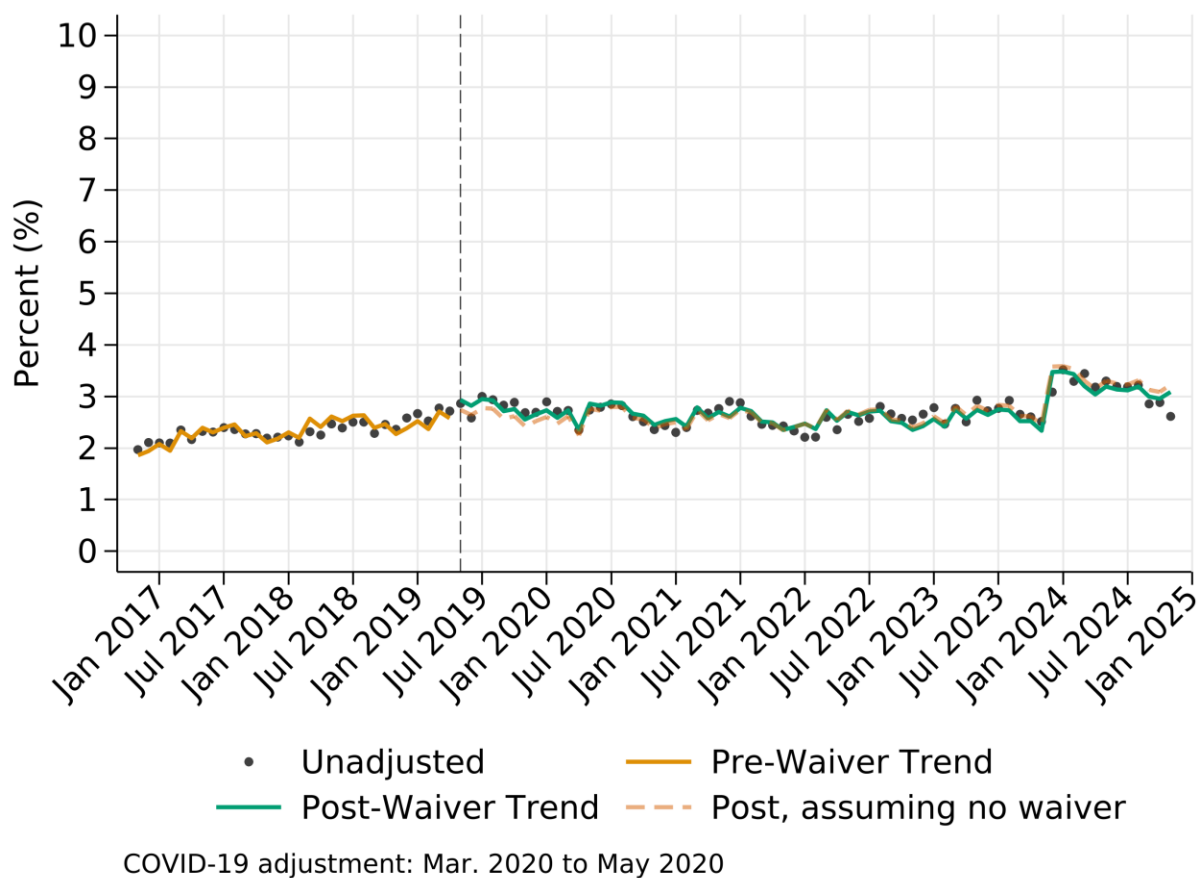
Figure 58: Comparison groups in Emergency Department Utilization for SUD



Notes: Estimates from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model. Each of the subgroup variables is interacted with the Waiver-specific intercept and slope. The difference in intercept change (for example), is the intercept change for the first subgroup (e.g., 65+) minus the intercept change for the second subgroup (e.g., 18-64).

Inpatient Stays for SUD

Figure 60: Trends in Inpatient Stays for SUD



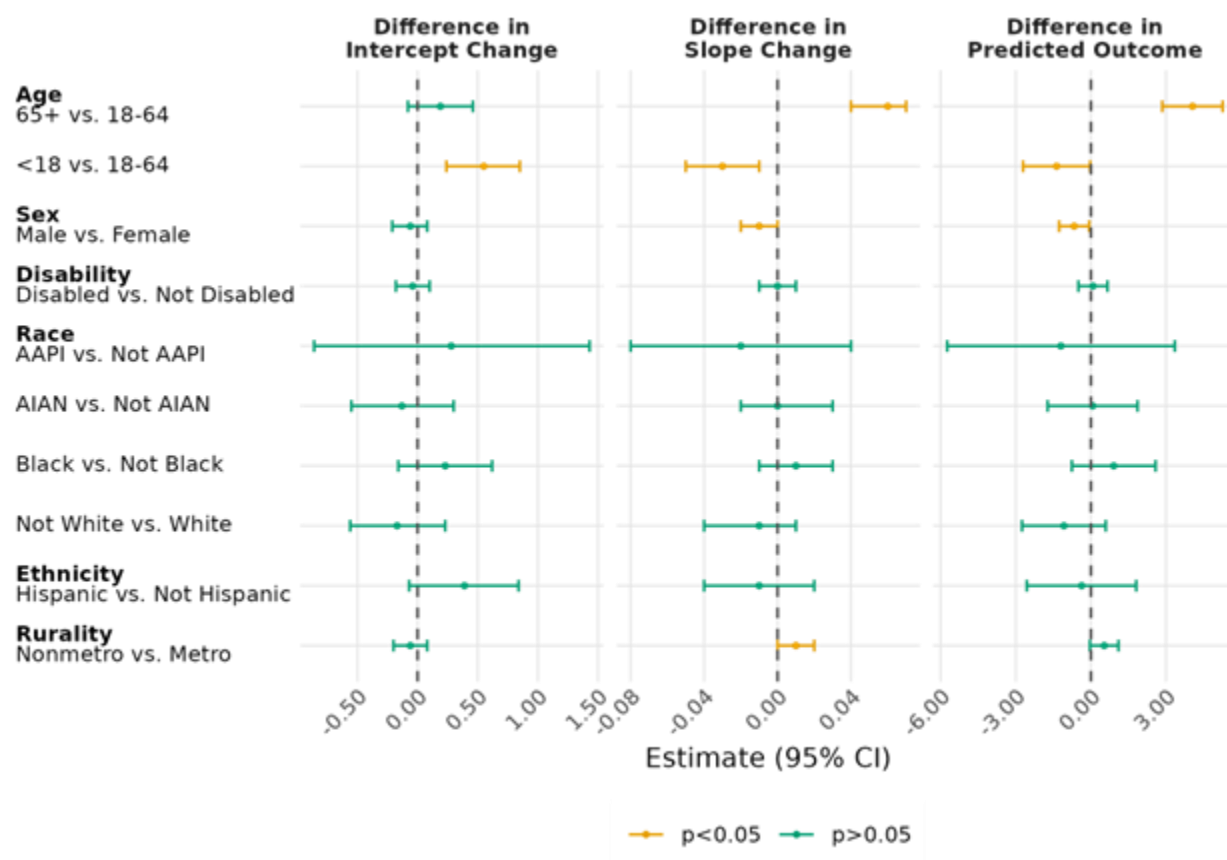
Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population with a substance use disorder.

Table 25: Interrupted time series estimates of Inpatient Stays for SUD

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	2.50* (2.39, 2.61)	2.68* (2.58, 2.78)	0.18* (0.10, 0.26)
Monthly Change	0.014* (0.0074, 0.020)	0.0045 (-0.0023, 0.011)	-0.0091* (-0.016, -0.0025)
Predicted Average Outcome Nov 2024	3.34* (2.95, 3.72)	2.91* (2.68, 3.15)	-0.42* (-0.83, -0.013)
N	7,656,186		

Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population with a substance use disorder.

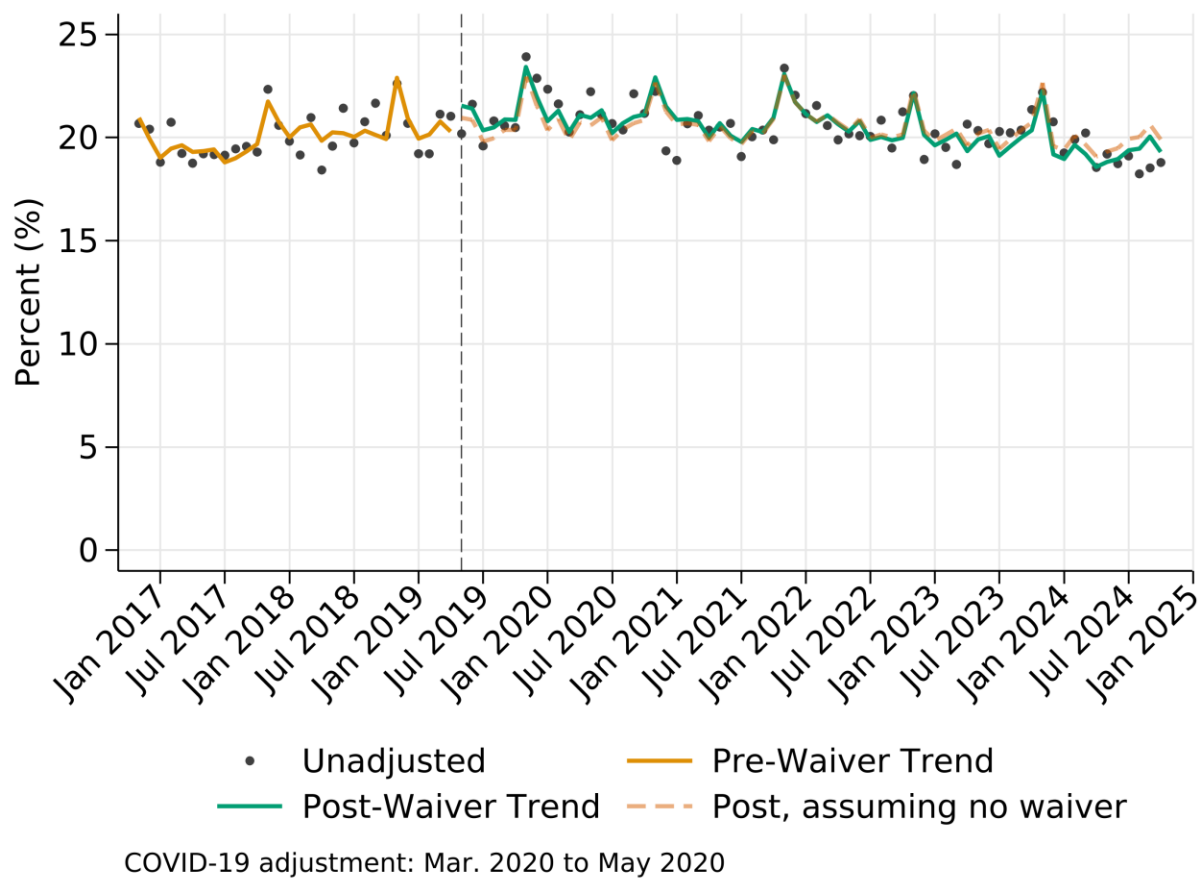
Figure 61: Comparison groups in Inpatient Stays for SUD



Notes: Estimates from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Each of the subgroup variables is interacted with the Waiver-specific intercept and slope. The difference in intercept change (for example), is the intercept change for the first subgroup (e.g., 65+) minus the intercept change for the second subgroup (e.g., 18-64).

Readmissions Among Beneficiaries with SUD

Figure 17: Trends in Readmissions Among Beneficiaries with SUD



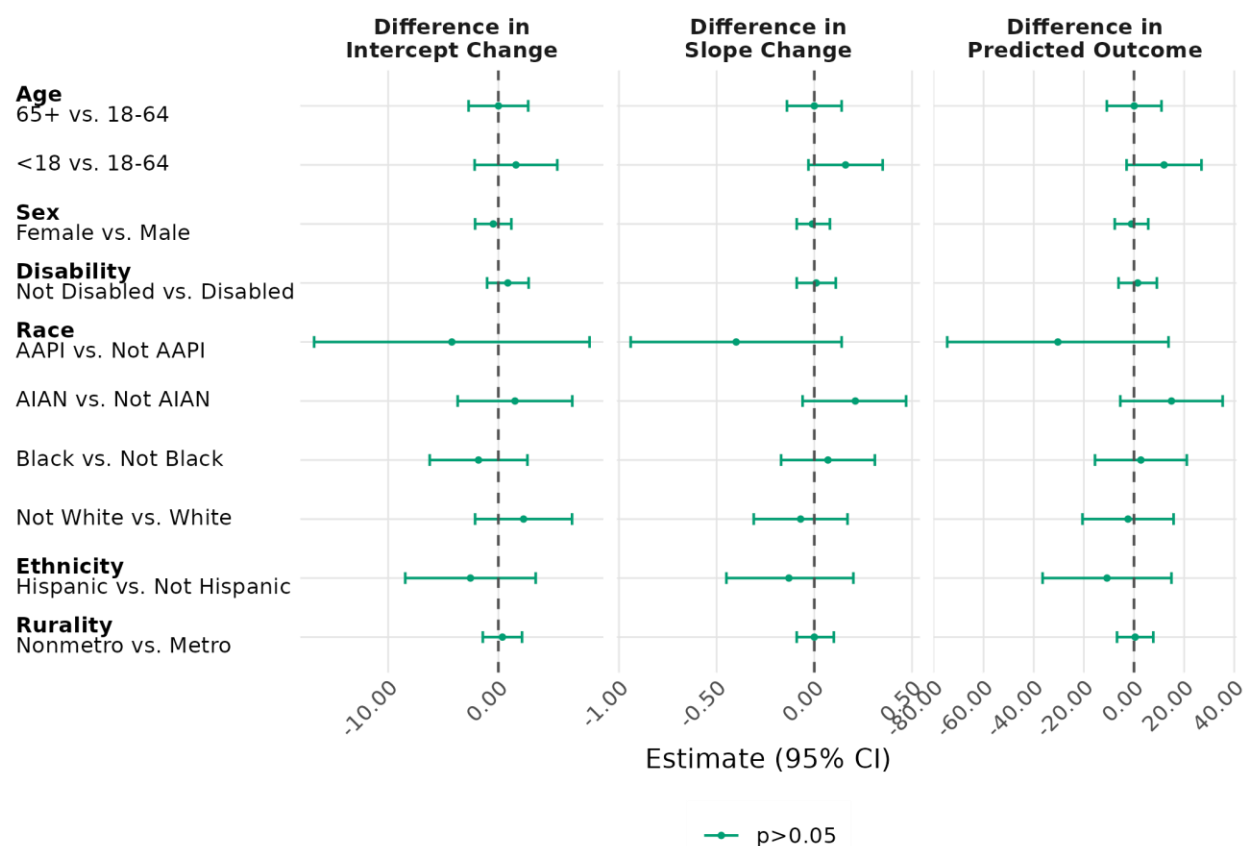
Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population as determined in the metric specifications and with a substance use disorder.

Table 26: Interrupted time series estimates of Readmissions Among Beneficiaries with SUD

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	20.04* (19.08, 21.00)	20.62* (19.92, 21.32)	0.58 (-0.36, 1.51)
Monthly Change	0.025 (-0.014, 0.065)	0.0075 (-0.037, 0.052)	-0.018 (-0.079, 0.043)
Predicted Average Outcome Oct 2024	21.30* (17.86, 24.74)	20.70* (19.46, 21.95)	-0.60 (-4.64, 3.45)
N	254,081		

Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population as determined in the metric specifications and with a substance use disorder.

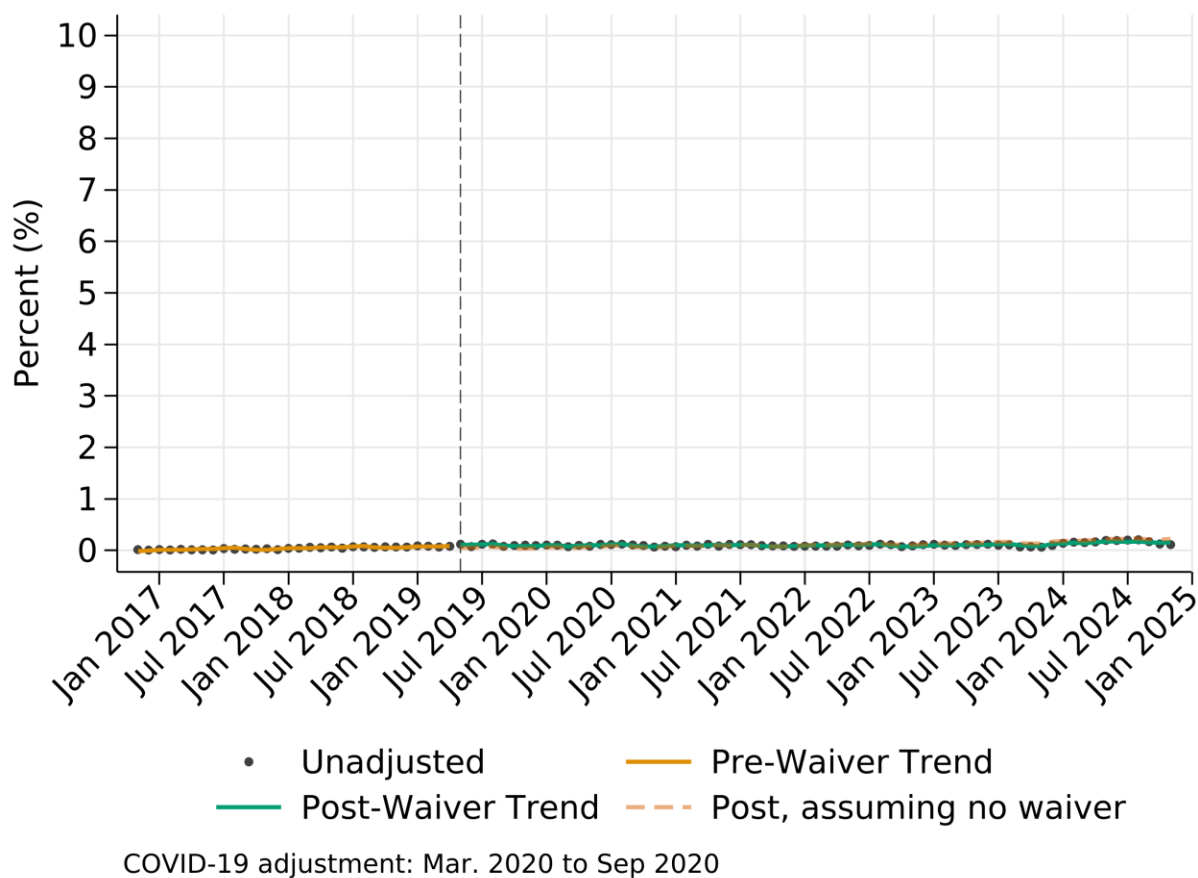
Figure 62: Comparison groups in Readmissions Among Beneficiaries with SUD



Notes: Estimates from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model. Each of the subgroup variables is interacted with the Waiver-specific intercept and slope. The difference in intercept change (for example), is the intercept change for the first subgroup (e.g., 65+) minus the intercept change for the second subgroup (e.g., 18-64).

Medicaid Beneficiaries Treated in an IMD for SUD

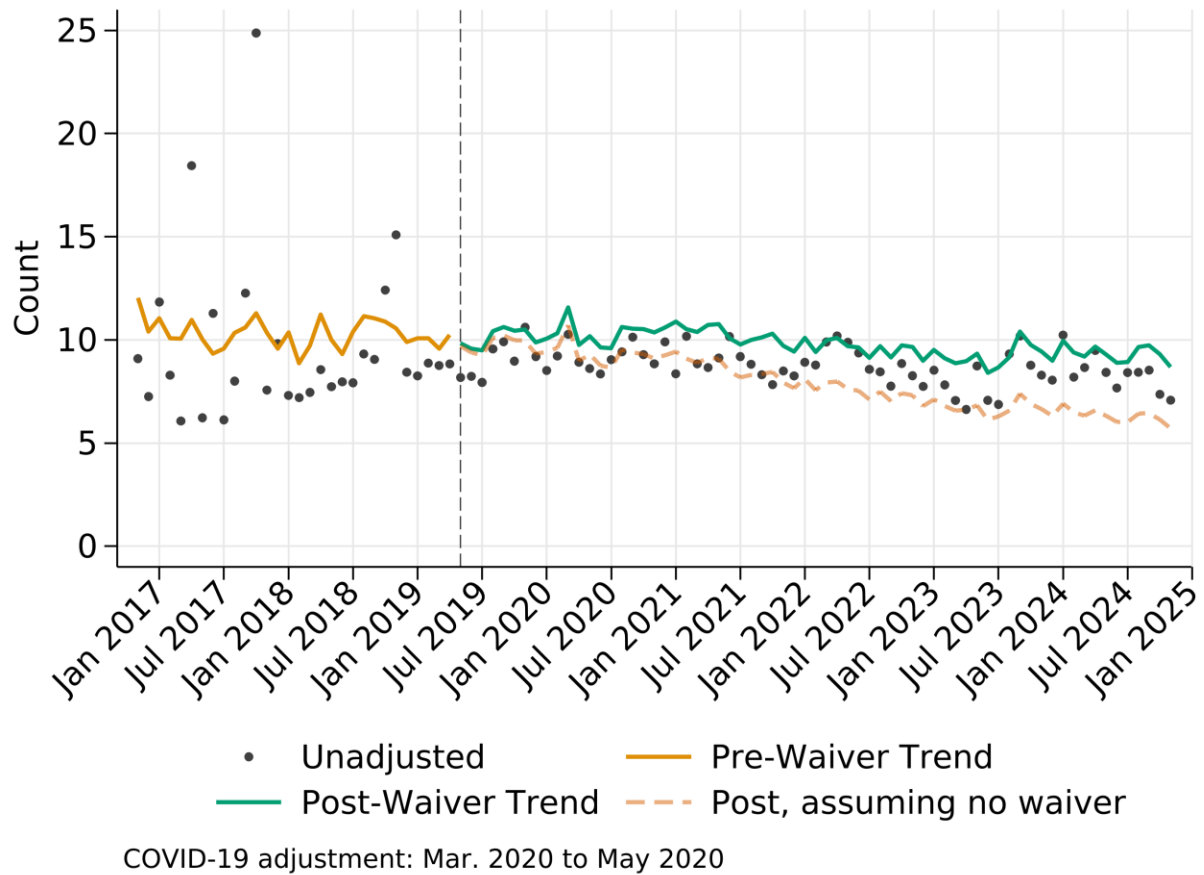
Figure 63: Trends in Medicaid Beneficiaries Treated in an IMD for SUD



Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population with a substance use disorder.

Average Length of Stay in IMDs

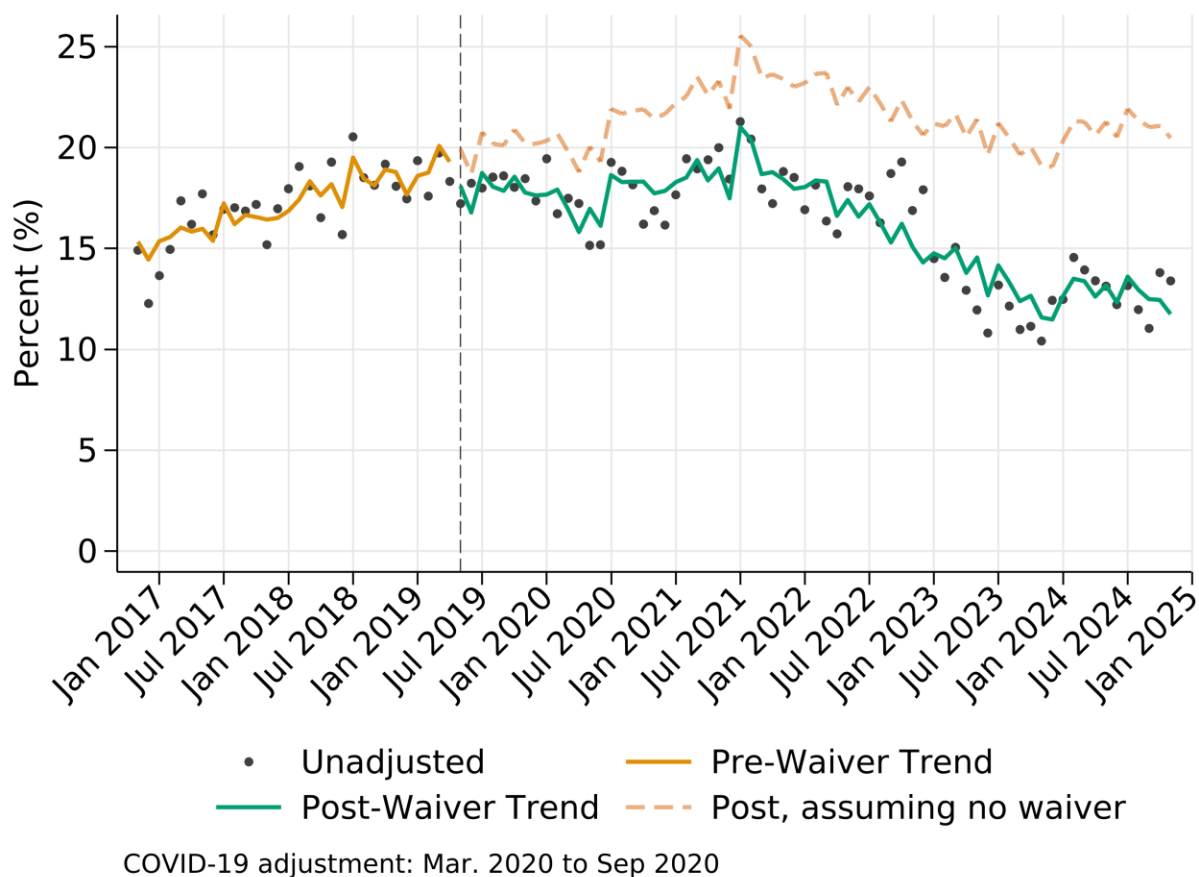
Figure 64: Trends in Average Length of Stay in IMDs



Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a GEE negative binomial regression with an exchangeable correlation structure at the person-level with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population as determined in the metric specifications.

Follow-Up After Emergency Department Visit for Alcohol and Other Drug Abuse or Dependence

Figure 18: Trends in Follow-Up After Emergency Department Visit for Alcohol and Other Drug Abuse or Dependence: Age 18 and older (FUA-AD): 7 days



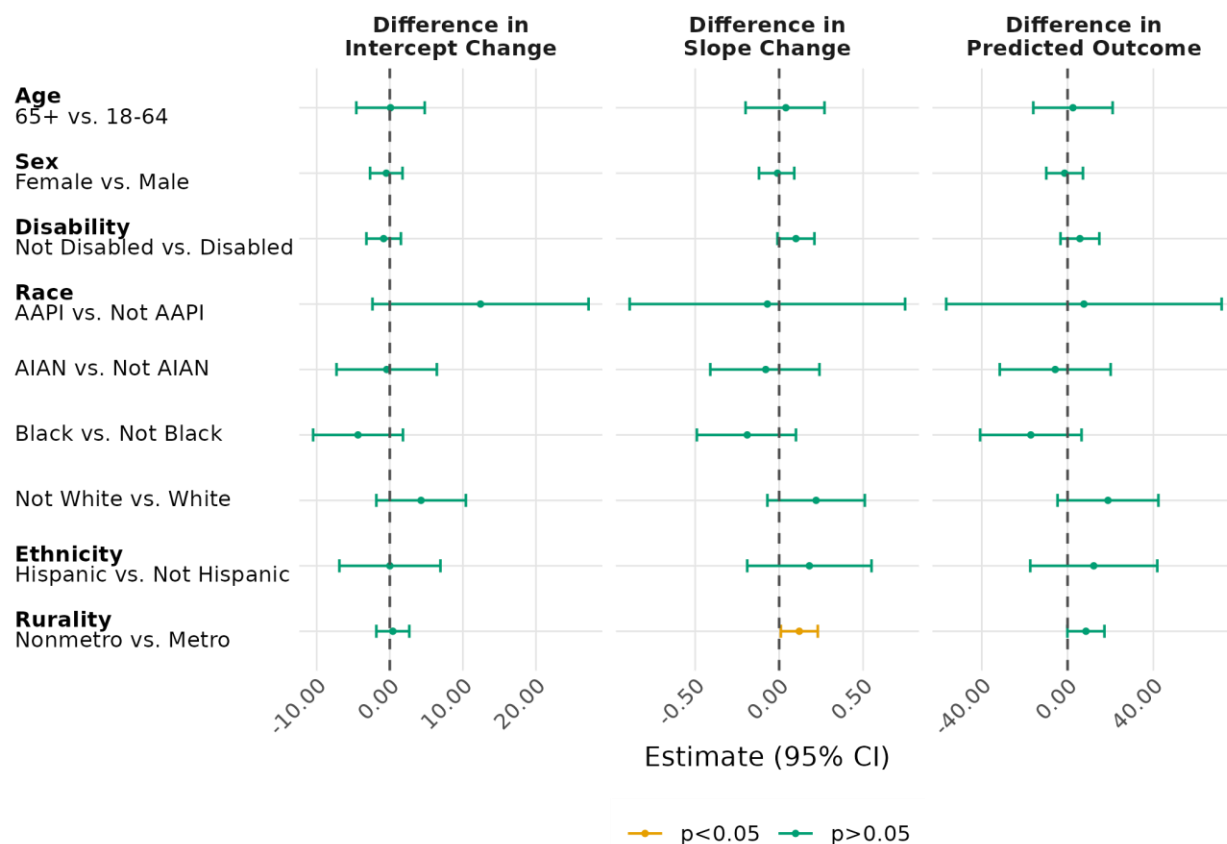
Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model. Estimates were generated from a random 20% sample of individuals (aged 18+) in the NC Medicaid population as determined in the metric specifications.

Table 10: Interrupted time series estimates of Follow-Up After Emergency Department Visit for Alcohol and Other Drug Abuse or Dependence: Age 18 and older (FUA-AD): 7 days

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	22.72* (21.53, 23.91)	20.89* (19.97, 21.81)	-1.83* (-3.11, -0.54)
Monthly Change	0.13* (0.082, 0.18)	0.026 (-0.037, 0.089)	-0.10* (-0.18, -0.024)
Predicted Average Outcome Nov 2024	24.64* (20.40, 28.88)	15.91* (13.81, 18.01)	-8.73* (-14.02, -3.44)
N	96,719		

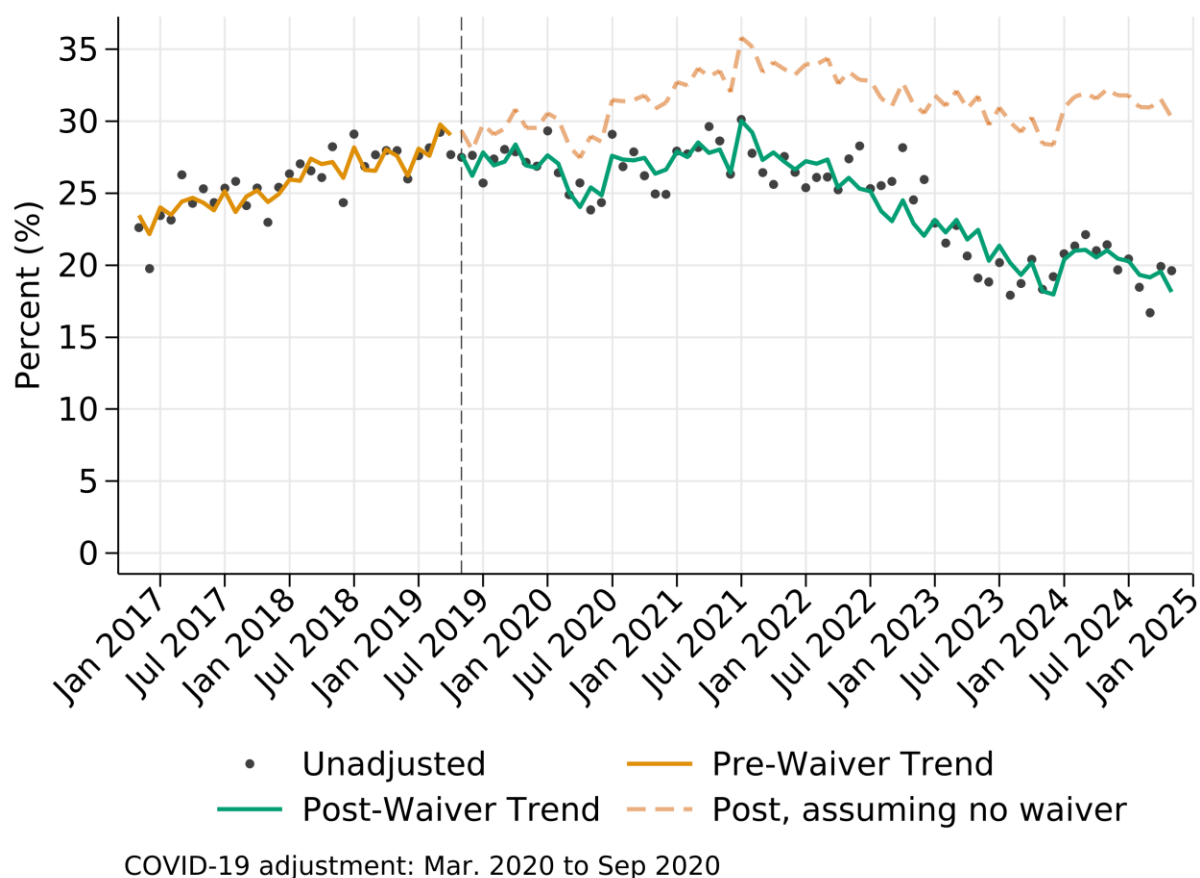
*Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model. Estimates were generated from a random 20% sample of individuals (aged 18+) in the NC Medicaid population as determined in the metric specifications.*

Figure 20: Comparison groups in Follow-Up After Emergency Department Visit for Alcohol and Other Drug Abuse or Dependence: Age 18 and older (FUA-AD): 7 days



Notes: Estimates from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model. Each of the subgroup variables is interacted with the Waiver-specific intercept and slope. The difference in intercept change (for example), is the intercept change for the first subgroup (e.g., 65+) minus the intercept change for the second subgroup (e.g., 18-64).

Figure 19: Trends in Follow-Up After Emergency Department Visit for Alcohol and Other Drug Abuse or Dependence: Age 18 and older (FUA-AD): 30 days



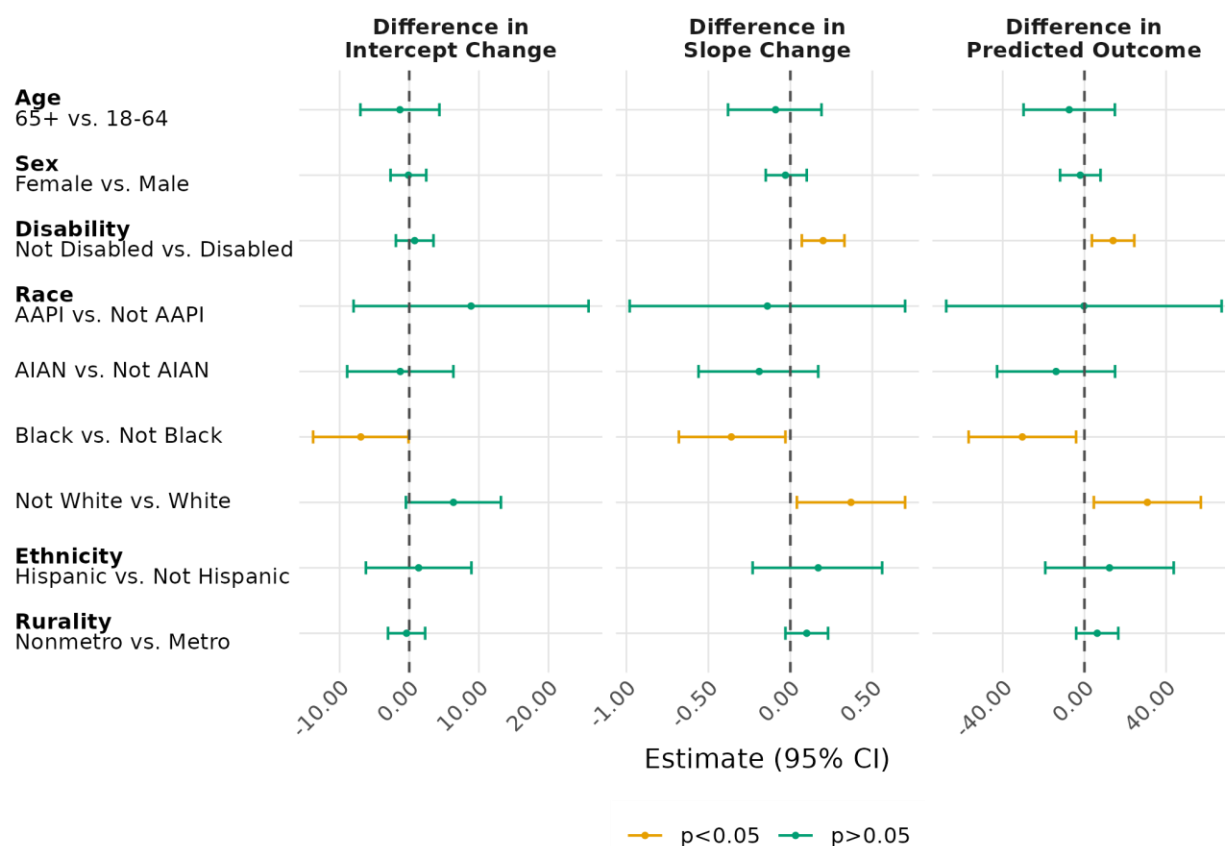
Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model. Estimates were generated from a random 20% sample of individuals (aged 18+) in the NC Medicaid population as determined in the metric specifications.

Table 11: Interrupted time series estimates of Follow-Up After Emergency Department Visit for Alcohol and Other Drug Abuse or Dependence: Age 18 and older (FUA-AD): 30 days

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	32.18* (30.80, 33.56)	30.53* (29.46, 31.60)	-1.65* (-3.14, -0.17)
Monthly Change	0.17* (0.11, 0.22)	0.0085 (-0.064, 0.080)	-0.16* (-0.25, -0.067)
Predicted Average Outcome Nov 2024	35.78* (30.86, 40.71)	23.65* (21.24, 26.05)	-12.14* (-18.23, -6.04)
N	96,719		

*Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model. Estimates were generated from a random 20% sample of individuals (aged 18+) in the NC Medicaid population as determined in the metric specifications.*

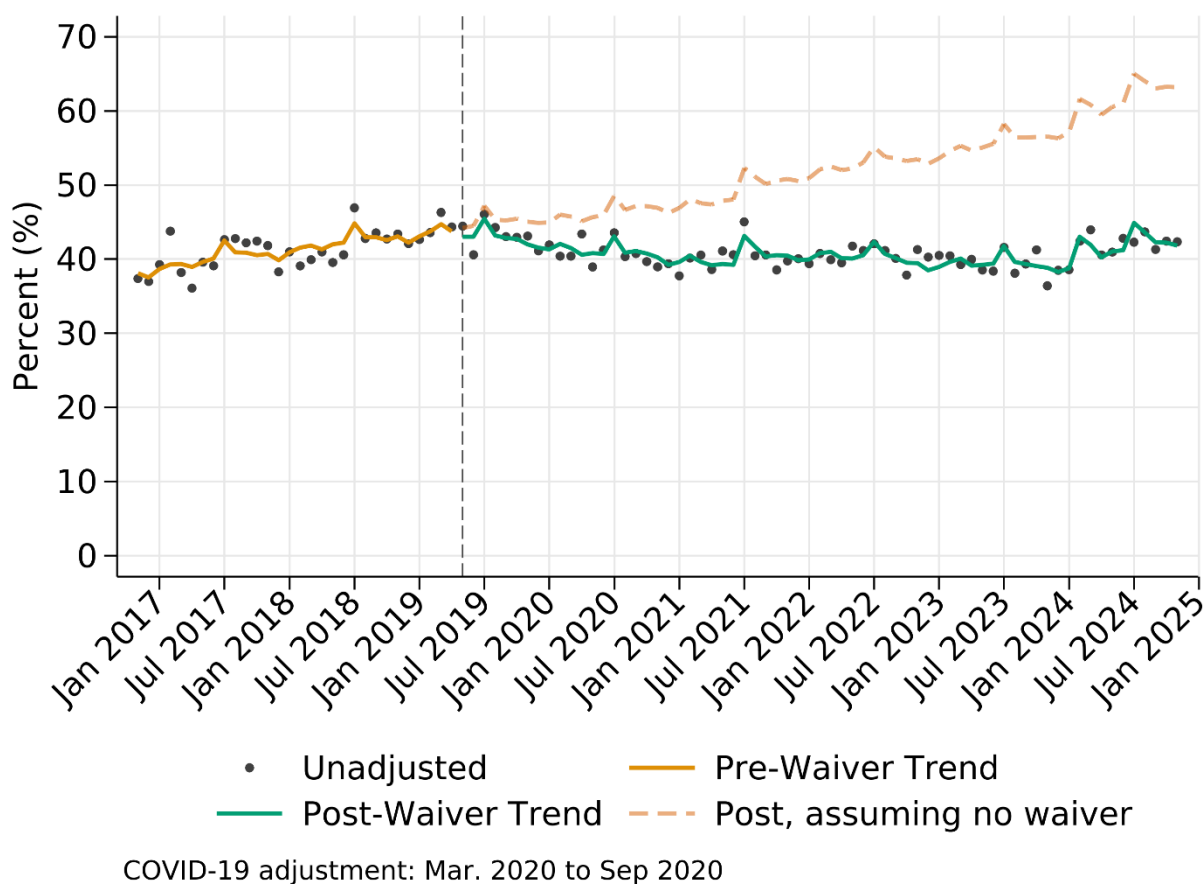
Figure 21: Comparison groups in Follow-Up After Emergency Department Visit for Alcohol and Other Drug Abuse or Dependence: Age 18 and older (FUA-AD): 30 days



Notes: Estimates from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model. Each of the subgroup variables is interacted with the Waiver-specific intercept and slope. The difference in intercept change (for example), is the intercept change for the first subgroup (e.g., 65+) minus the intercept change for the second subgroup (e.g., 18-64).

Initiation and Engagement of Alcohol and Other Drug Abuse or Dependence Treatment (IET-AD)

Figure 65: Trends in Initiation of Alcohol Dependence Treatment (IET-AD)



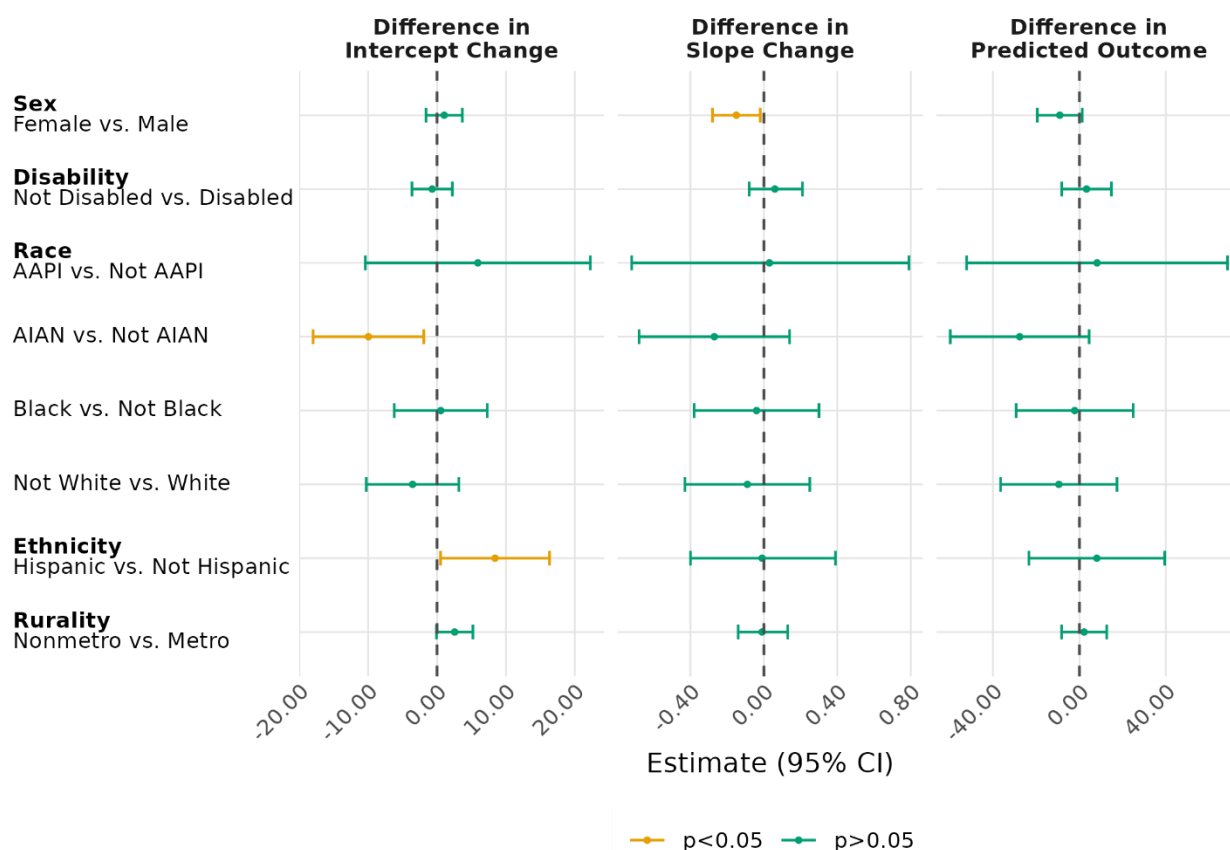
Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model. Estimates were generated from a random 20% sample of individuals (aged 18+) in the NC Medicaid population as determined in the metric specifications.

Table 27: Interrupted time series estimates of Initiation of Alcohol Dependence Treatment (IET-AD)

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	44.39* (42.92, 45.87)	43.20* (42.12, 44.28)	-1.19 (-2.66, 0.28)
Monthly Change	0.17* (0.12, 0.23)	-0.13* (-0.20, -0.060)	-0.31* (-0.40, -0.21)
Predicted Average Outcome Nov 2024	58.47* (53.34, 63.59)	37.11* (35.13, 39.09)	-21.35* (-27.49, -15.22)
N	140,323		

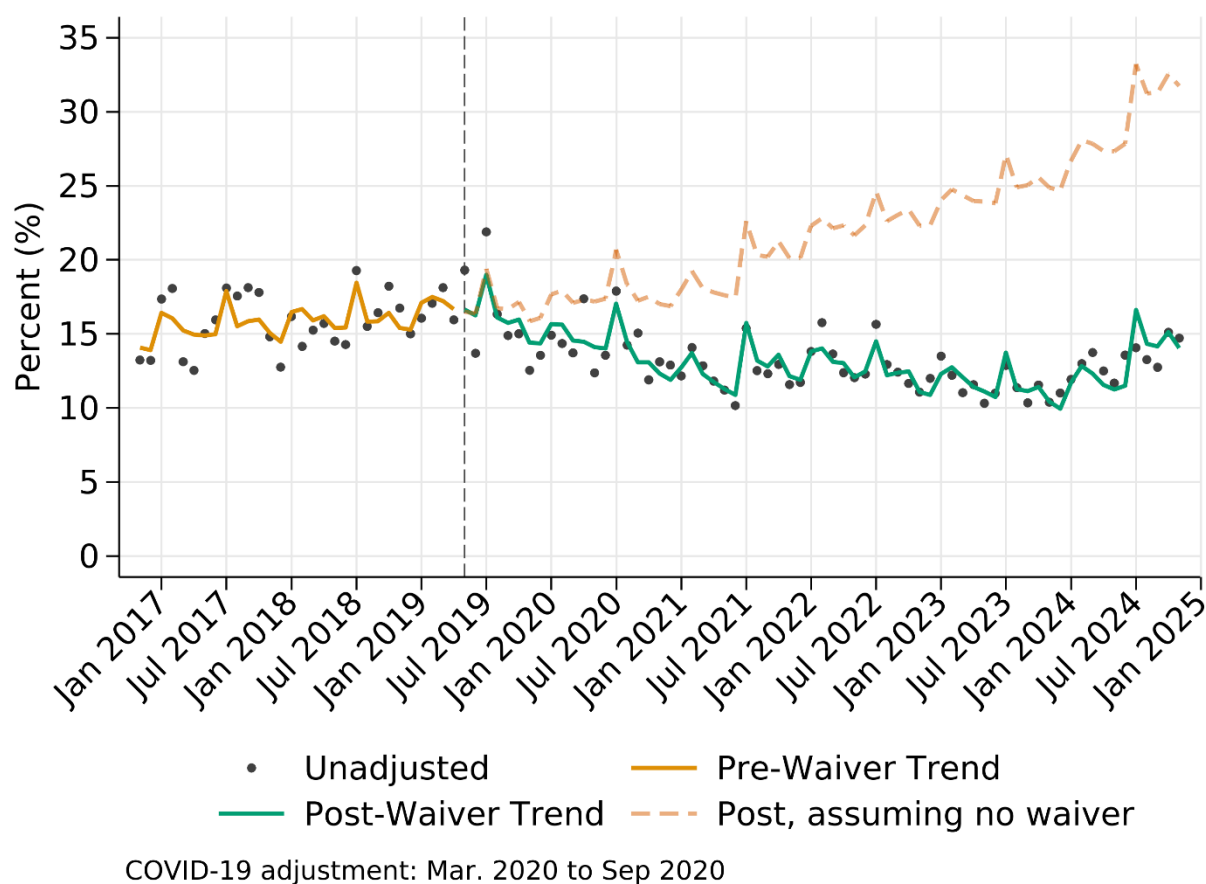
Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model. Estimates were generated from a random 20% sample of individuals (aged 18+) in the NC Medicaid population as determined in the metric specifications.

Figure 66: Comparison groups in Initiation of Alcohol Dependence Treatment (IET-AD)



Notes: Estimates from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model. Each of the subgroup variables is interacted with the Waiver-specific intercept and slope. The difference in intercept change (for example), is the intercept change for the first subgroup (e.g., 65+) minus the intercept change for the second subgroup (e.g., 18-64).

Figure 67: Trends in Engagement of Alcohol Dependence Treatment (IET-AD)



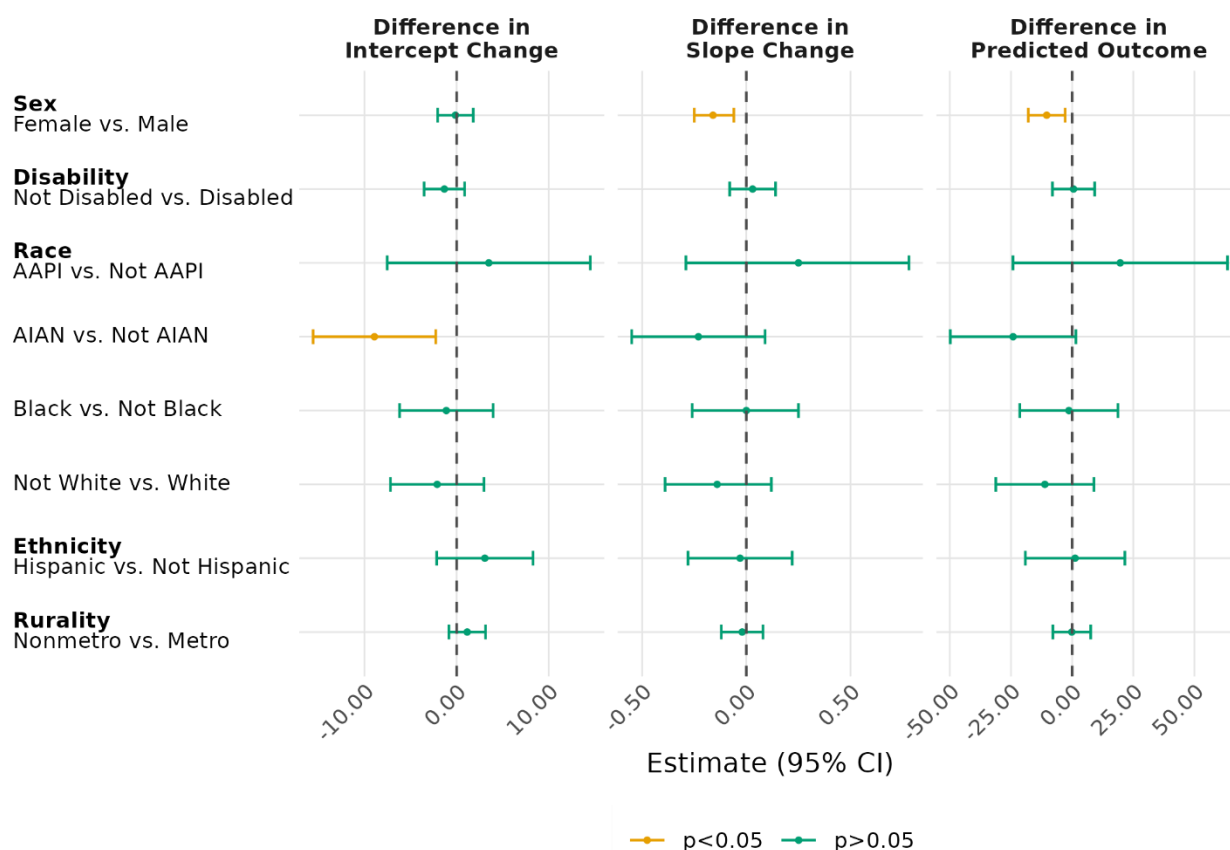
Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model. Estimates were generated from a random 20% sample of individuals (aged 18+) in the NC Medicaid population as determined in the metric specifications.

Table 28: Interrupted time series estimates of Engagement of Alcohol Dependence Treatment (IET-AD)

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	16.74* (15.70, 17.77)	16.90* (16.16, 17.64)	0.16 (-0.90, 1.22)
Monthly Change	0.060* (0.019, 0.10)	-0.21* (-0.26, -0.16)	-0.27* (-0.34, -0.21)
Predicted Average Outcome Nov 2024	24.75* (21.09, 28.42)	7.07* (5.72, 8.41)	-17.69* (-22.01, -13.36)
N	140,323		

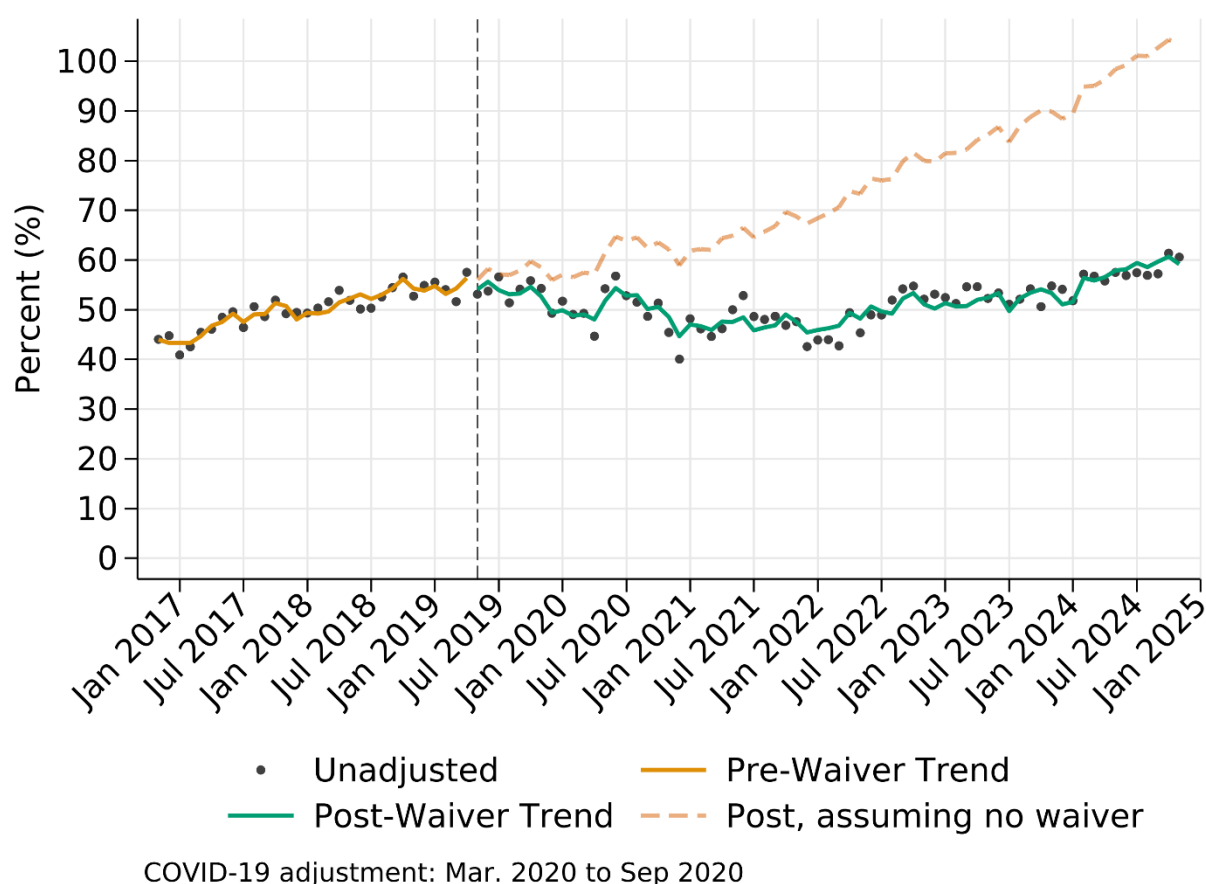
Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model. Estimates were generated from a random 20% sample of individuals (aged 18+) in the NC Medicaid population as determined in the metric specifications.

Figure 68: Comparison groups in Engagement of Alcohol Dependence Treatment (IET-AD)



Notes: Estimates from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model. Each of the subgroup variables is interacted with the Waiver-specific intercept and slope. The difference in intercept change (for example), is the intercept change for the first subgroup (e.g., 65+) minus the intercept change for the second subgroup (e.g., 18-64).

Figure 69: Trends in Initiation of Opioid Dependence Treatment (IET-AD)



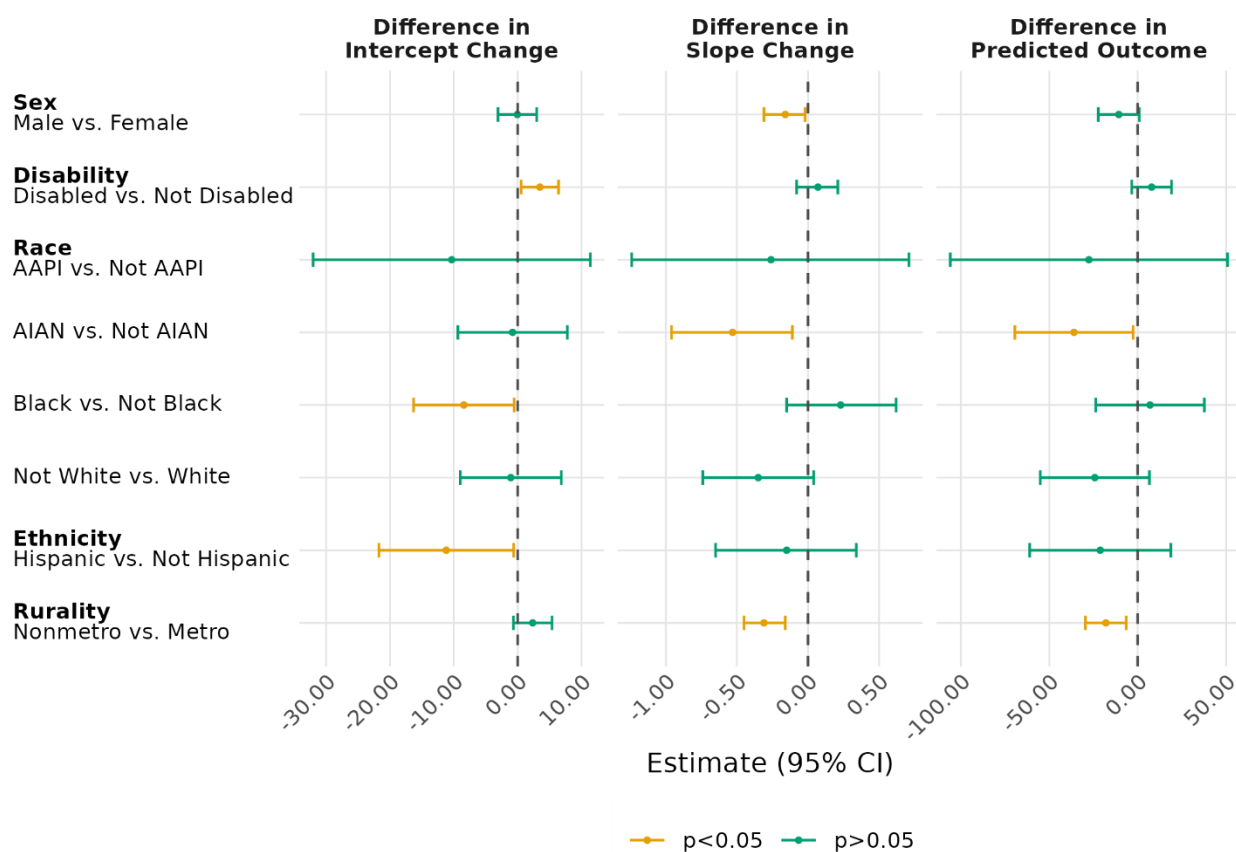
Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model. Estimates were generated from a random 20% sample of individuals (aged 18+) in the NC Medicaid population as determined in the metric specifications.

Table 29: Interrupted time series estimates of Initiation of Opioid Dependence Treatment (IET-AD)

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	50.89* (49.28, 52.51)	48.89* (47.68, 50.09)	-2.01* (-3.65, -0.37)
Monthly Change	0.36* (0.30, 0.42)	-0.28* (-0.36, -0.20)	-0.64* (-0.74, -0.54)
Predicted Average Outcome Nov 2024	89.26* (83.67, 94.85)	44.92* (42.62, 47.22)	-44.34* (-51.08, -37.60)
N	108,546		

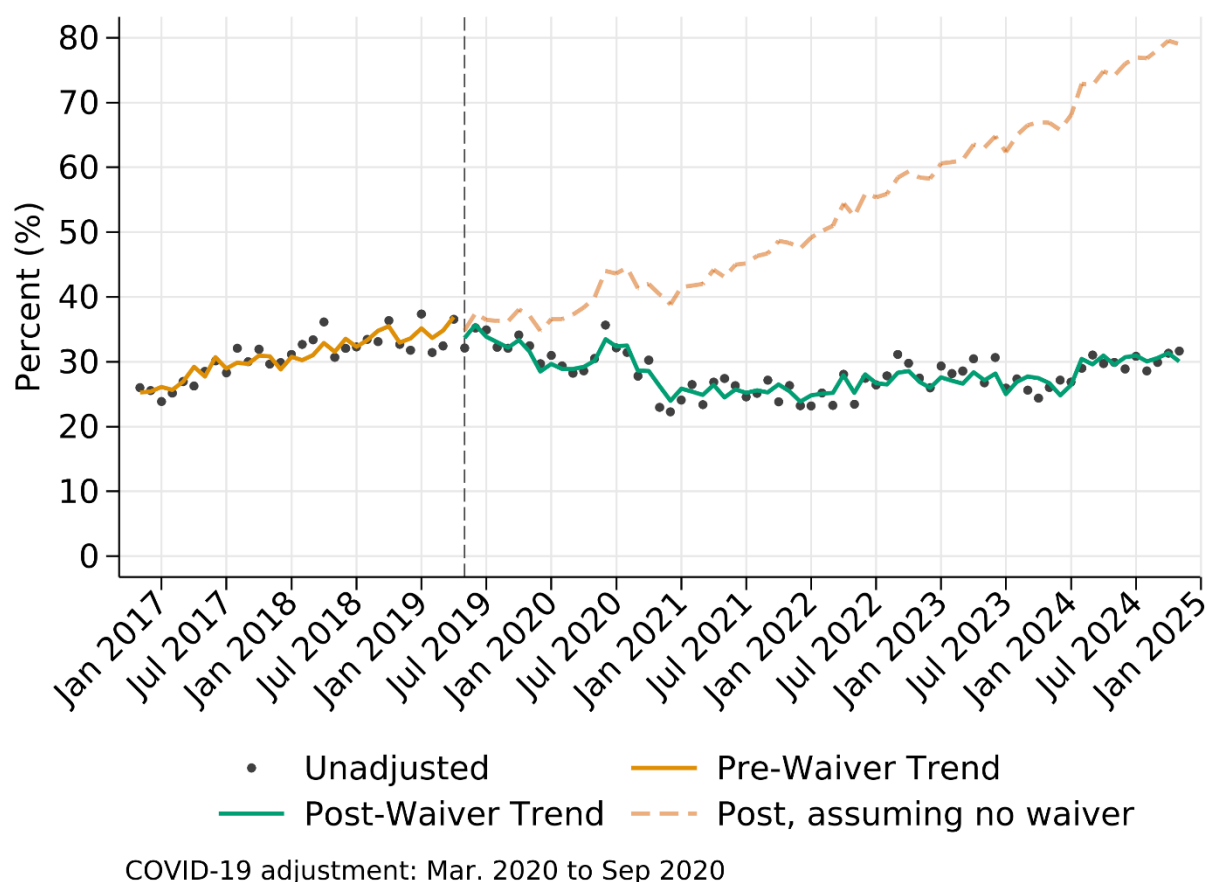
Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model. Estimates were generated from a random 20% sample of individuals (aged 18+) in the NC Medicaid population as determined in the metric specifications.

Figure 70: Comparison groups in Initiation of Opioid Dependence Treatment (IET-AD)



Notes: Estimates from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model. Each of the subgroup variables is interacted with the Waiver-specific intercept and slope. The difference in intercept change (for example), is the intercept change for the first subgroup (e.g., 65+) minus the intercept change for the second subgroup (e.g., 18-64).

Figure 71: Trends in Engagement of Opioid Dependence Treatment (IET-AD)



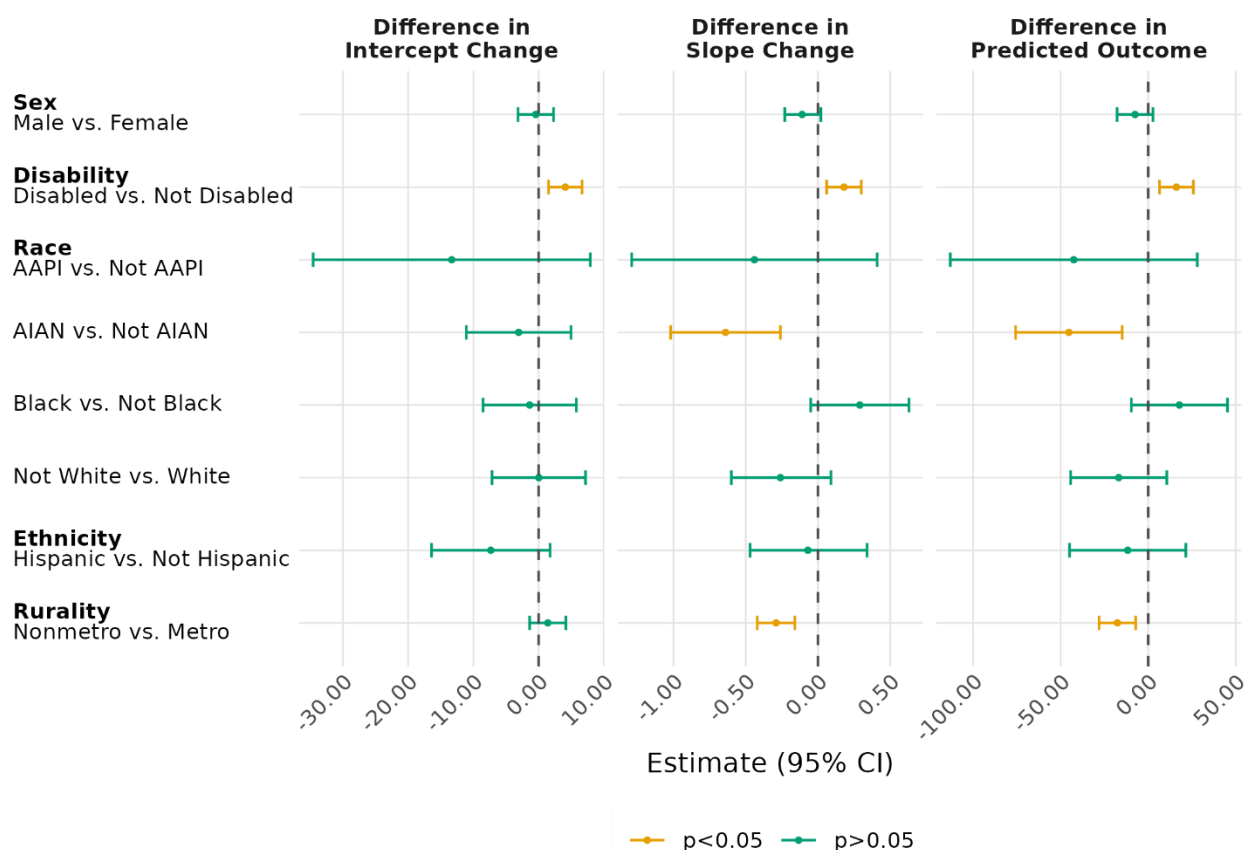
Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model. Estimates were generated from a random 20% sample of individuals (aged 18+) in the NC Medicaid population as determined in the metric specifications.

Table 30: Interrupted time series estimates of Engagement of Opioid Dependence Treatment (IET-AD)

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	31.91* (30.46, 33.37)	30.76* (29.70, 31.82)	-1.16 (-2.69, 0.38)
Monthly Change	0.31* (0.25, 0.36)	-0.42* (-0.49, -0.35)	-0.72* (-0.82, -0.63)
Predicted Average Outcome Nov 2024	65.75* (60.71, 70.80)	16.83* (14.76, 18.89)	-48.93* (-55.00, -42.86)
N	108,546		

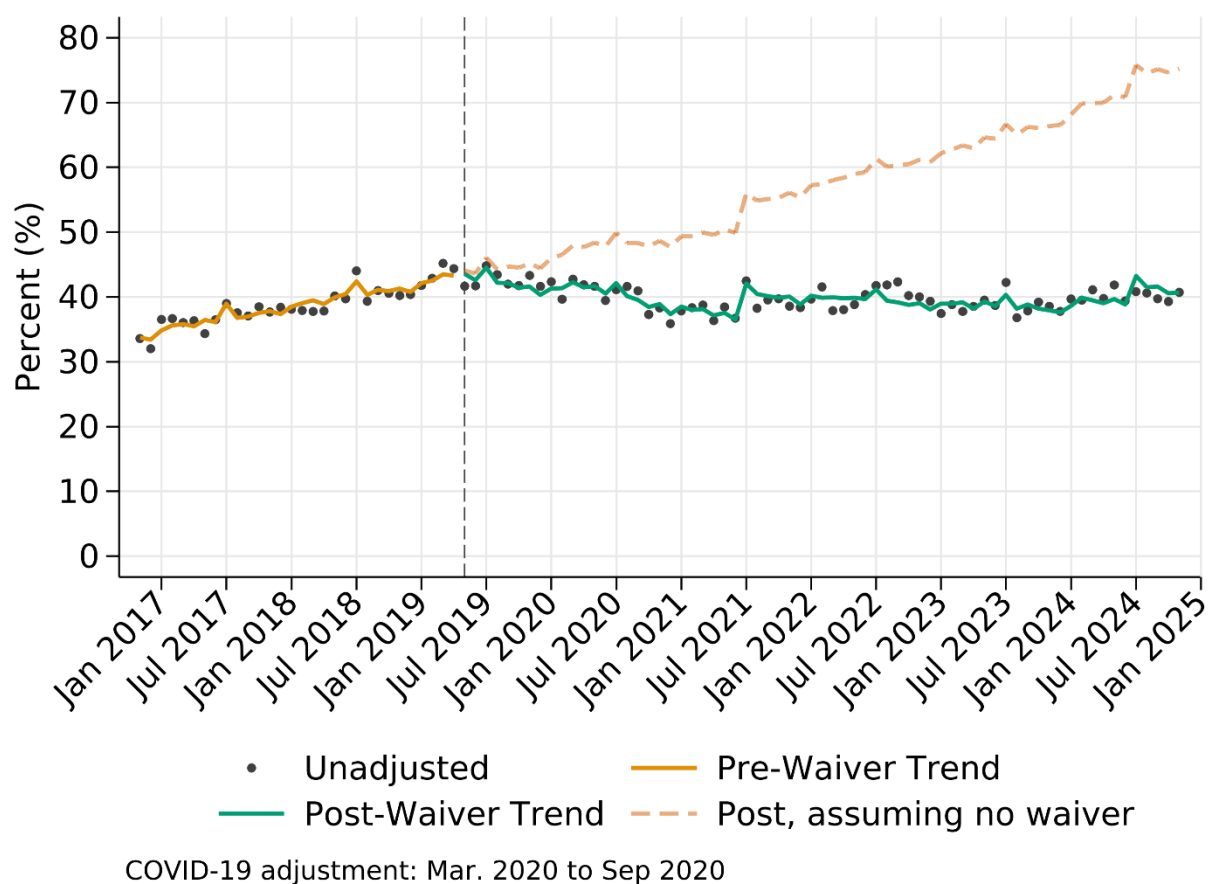
Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model. Estimates were generated from a random 20% sample of individuals (aged 18+) in the NC Medicaid population as determined in the metric specifications.

Figure 72: Comparison groups in Engagement of Opioid Dependence Treatment (IET-AD)



Notes: Estimates from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model. Each of the subgroup variables is interacted with the Waiver-specific intercept and slope. The difference in intercept change (for example), is the intercept change for the first subgroup (e.g., 65+) minus the intercept change for the second subgroup (e.g., 18-64).

Figure 73: Trends in Initiation of Other Drug Dependence Treatment (IET-AD)



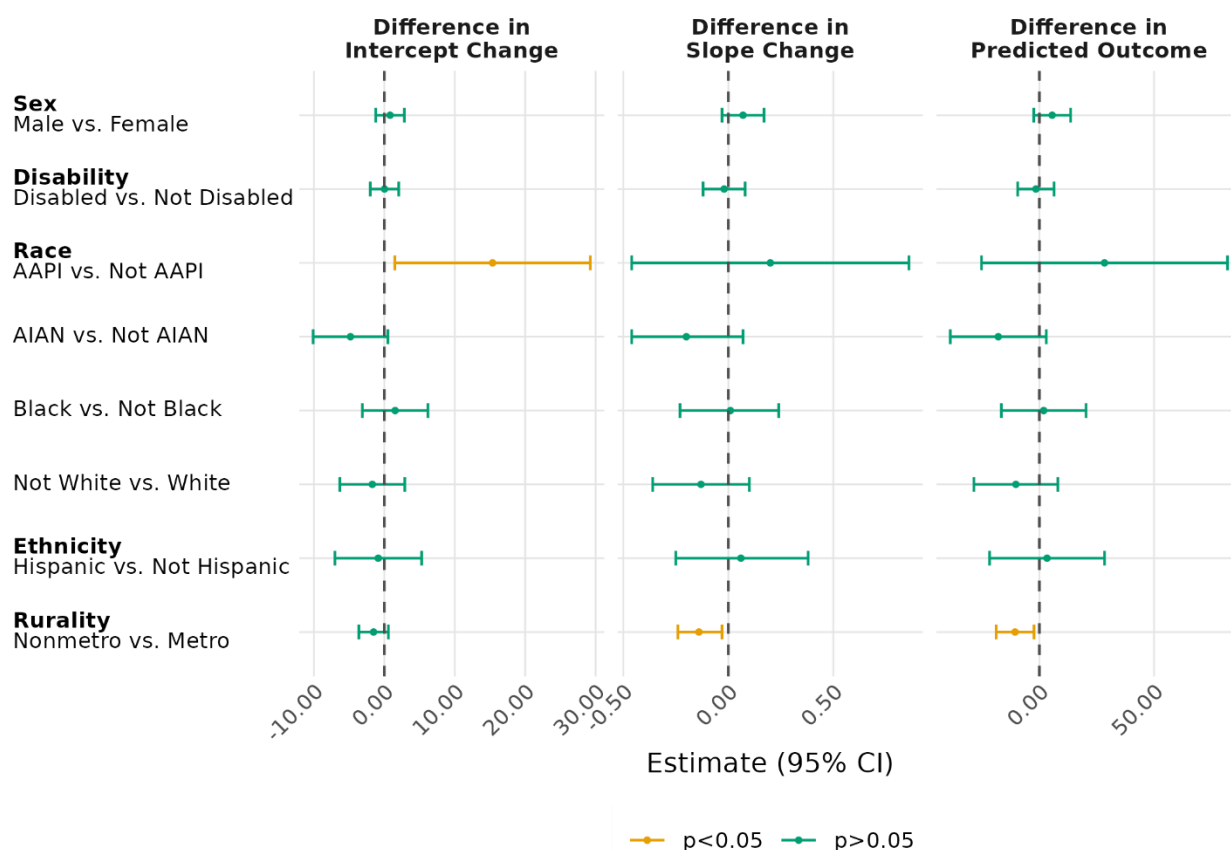
Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model. Estimates were generated from a random 20% sample of individuals (aged 18+) in the NC Medicaid population as determined in the metric specifications.

Table 31: Interrupted time series estimates of Initiation of Other Drug Dependence Treatment (IET-AD)

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	43.41* (42.27, 44.55)	42.90* (42.07, 43.73)	-0.51 (-1.67, 0.64)
Monthly Change	0.28* (0.23, 0.32)	-0.24* (-0.29, -0.18)	-0.52* (-0.59, -0.45)
Predicted Average Outcome Nov 2024	67.37* (63.41, 71.34)	32.78* (31.28, 34.27)	-34.60* (-39.28, -29.91)
N	231,277		

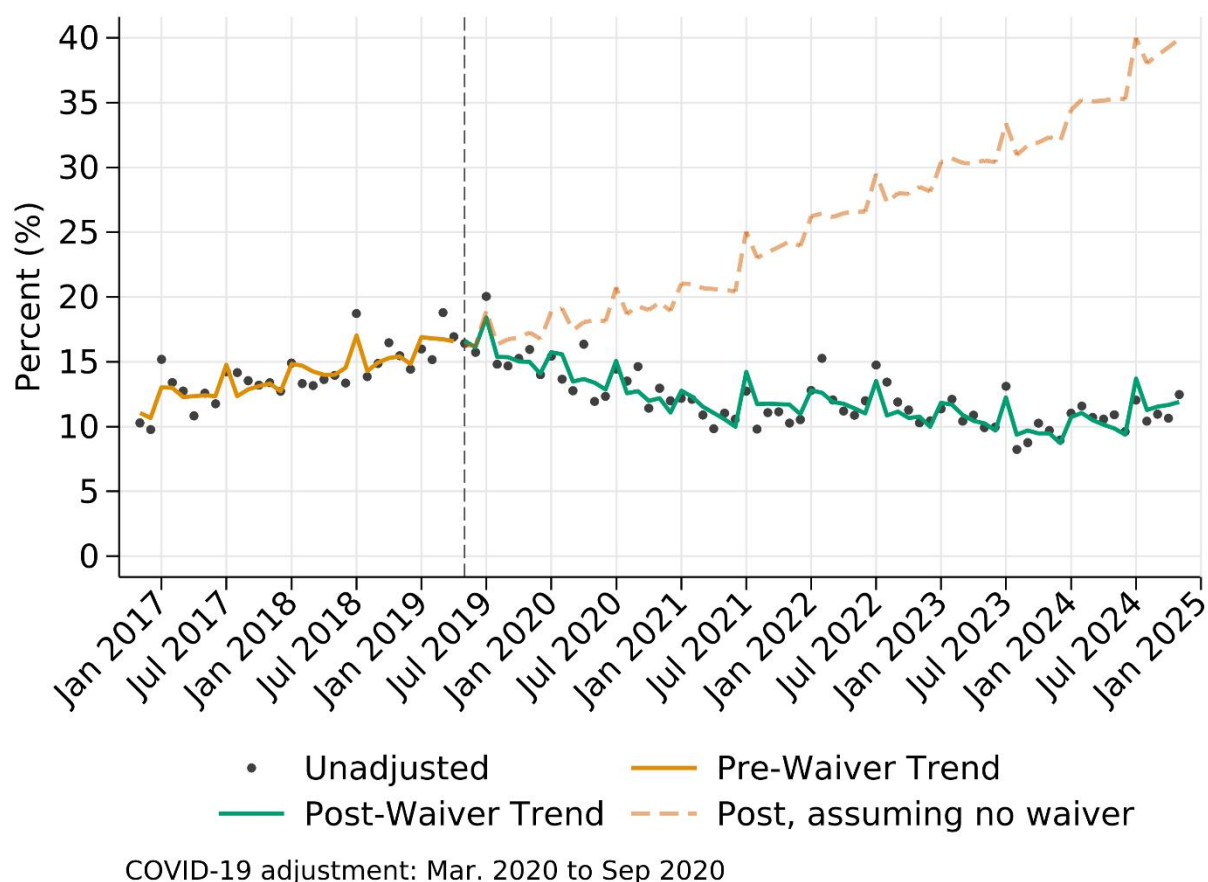
Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model. Estimates were generated from a random 20% sample of individuals (aged 18+) in the NC Medicaid population as determined in the metric specifications.

Figure 74: Comparison groups in Initiation of Other Drug Dependence Treatment (IET-AD)



Notes: Estimates from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model. Each of the subgroup variables is interacted with the Waiver-specific intercept and slope. The difference in intercept change (for example), is the intercept change for the first subgroup (e.g., 65+) minus the intercept change for the second subgroup (e.g., 18-64).

Figure 75: Trends in Engagement of Other Drug Dependence Treatment (IET-AD)



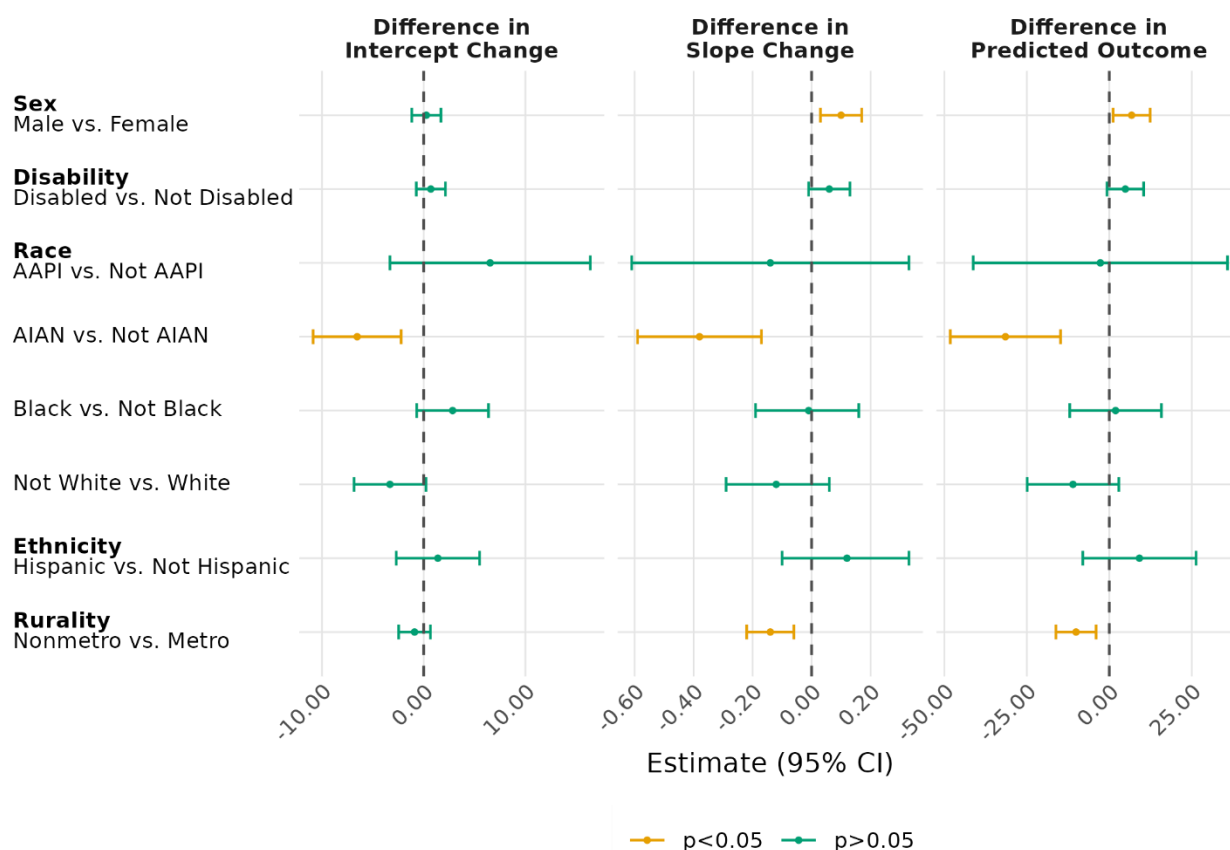
Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model. Estimates were generated from a random 20% sample of individuals (aged 18+) in the NC Medicaid population as determined in the metric specifications.

Table 32: Interrupted time series estimates of Engagement of Other Drug Dependence Treatment (IET-AD)

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	15.82* (15.03, 16.60)	16.13* (15.58, 16.68)	0.32 (-0.51, 1.14)
Monthly Change	0.17* (0.14, 0.20)	-0.26* (-0.30, -0.22)	-0.43* (-0.48, -0.38)
Predicted Average Outcome Nov 2024	32.70* (29.91, 35.48)	4.68* (3.68, 5.68)	-28.02* (-31.28, -24.76)
N	231,277		

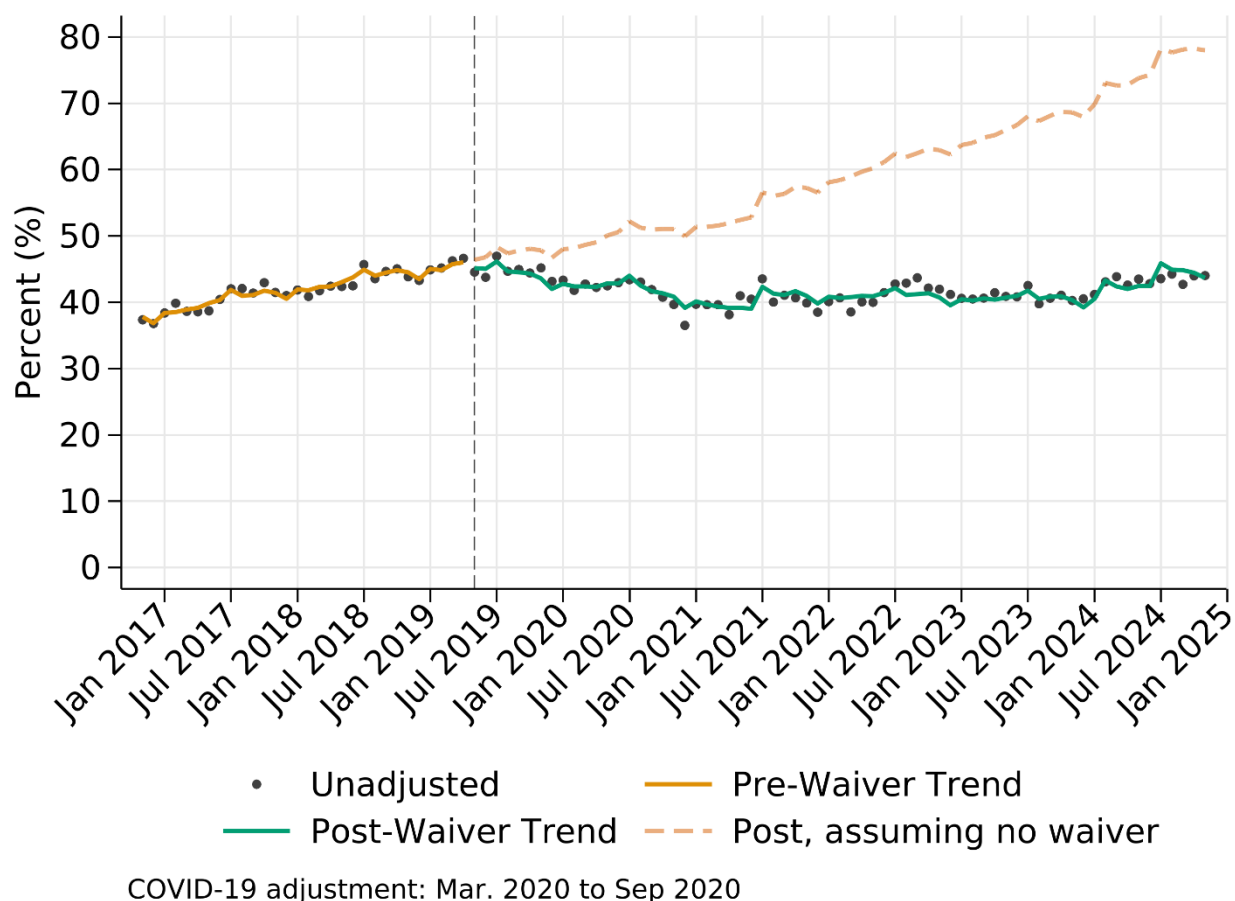
Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model. Estimates were generated from a random 20% sample of individuals (aged 18+) in the NC Medicaid population as determined in the metric specifications.

Figure 76: Comparison groups in Engagement of Other Drug Dependence Treatment (IET-AD)



Notes: Estimates from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model. Each of the subgroup variables is interacted with the Waiver-specific intercept and slope. The difference in intercept change (for example), is the intercept change for the first subgroup (e.g., 65+) minus the intercept change for the second subgroup (e.g., 18-64).

Figure 22: Trends in Initiation of Alcohol and Other Drug Abuse or Dependence Treatment (IET-AD)



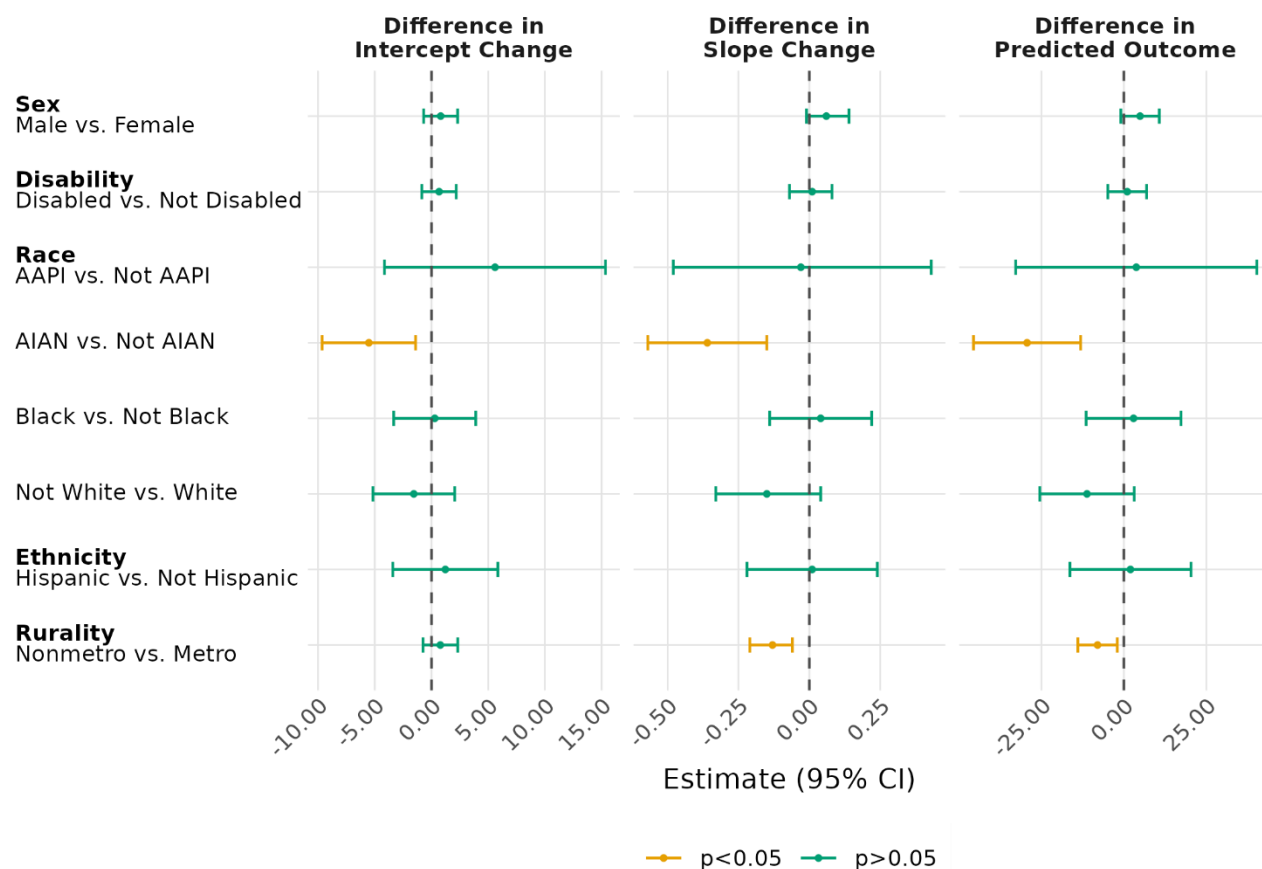
Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model. Estimates were generated from a random 20% sample of individuals (aged 18+) in the NC Medicaid population as determined in the metric specifications.

Table 12: Interrupted time series estimates of Initiation of Alcohol and Other Drug Abuse or Dependence Treatment (IET-AD)

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	45.05* (44.21, 45.88)	43.82* (43.21, 44.44)	-1.22* (-2.07, -0.38)
Monthly Change	0.25* (0.22, 0.28)	-0.25* (-0.29, -0.21)	-0.50* (-0.55, -0.45)
Predicted Average Outcome Nov 2024	69.00* (66.11, 71.90)	34.72* (33.58, 35.85)	-34.29* (-37.75, -30.83)
N	432,268		

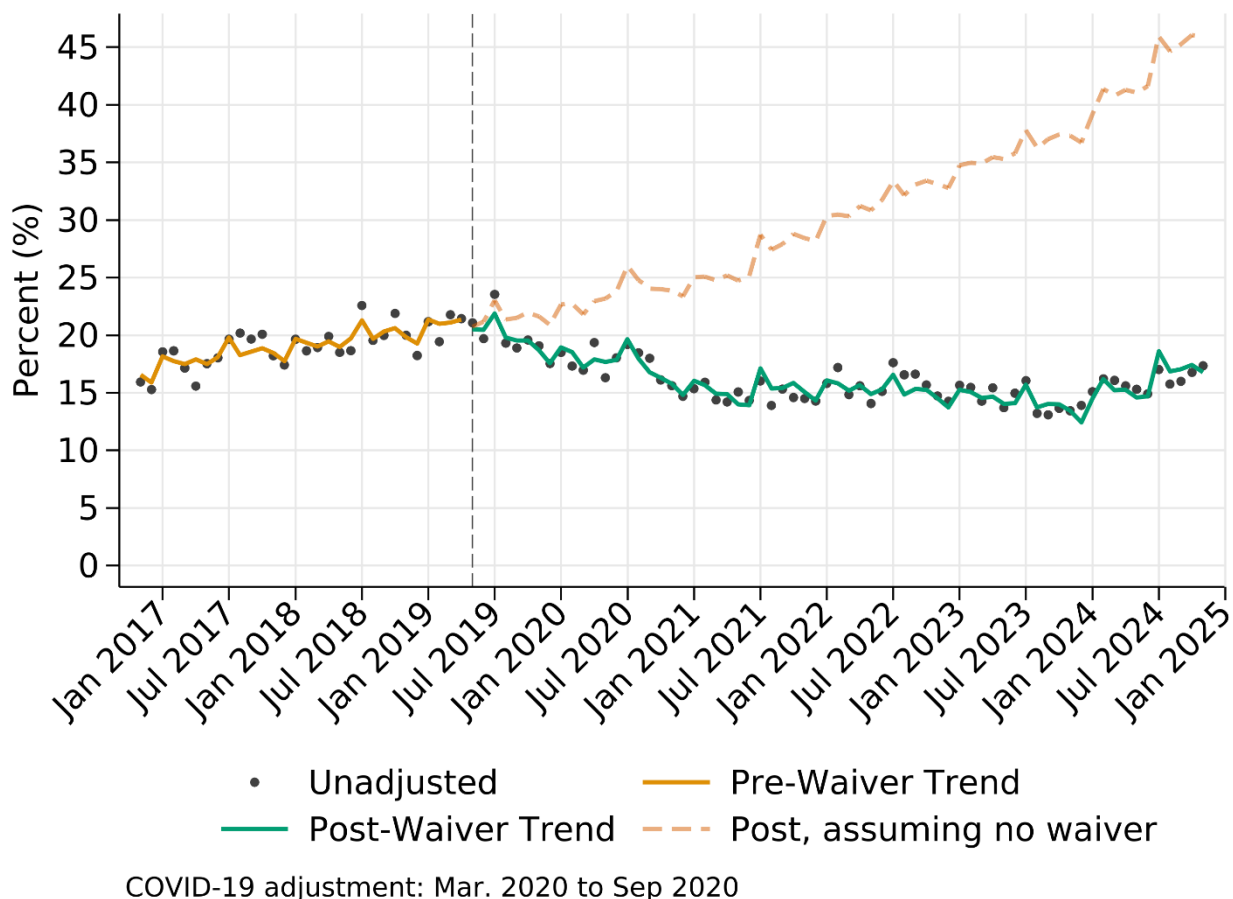
*Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model. Estimates were generated from a random 20% sample of individuals (aged 18+) in the NC Medicaid population as determined in the metric specifications.*

Figure 24: Comparison groups in Initiation of Alcohol and Other Drug Abuse or Dependence Treatment (IET-AD)



Notes: Estimates from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model. Each of the subgroup variables is interacted with the Waiver-specific intercept and slope. The difference in intercept change (for example), is the intercept change for the first subgroup (e.g., 65+) minus the intercept change for the second subgroup (e.g., 18-64).

Figure 23: Trends in Engagement of Alcohol and Other Drug Abuse or Dependence Treatment (IET-AD)



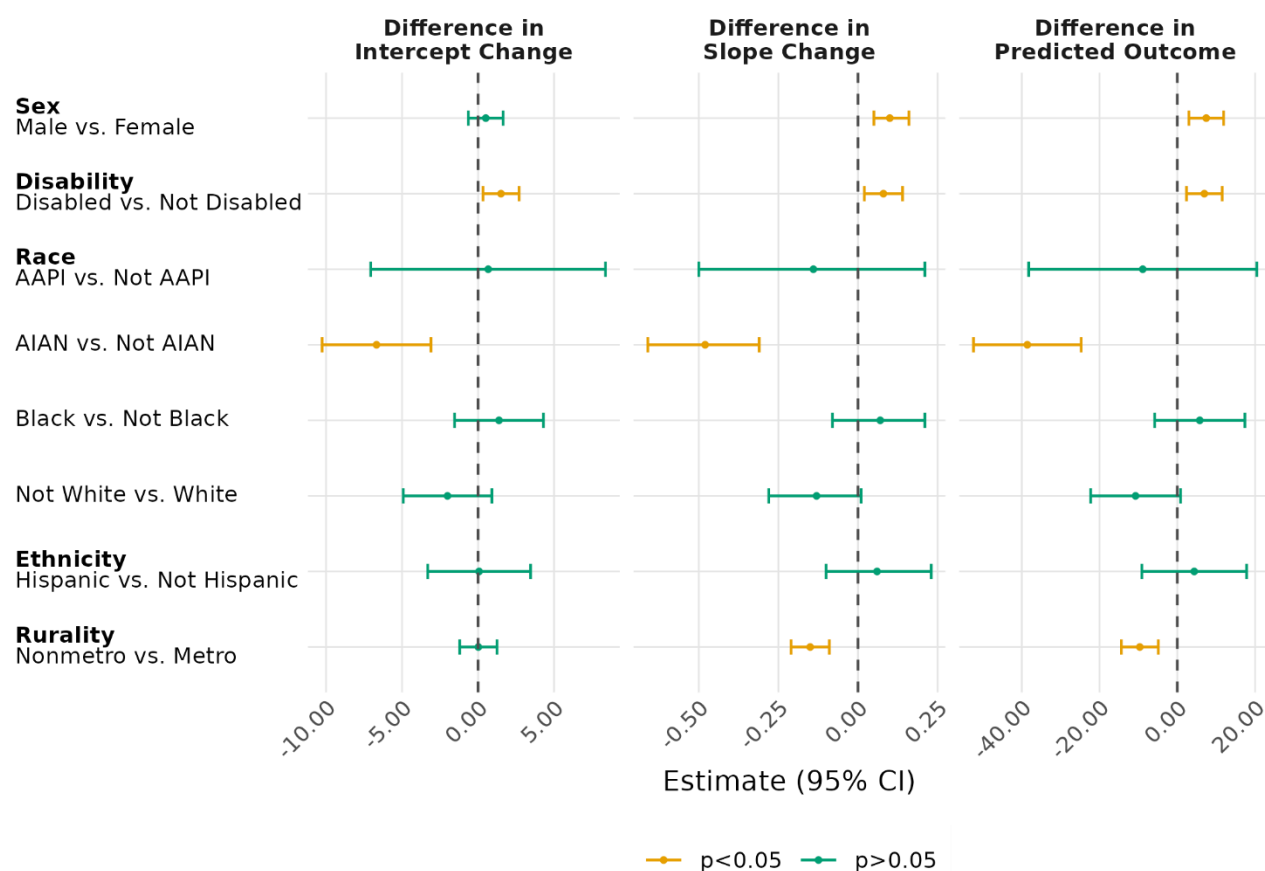
Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model. Estimates were generated from a random 20% sample of individuals (aged 18+) in the NC Medicaid population as determined in the metric specifications.

Table 13: Interrupted time series estimates of Engagement of Alcohol and Other Drug Abuse or Dependence Treatment (IET-AD)

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	20.14* (19.51, 20.77)	19.89* (19.44, 20.34)	-0.25 (-0.91, 0.42)
Monthly Change	0.14* (0.12, 0.17)	-0.29* (-0.32, -0.26)	-0.44* (-0.48, -0.40)
Predicted Average Outcome Nov 2024	36.90* (34.66, 39.14)	7.79* (6.95, 8.63)	-29.11* (-31.75, -26.46)
N	432,268		

*Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model. Estimates were generated from a random 20% sample of individuals (aged 18+) in the NC Medicaid population as determined in the metric specifications.*

Figure 25: Comparison groups in Engagement of Alcohol and Other Drug Abuse or Dependence Treatment (IET-AD)



Notes: Estimates from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model. Each of the subgroup variables is interacted with the Waiver-specific intercept and slope. The difference in intercept change (for example), is the intercept change for the first subgroup (e.g., 65+) minus the intercept change for the second subgroup (e.g., 18-64).

Overdose Deaths

Figure 77: Trends in Overdose Deaths (rate)

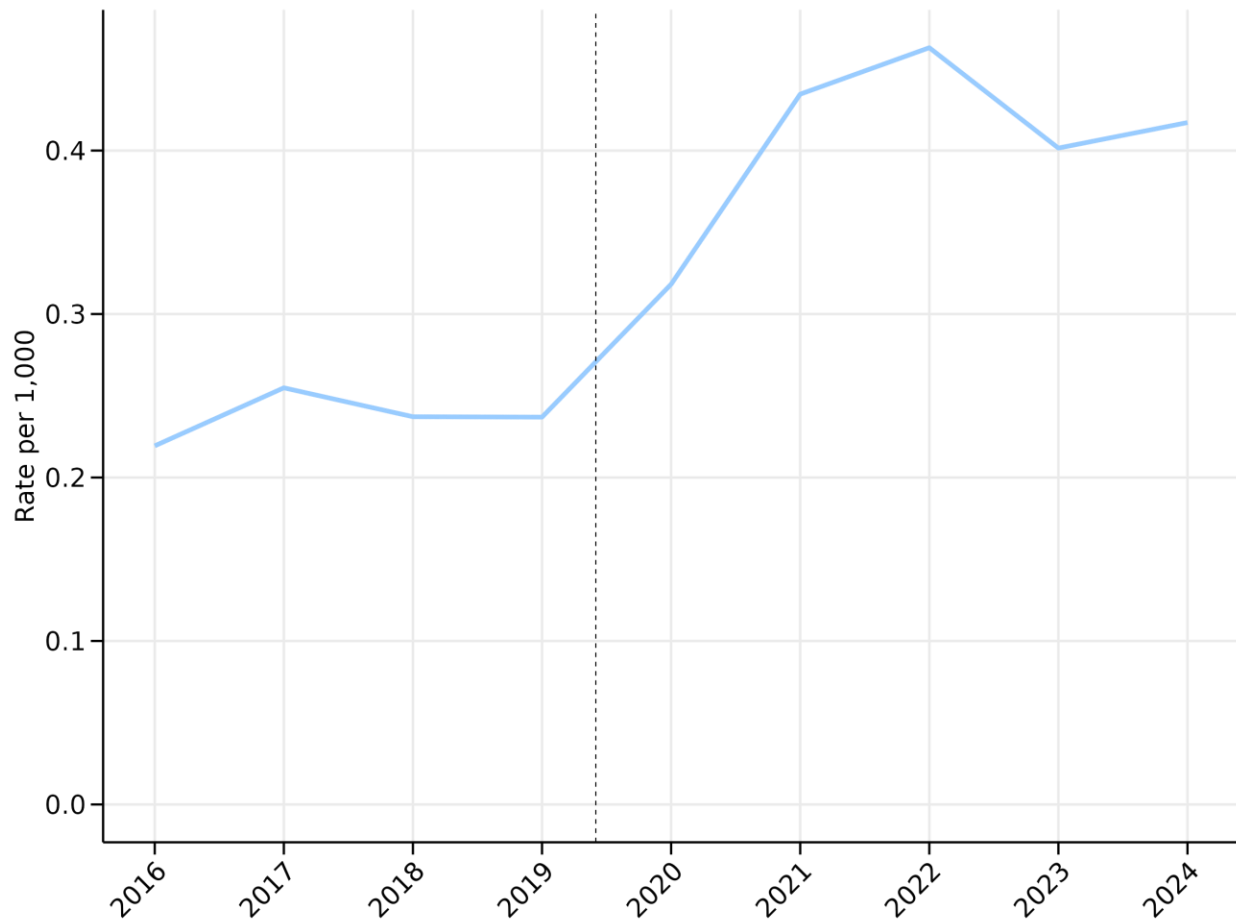


Figure 78: Trends in OUD Overdose Deaths (rate)

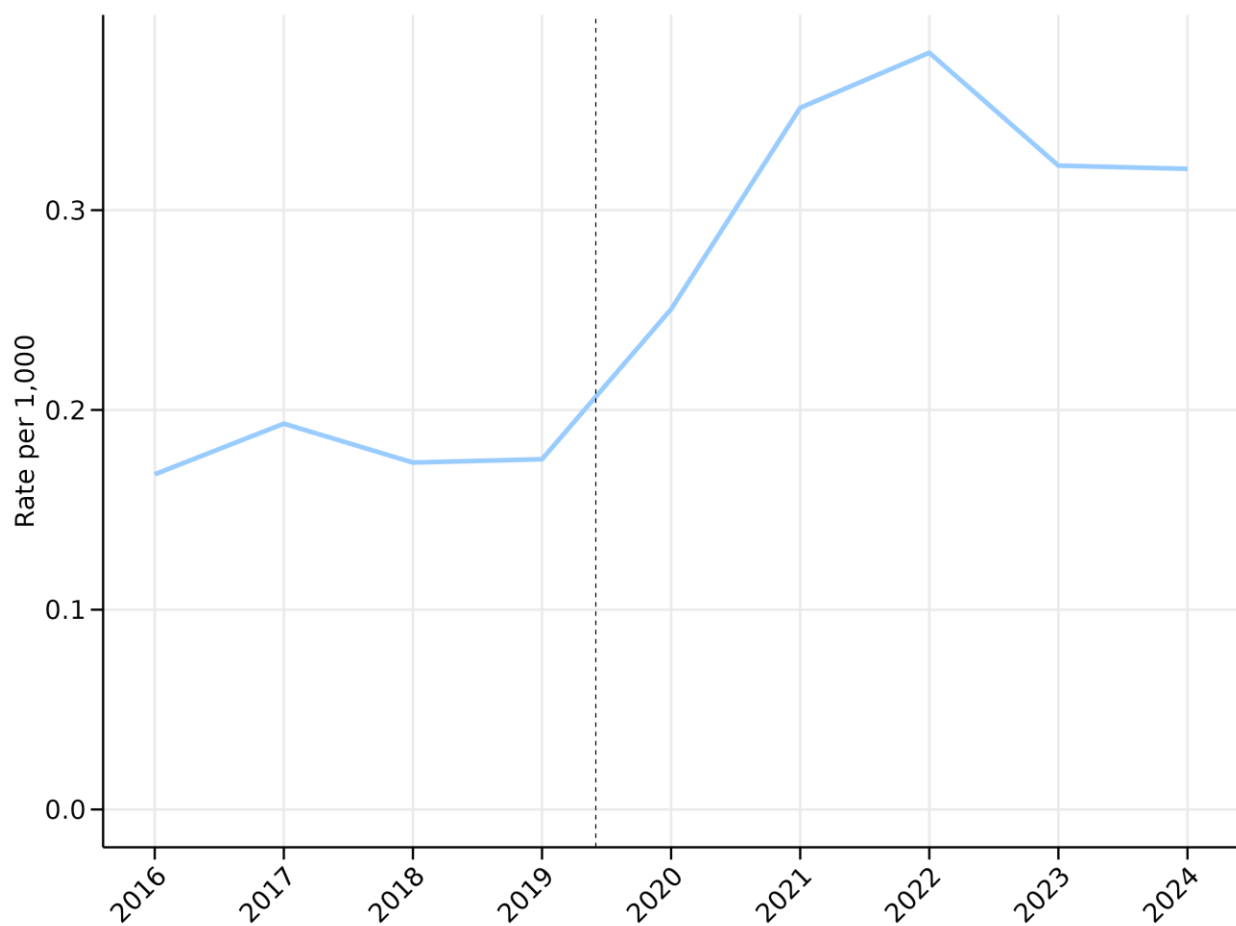
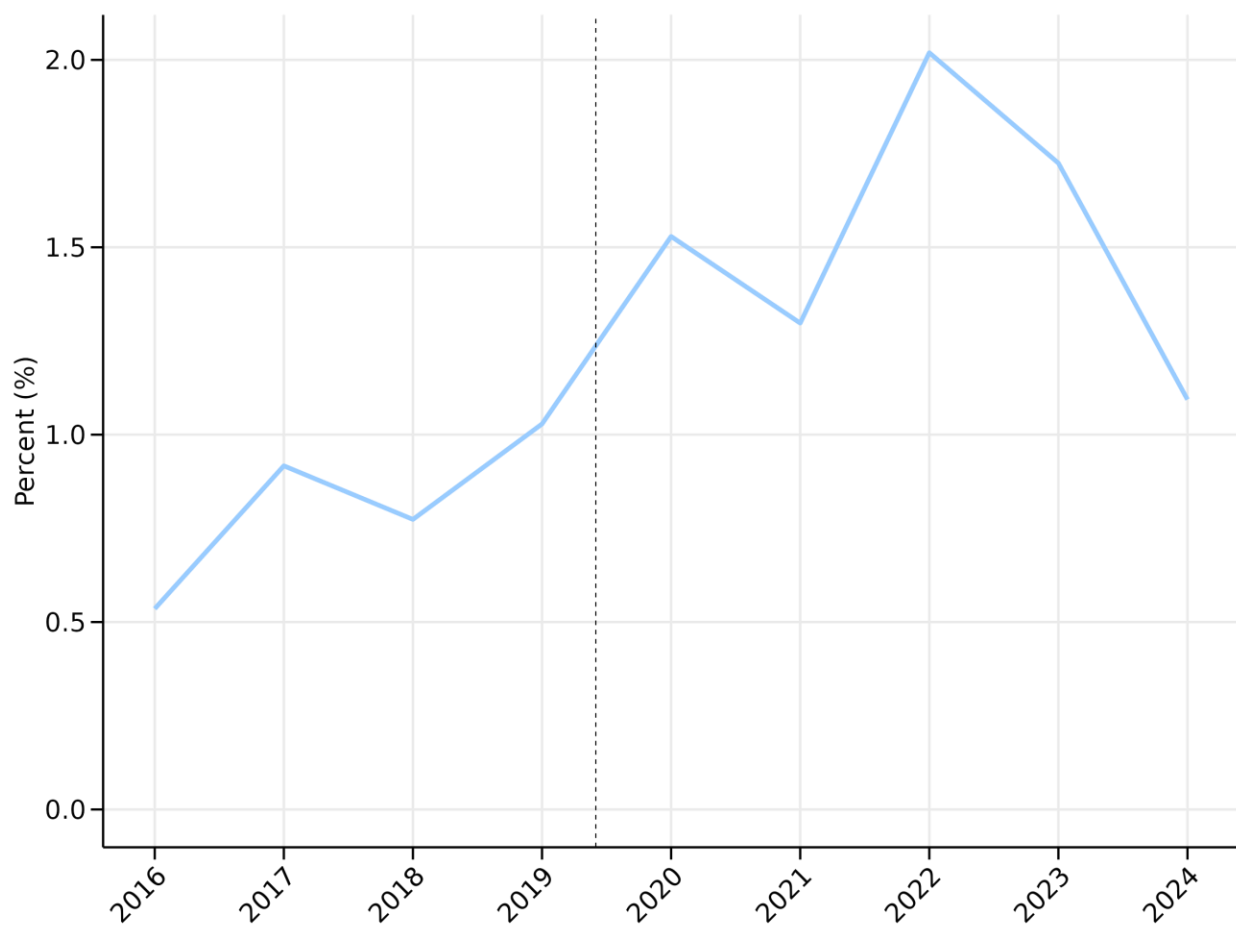


Figure 79: Trends in Death Rate from Overdose Post-prison Release



SUD Provider Availability

Figure 80: Counts of SUD Provider Availability

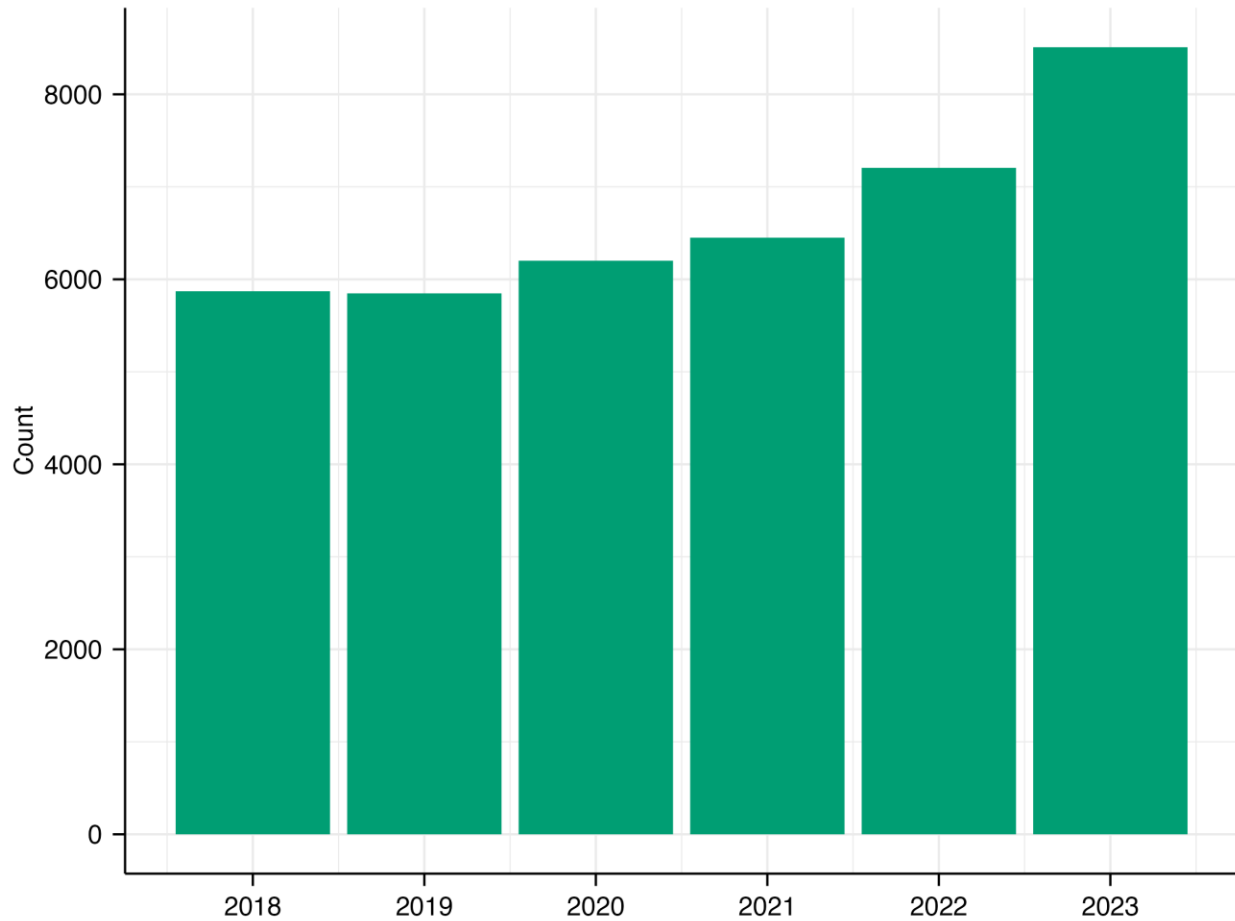
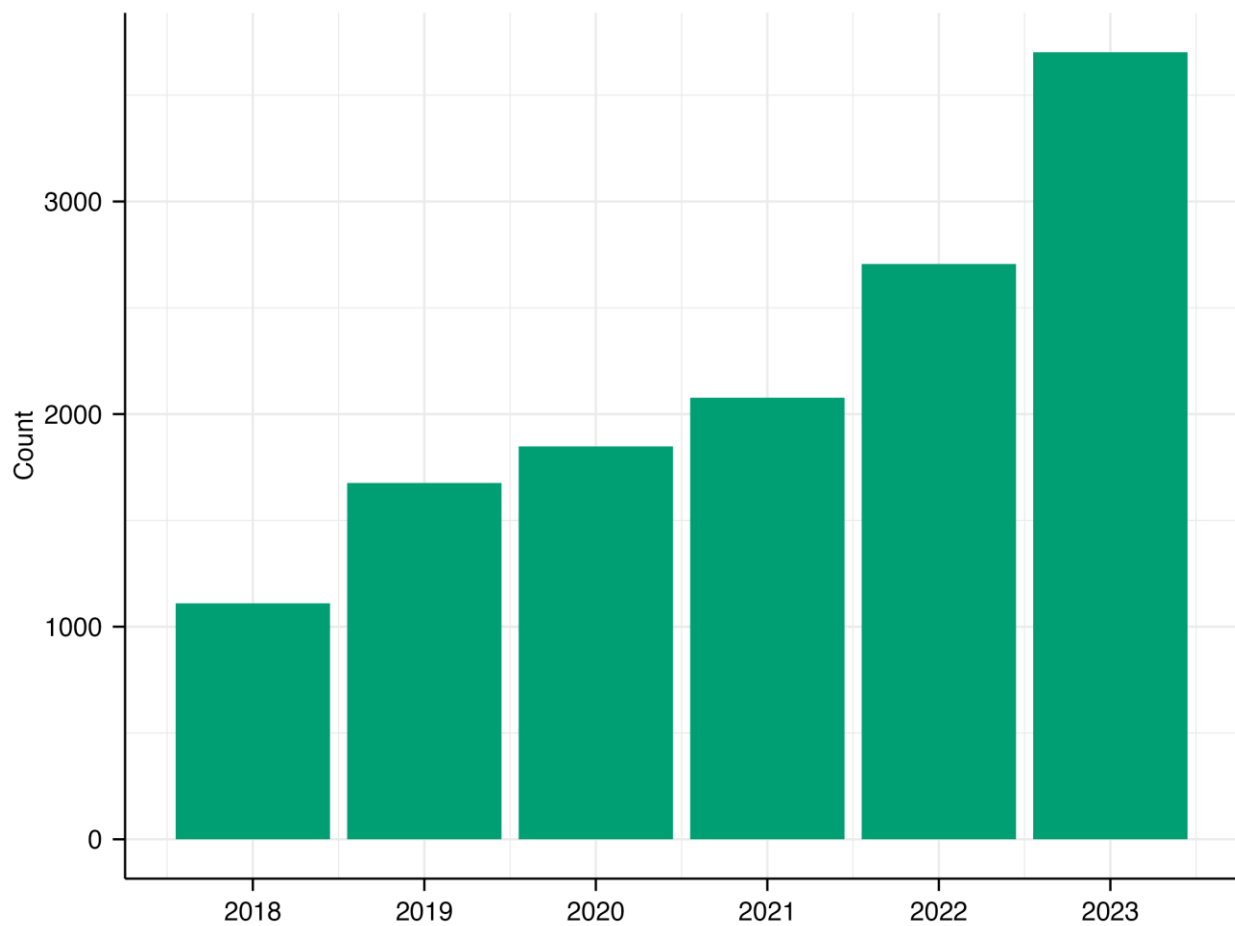
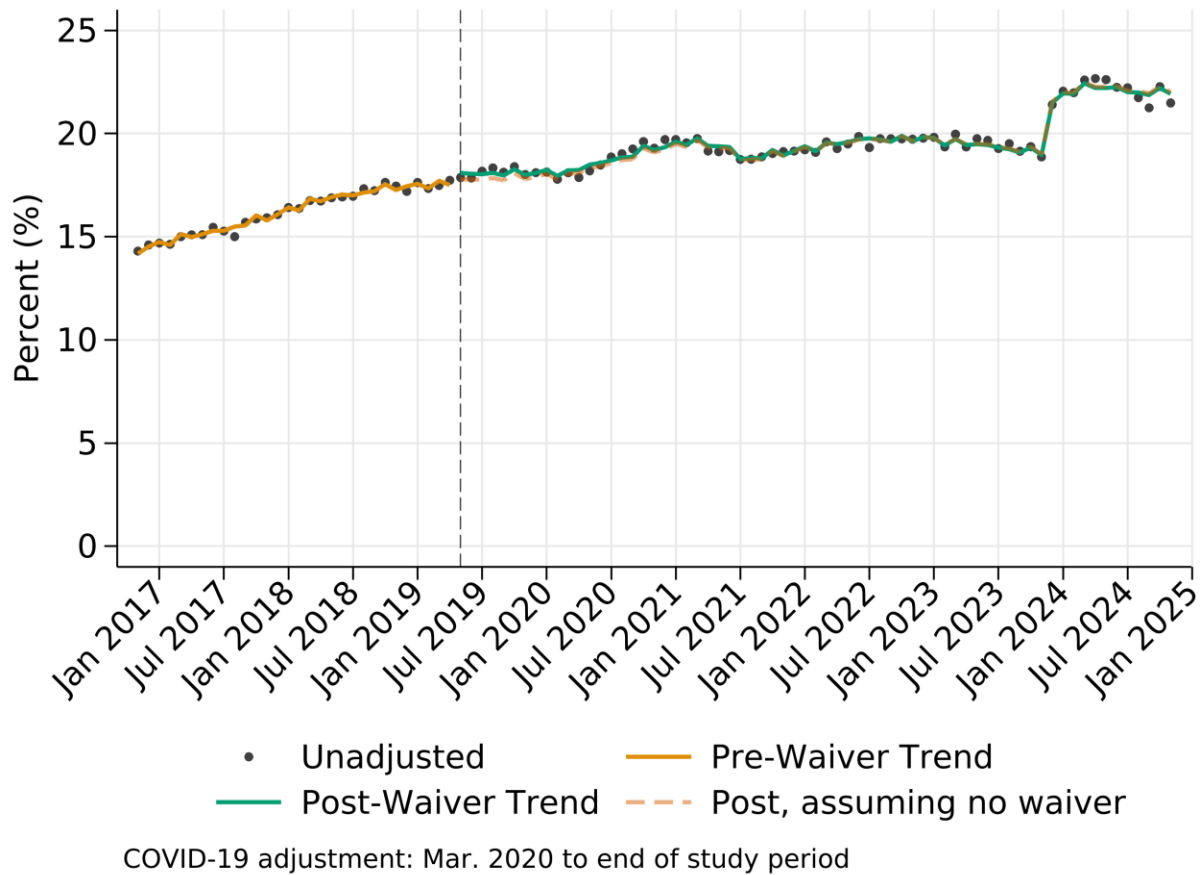


Figure 81: Counts of SUD Provider Availability (MAT)



Medication Assisted Treatment (SUD)

Figure 82: Trends in Medication Assisted Treatment (SUD)



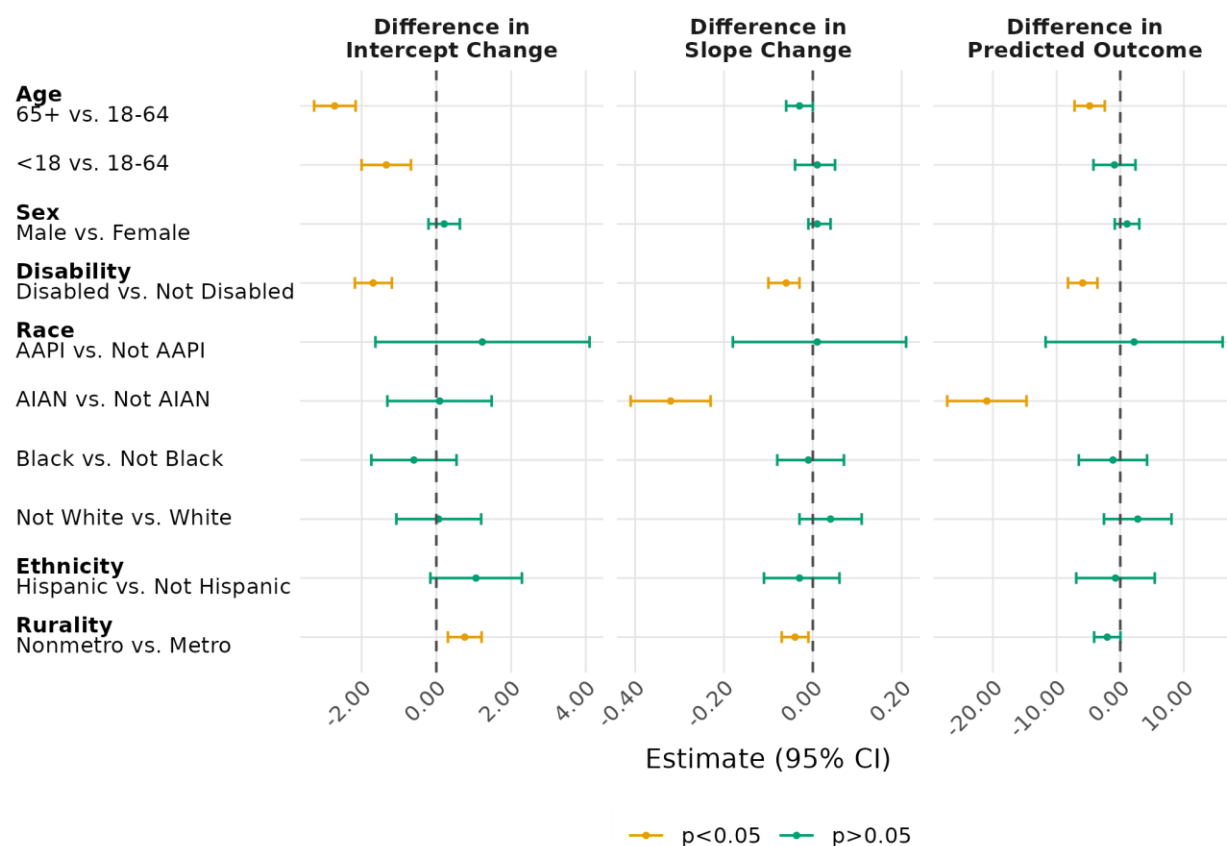
Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population with a substance use disorder.

Table 33: Interrupted time series estimates of Medication Assisted Treatment (SUD)

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	18.90* (18.41, 19.40)	19.41* (19.00, 19.81)	0.50* (0.20, 0.81)
Monthly Change	0.032 (-0.0071, 0.072)	0.024 (-0.040, 0.088)	-0.0078 (-0.076, 0.060)
Predicted Average Outcome Nov 2024	20.13* (15.69, 24.57)	20.12* (19.03, 21.20)	-0.012 (-4.44, 4.42)
N	7,656,186		

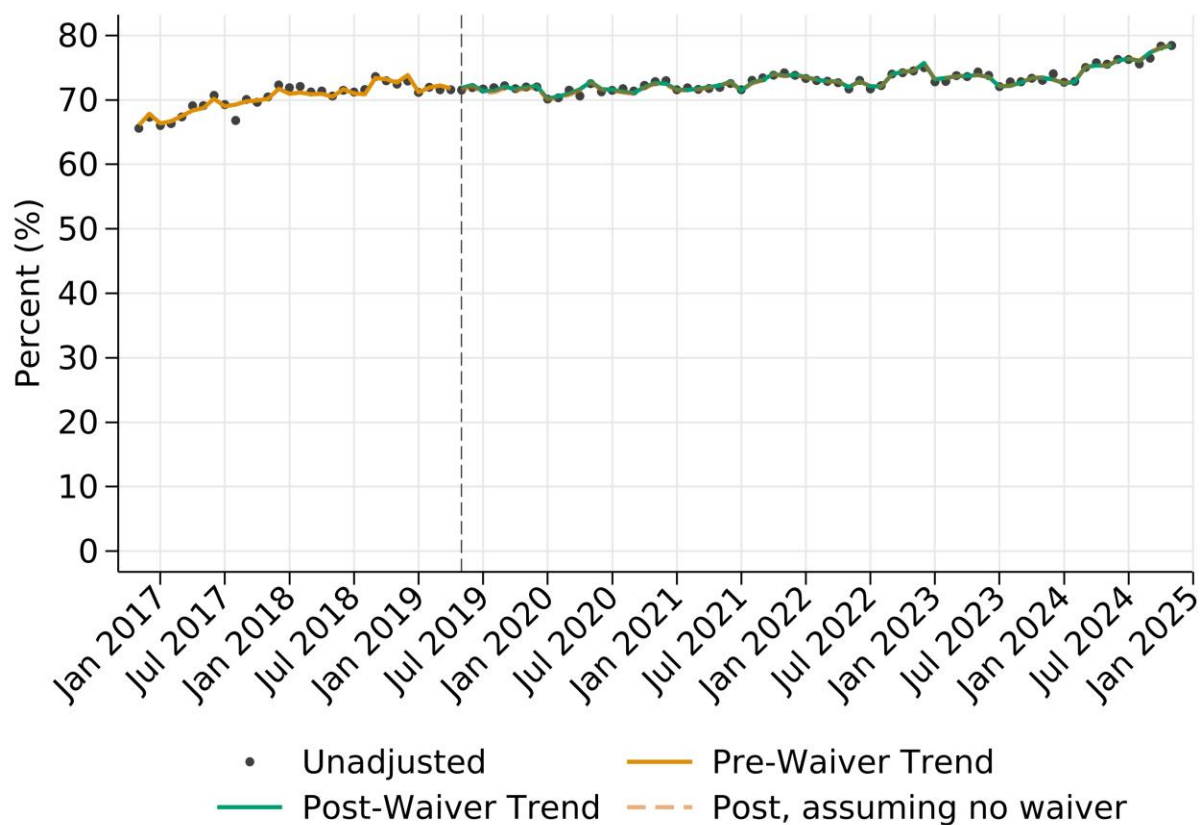
Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population with a substance use disorder.

Figure 83: Comparison groups in Medication Assisted Treatment (SUD)



Notes: Estimates from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Each of the subgroup variables is interacted with the Waiver-specific intercept and slope. The difference in intercept change (for example), is the intercept change for the first subgroup (e.g., 65+) minus the intercept change for the second subgroup (e.g., 18-64).

Figure 27: Trends in Medication Assisted Treatment (SUD): OUD population



COVID-19 adjustment: Mar. 2020 to end of study period

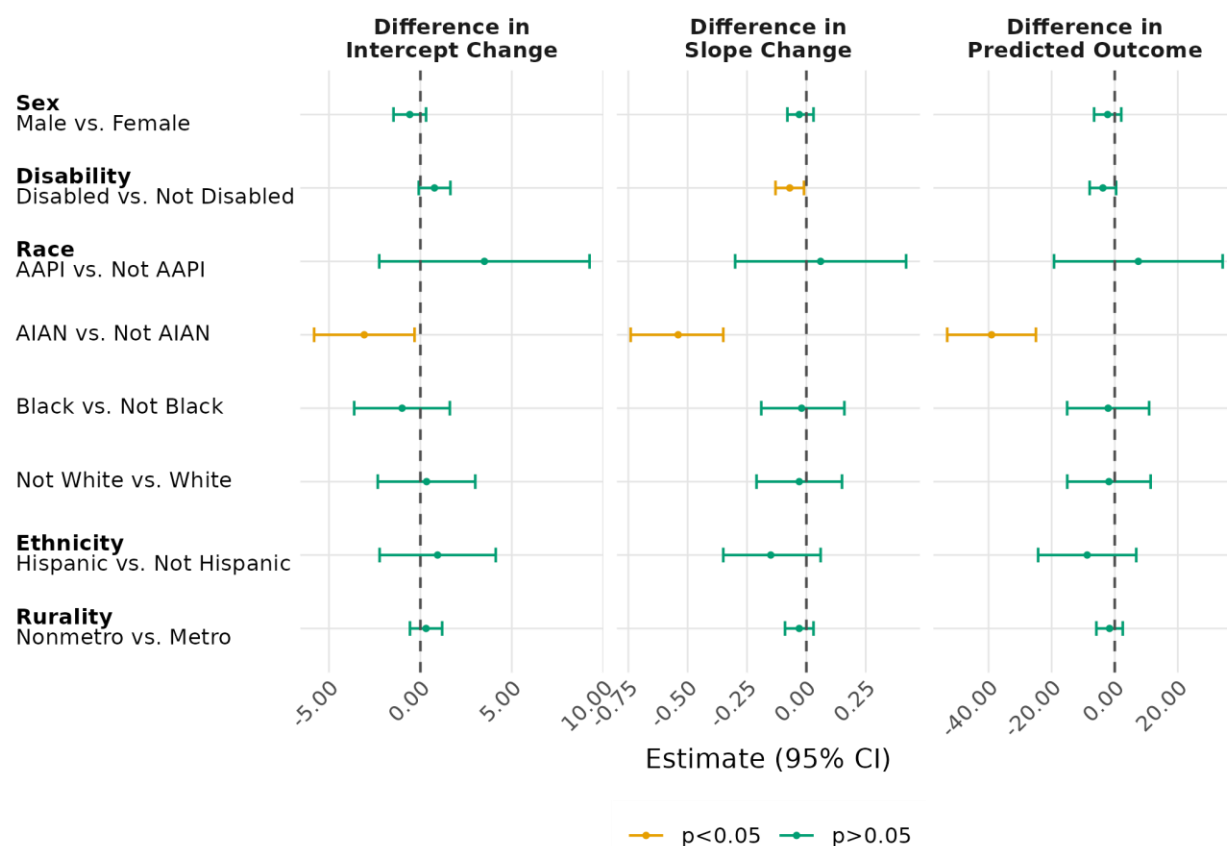
Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population with a substance use disorder.

Table 14: Interrupted time series estimates of Medication Assisted Treatment (SUD): OUD population

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	72.36* (71.40, 73.32)	72.91* (71.99, 73.83)	0.55* (0.023, 1.08)
Monthly Change	-0.0042 (-0.061, 0.053)	-0.011 (-0.13, 0.11)	-0.0064 (-0.14, 0.13)
Predicted Average Outcome Nov 2024	73.41* (65.02, 81.79)	73.54* (72.00, 75.07)	0.13 (-8.72, 8.98)
N	1,593,445		

*Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population with a substance use disorder.*

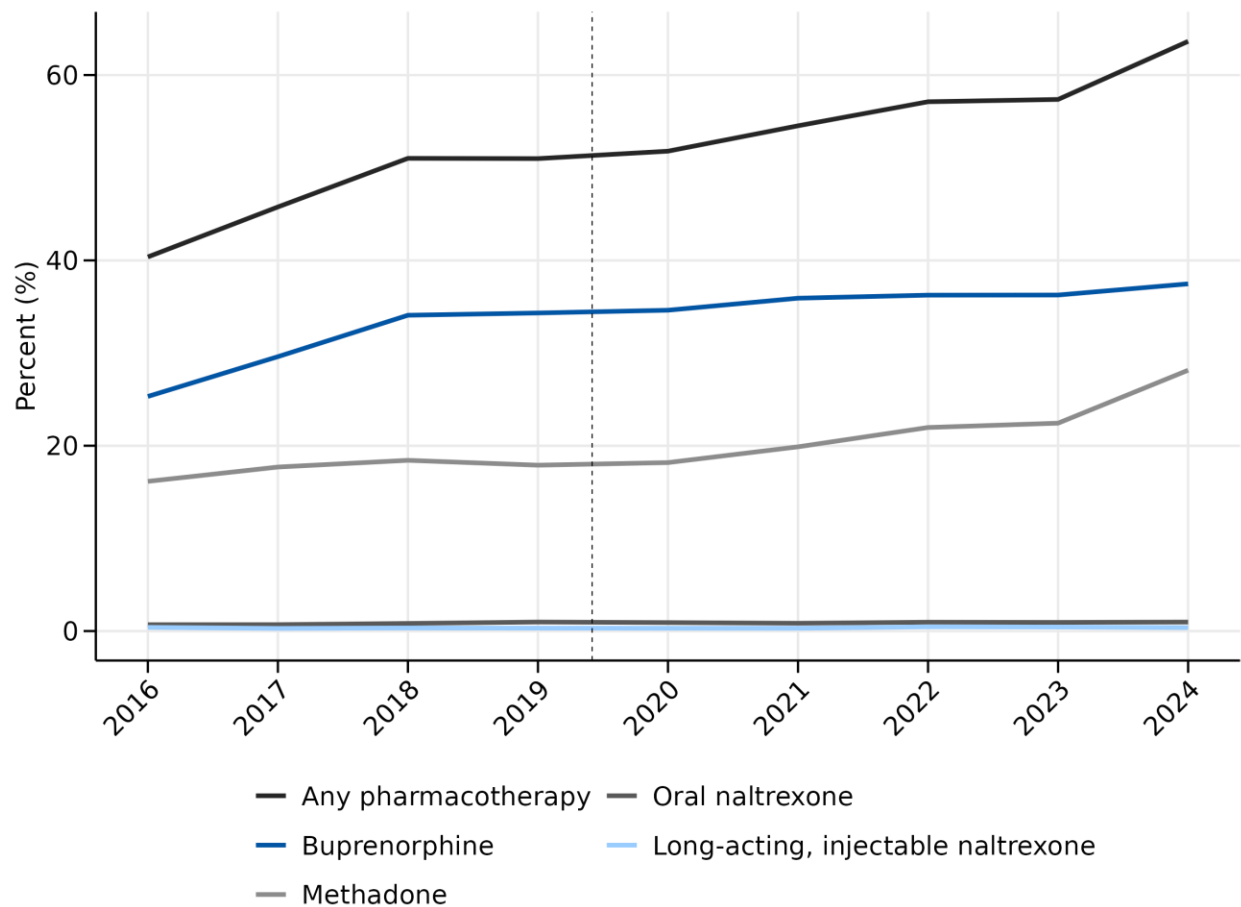
Figure 84: Comparison groups in Medication Assisted Treatment (SUD): OUD population



Notes: Estimates from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Each of the subgroup variables is interacted with the Waiver-specific intercept and slope. The difference in intercept change (for example), is the intercept change for the first subgroup (e.g., 65+) minus the intercept change for the second subgroup (e.g., 18-64).

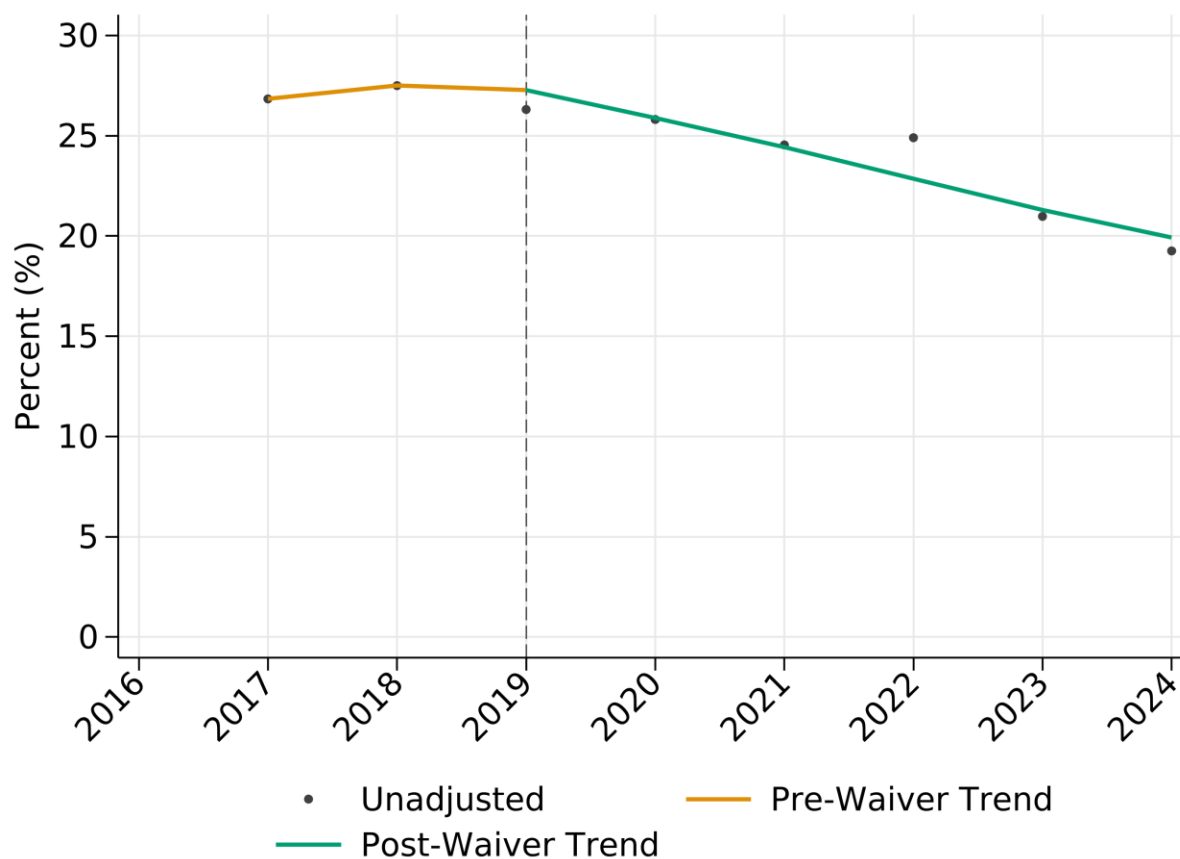
Pharmacotherapy for Opioid Use Disorder

Figure 26: Trends in Use of Pharmacotherapy for Opioid Use Disorder (OUD): Unadjusted



Notes: This figure plots unadjusted rates from the metric population. Estimates were generated from a random 20% sample of individuals (aged 18+) in the NC Medicaid population as determined in the metric specifications.

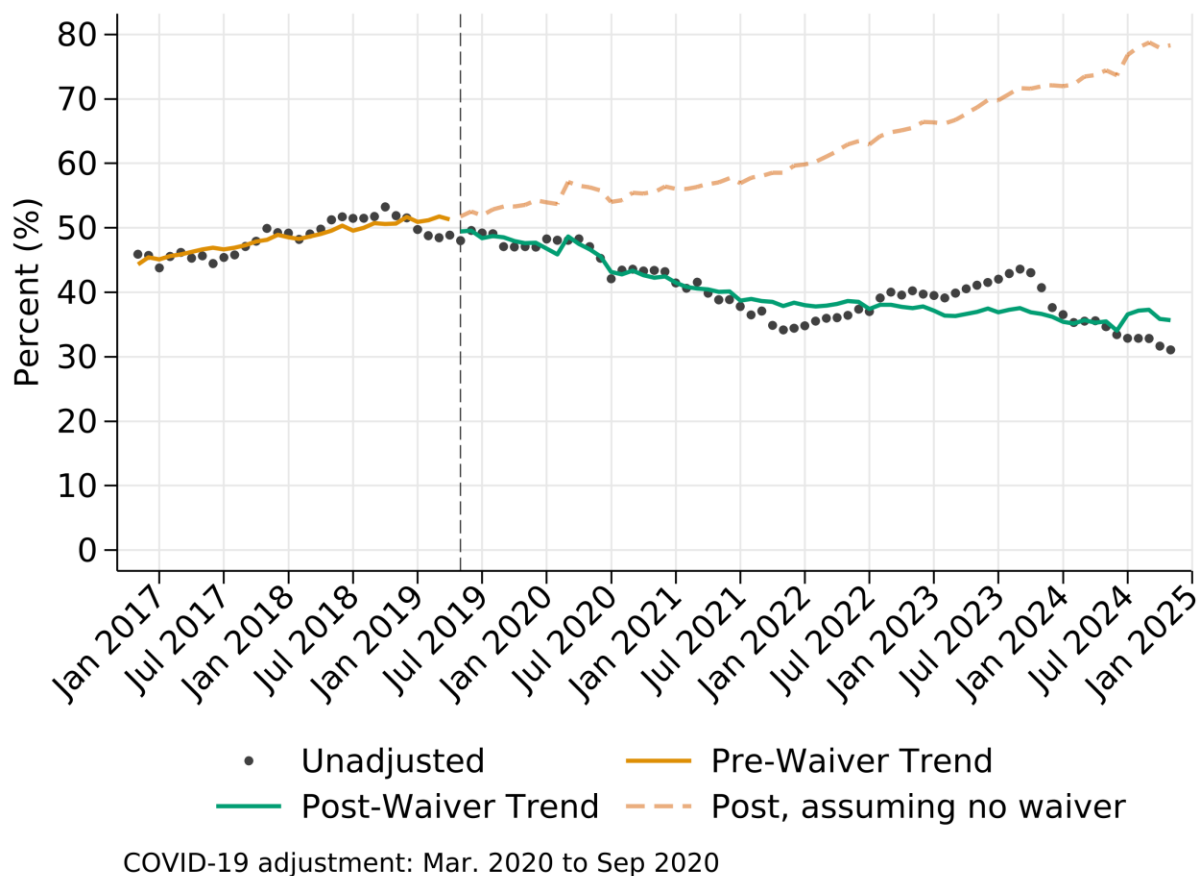
Figure 28: Trends in Continuation of Pharmacotherapy for Opioid Use Disorder



Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model. Estimates were generated from a random 20% sample of individuals (aged 18+) in the NC Medicaid population as determined in the metric specifications.

Percent of individuals initiating MAT who receive psychosocial services within the first 12 months

Figure 85: Percent of individuals initiating MAT who receive psychosocial services within the first 12 months



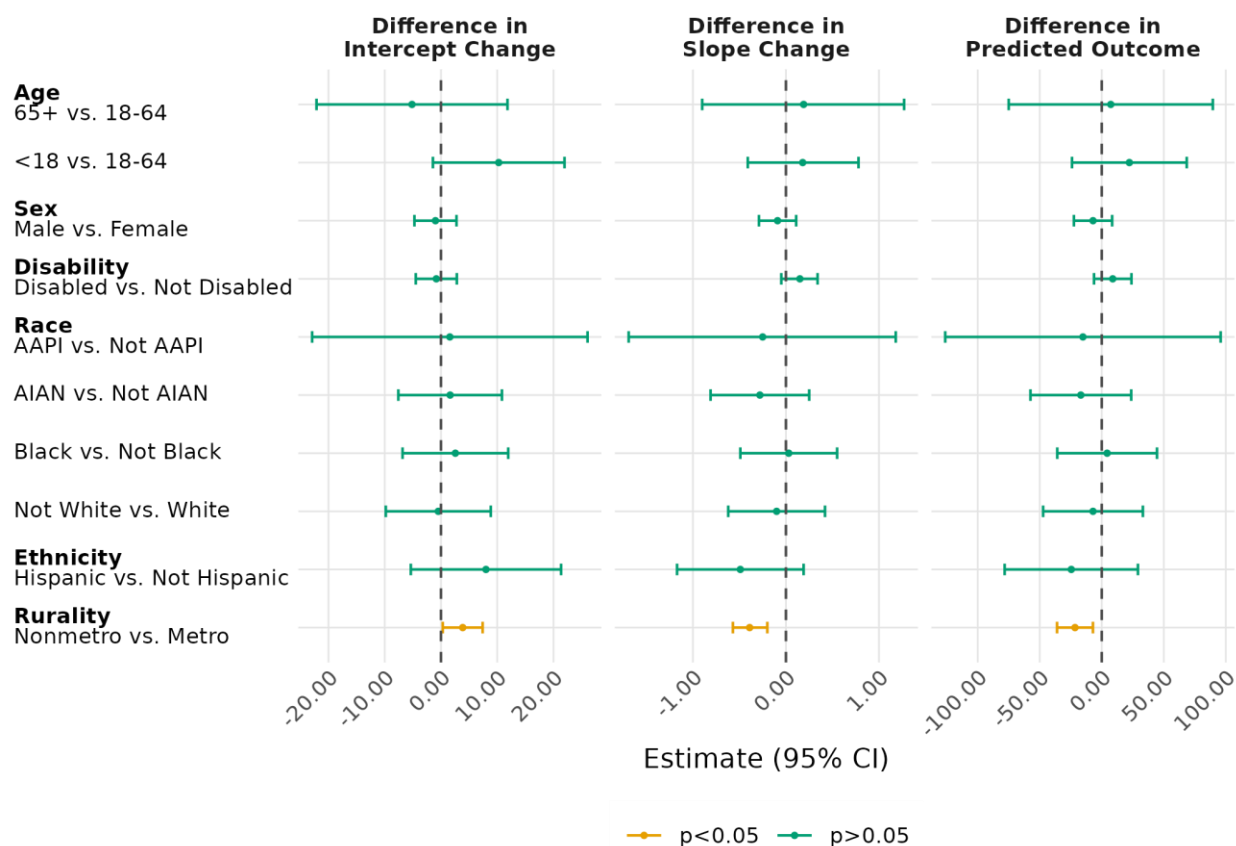
Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population as determined in the metric specifications.

Table 34: Interrupted time series estimates of Percent of individuals receiving Medication Opioid Use Disorder (MOUD) who are also receiving counseling and behavioral therapies to treat substance use disorders during the first 12 months of treatment

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	47.57* (45.73, 49.42)	45.26* (43.95, 46.57)	-2.32* (-4.16, -0.48)
Monthly Change	0.23* (0.15, 0.31)	-0.38* (-0.48, -0.29)	-0.61* (-0.74, -0.48)
Predicted Average Outcome Nov 2024	72.42* (65.12, 79.72)	29.76* (27.06, 32.45)	-42.66* (-51.43, -33.90)
N	332,697		

*Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population as determined in the metric specifications.*

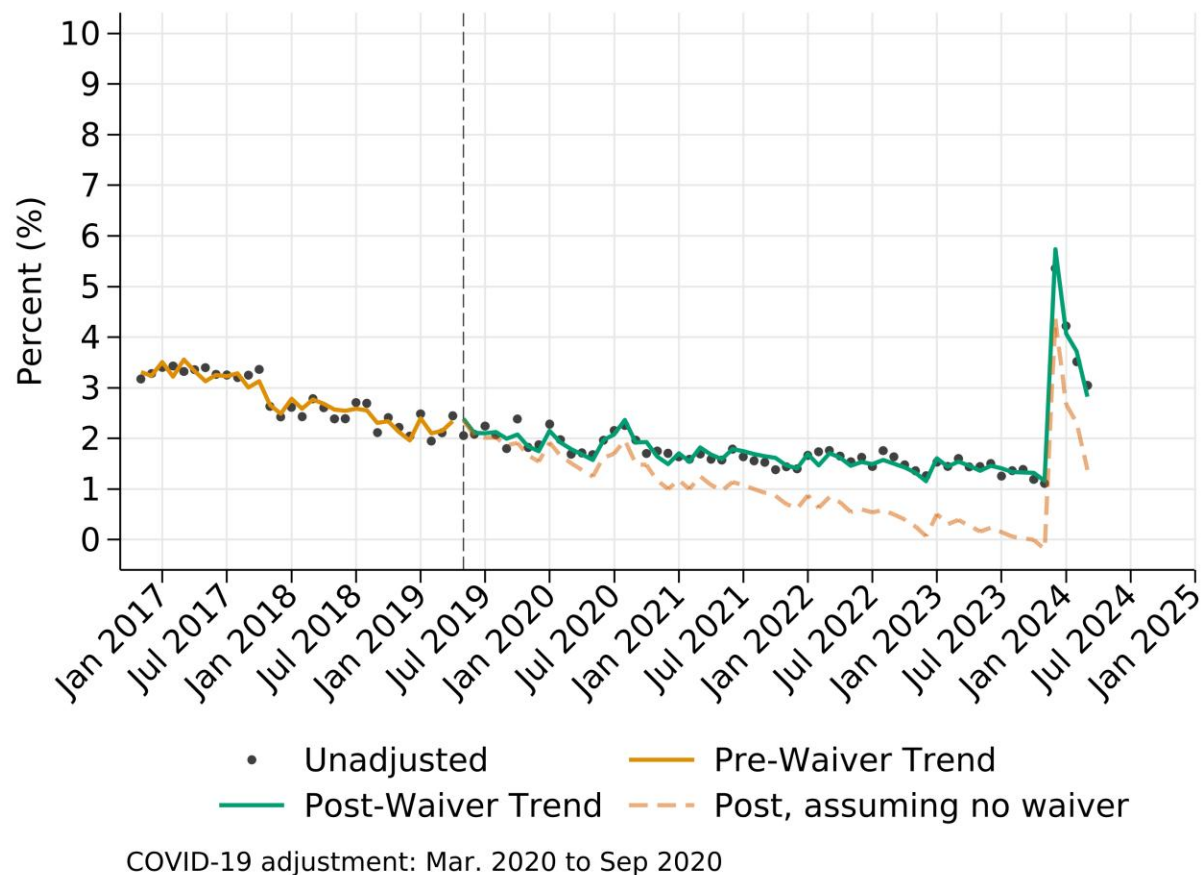
Figure 86: Comparison groups in Percent of individuals receiving Medication Opioid Use Disorder (MOUD) who are also receiving counseling and behavioral therapies to treat substance use disorders during the first 12 months of treatment



Notes: Estimates from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model. Each of the subgroup variables is interacted with the Waiver-specific intercept and slope. The difference in intercept change (for example), is the intercept change for the first subgroup (e.g., 65+) minus the intercept change for the second subgroup (e.g., 18-64).

Percent of Enrollees Diagnosed with OUD Receiving Non-medication Opioid Treatment Services

Figure 29: Trends in Percent of Enrollees Diagnosed with OUD Receiving Non-medication Opioid Treatment Services



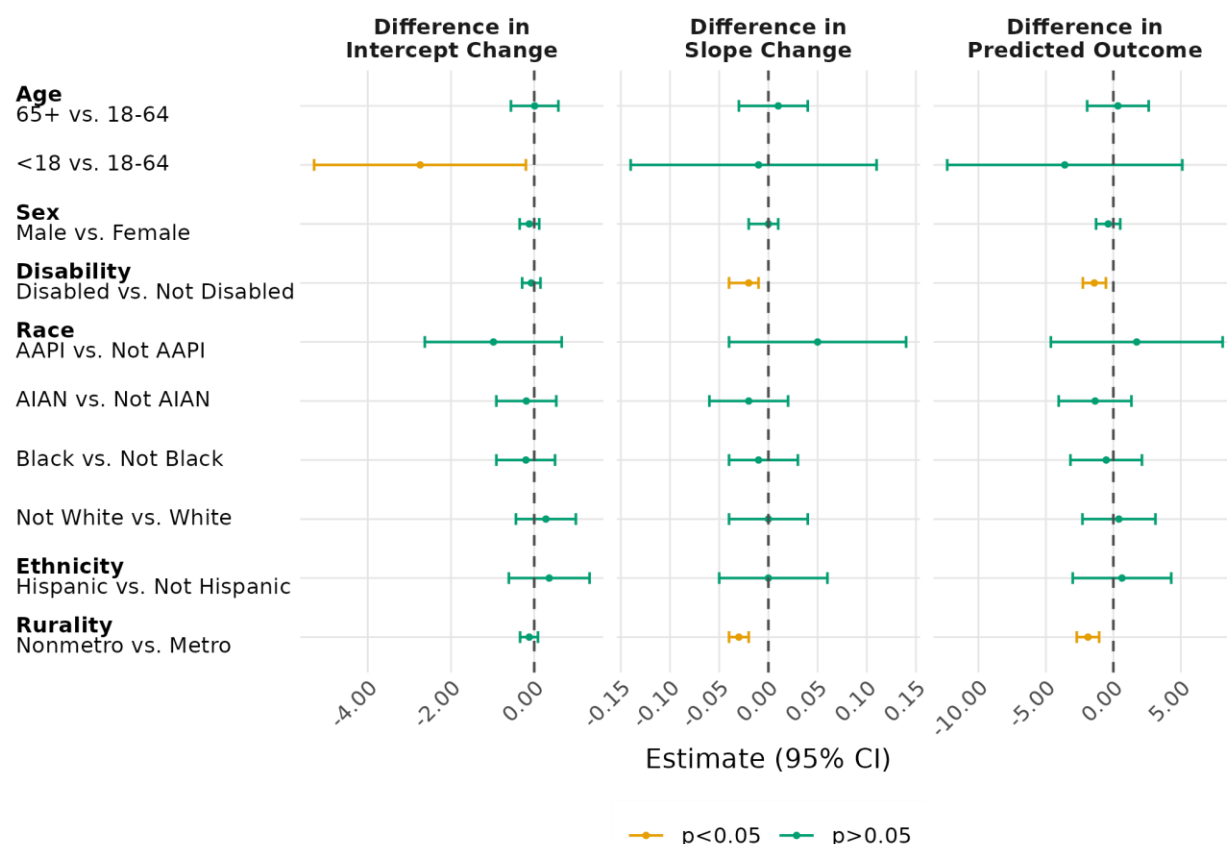
Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population as determined in the metric specifications.

Table 15: Interrupted time series estimates of Percent of Enrollees Diagnosed with OUD Receiving Non-medication Opioid Treatment Services

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	2.03* (1.93, 2.14)	2.07* (1.99, 2.15)	0.036 (-0.084, 0.16)
Monthly Change	-0.031* (-0.036, -0.026)	-0.0064* (-0.012, -0.0013)	0.024* (0.017, 0.032)
Predicted Average Outcome Mar 2024	0.35 (-0.038, 0.74)	1.80* (1.66, 1.94)	1.45* (1.01, 1.89)
N	1,501,790		

*Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population as determined in the metric specifications.*

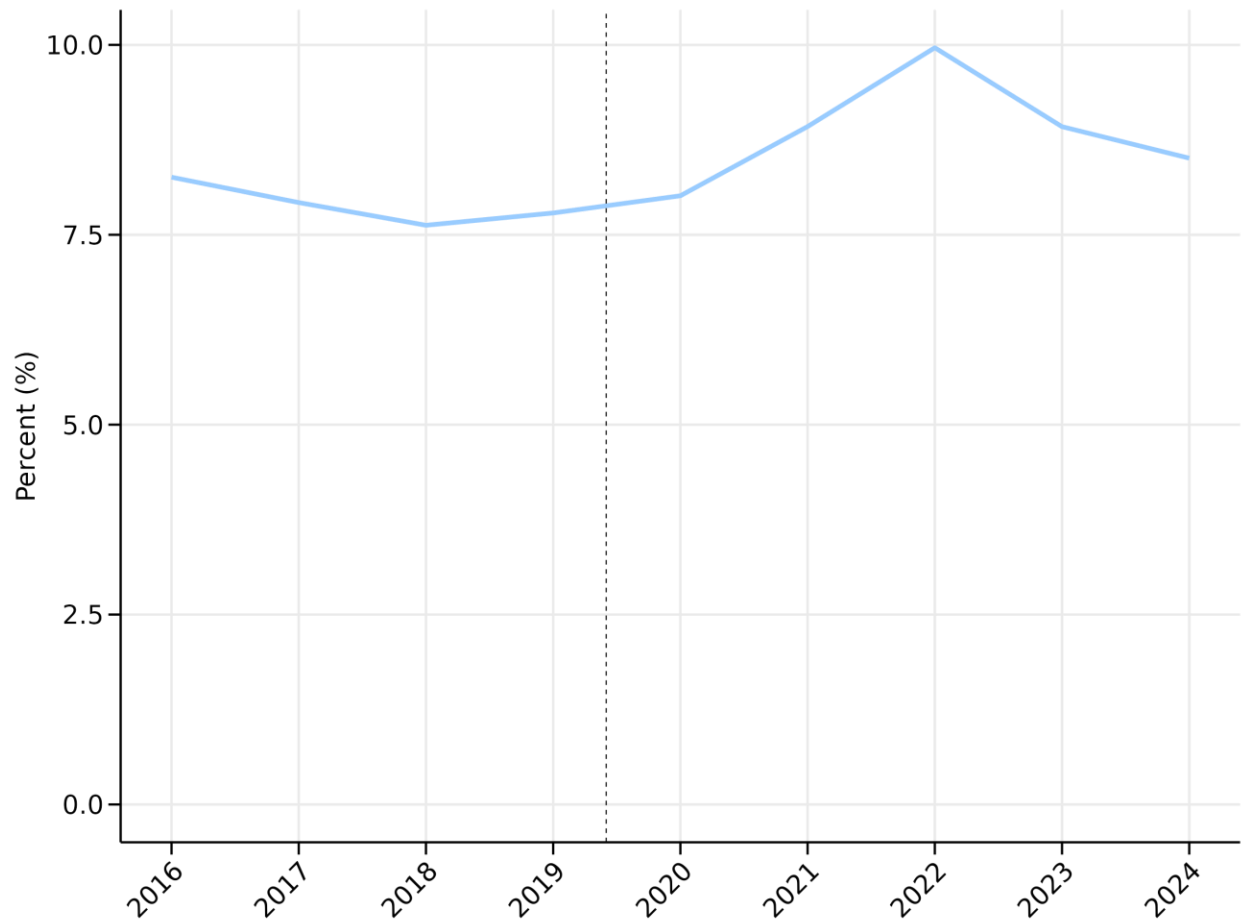
Figure 87: Comparison groups in Percent of Enrollees Diagnosed with OUD Receiving Non-medication Opioid Treatment Services



Notes: Estimates from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model. Each of the subgroup variables is interacted with the Waiver-specific intercept and slope. The difference in intercept change (for example), is the intercept change for the first subgroup (e.g., 65+) minus the intercept change for the second subgroup (e.g., 18-64).

Use of Opioids at High Dosage in Persons without Cancer (OHD-AD)

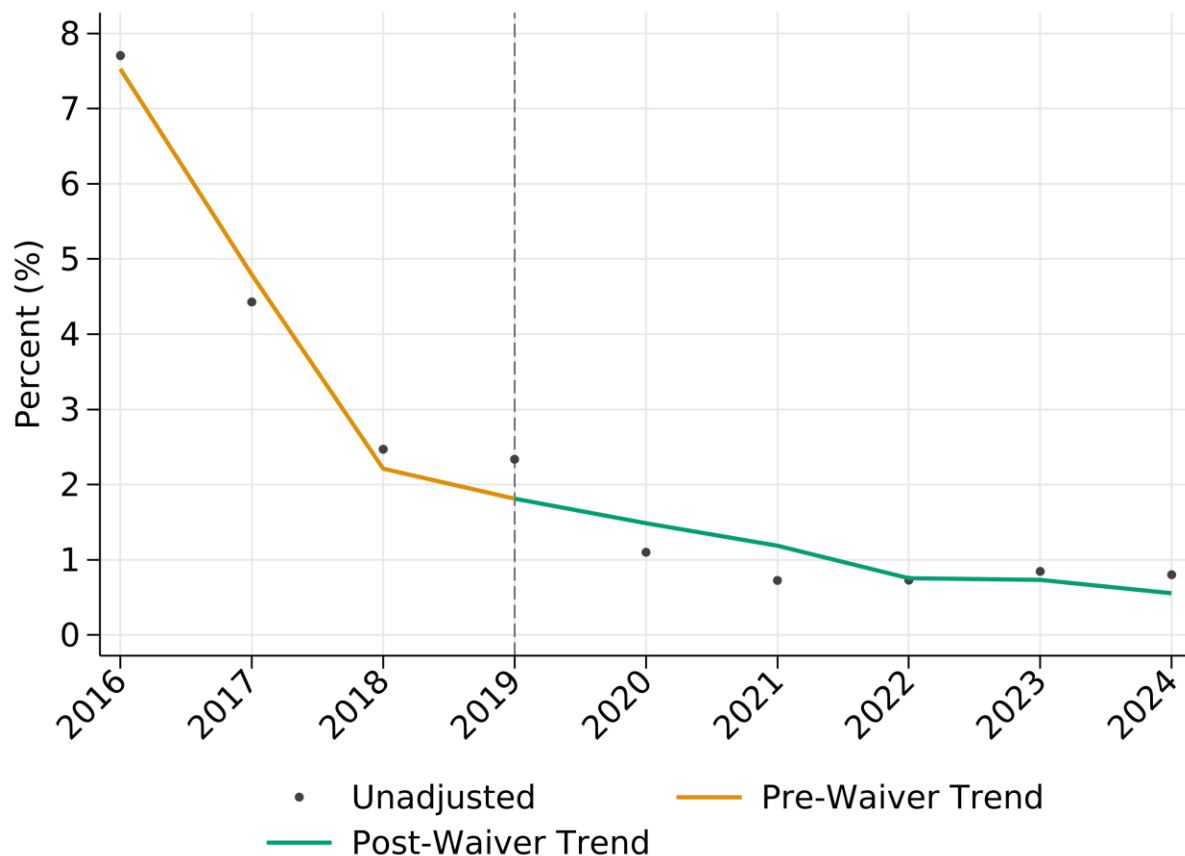
Figure 30: Trends in Use of Opioids at High Dosage in Persons without Cancer (OHD-AD)



Notes: This figure plots unadjusted rates from the metric population. Estimates were generated from a random 20% sample of individuals (aged 18+) in the NC Medicaid population as determined in the metric specifications.

Use of Opioids from Multiple Providers in Persons Without Cancer (OMP)

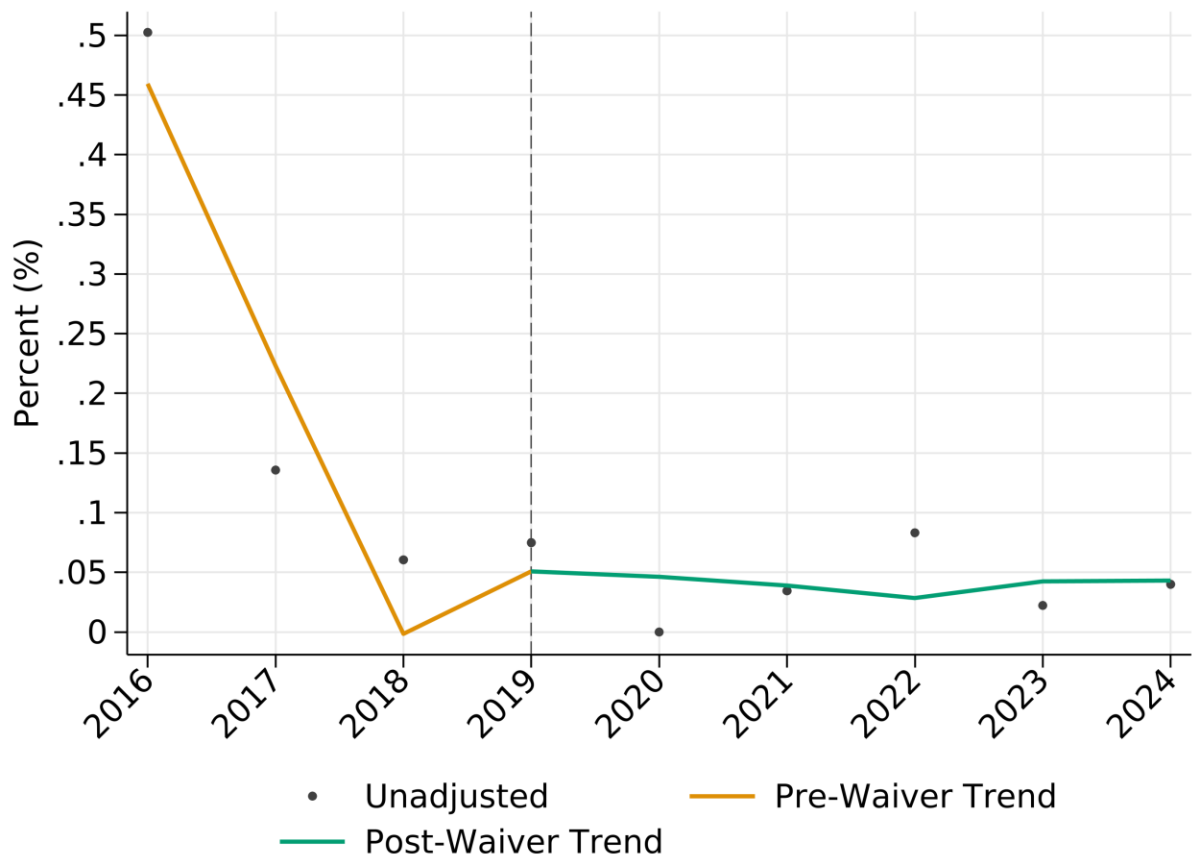
[Figure 31](#): Trends in Use of Opioids from Multiple Providers in Persons Without Cancer (OMP)



Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model. Estimates were generated from a random 20% sample of individuals (aged 18+) in the NC Medicaid population as determined in the metric specifications.

Use of Opioids at High Dosage and from Multiple Providers in Persons Without Cancer (OHDMP)

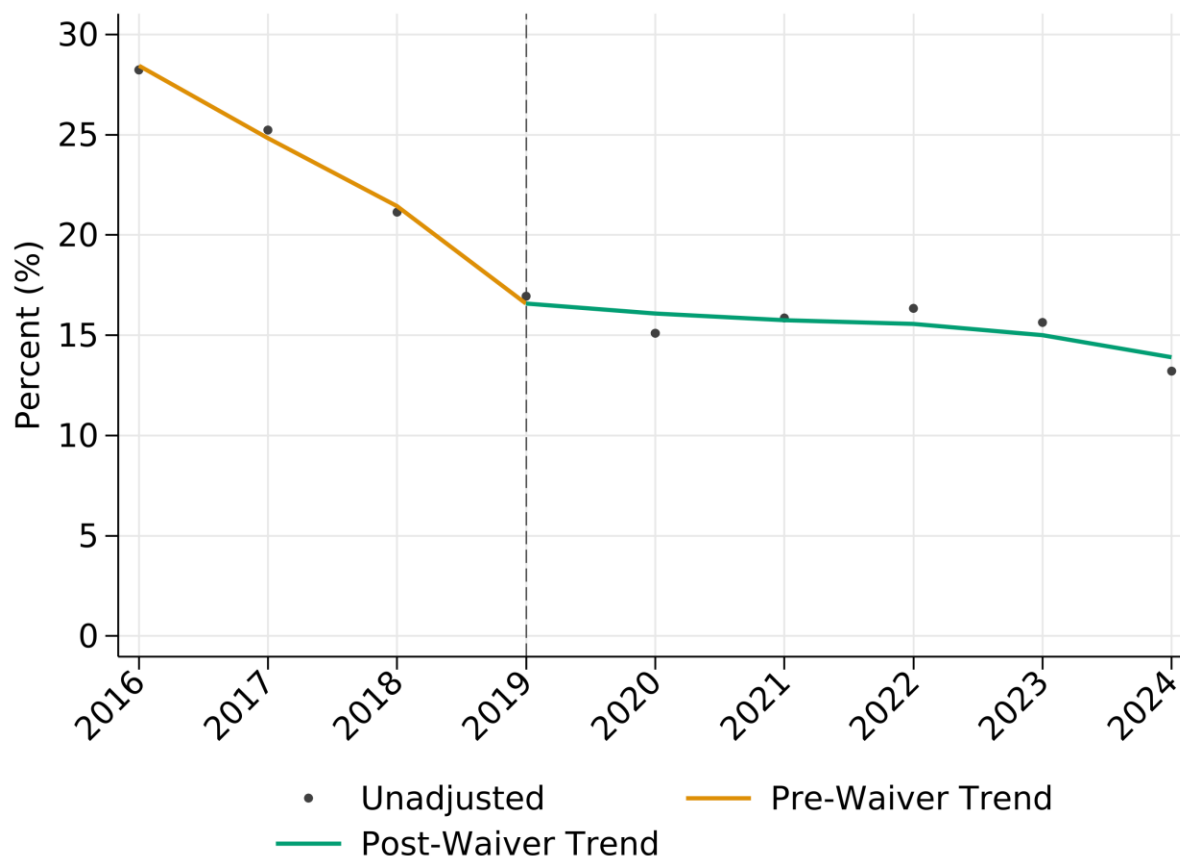
Figure 88: Trends in Use of Opioids at High Dosage and from Multiple Providers in Persons Without Cancer (OHDMP)



Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model. Estimates were generated from a random 20% sample of individuals (aged 18+) in the NC Medicaid population as determined in the metric specifications.

Concurrent Use of Opioids and Benzodiazepines (COB-AD)

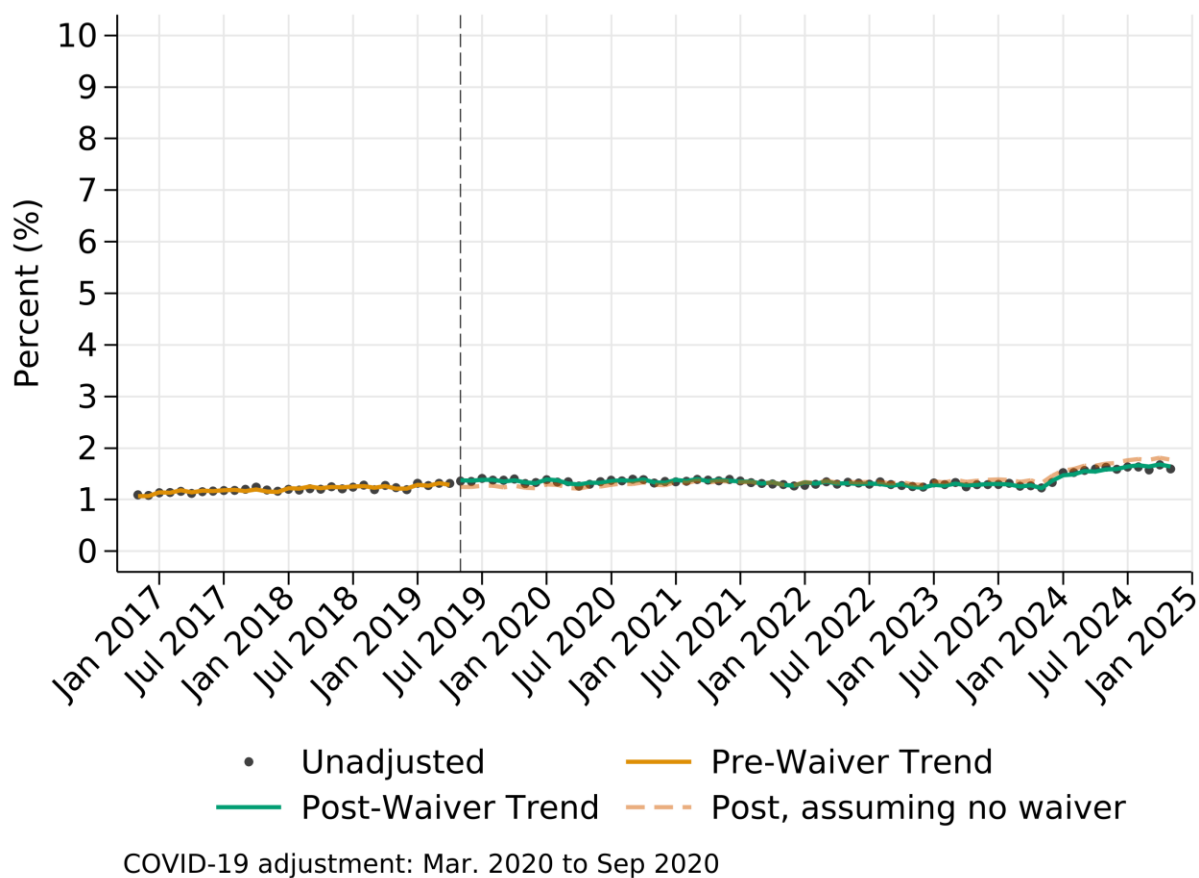
Figure 32: Trends in Concurrent Use of Opioids and Benzodiazepines (COB-AD)



Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model. Estimates were generated from a random 20% sample of individuals (aged 18+) in the NC Medicaid population as determined in the metric specifications.

Medicaid Expenditures

Figure 89: Trends in Proportion of beneficiaries with SUD Expenditures



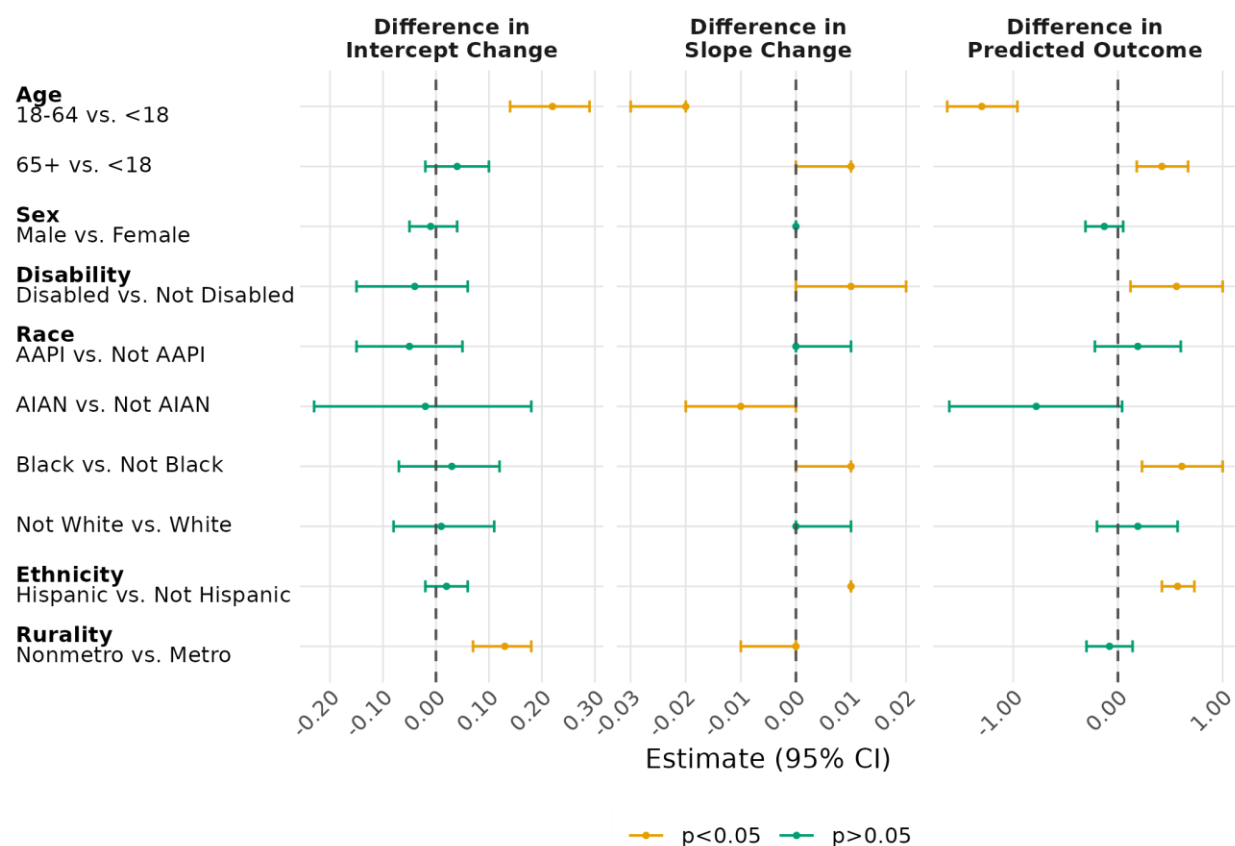
Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from the population of individuals (aged 0-64) in the NC Medicaid population as determined in the metric specifications.

Table 35: Interrupted time series estimates of Proportion of beneficiaries with SUD Expenditures

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	1.28* (1.25, 1.32)	1.35* (1.32, 1.39)	0.070* (0.027, 0.11)
Monthly Change	0.0064* (0.0038, 0.0090)	0.0014 (-0.0010, 0.0037)	-0.0051* (-0.0087, -0.0014)
Predicted Average Outcome Nov 2024	1.69* (1.49, 1.89)	1.43* (1.36, 1.50)	-0.27* (-0.49, -0.039)
N	42,278,923		

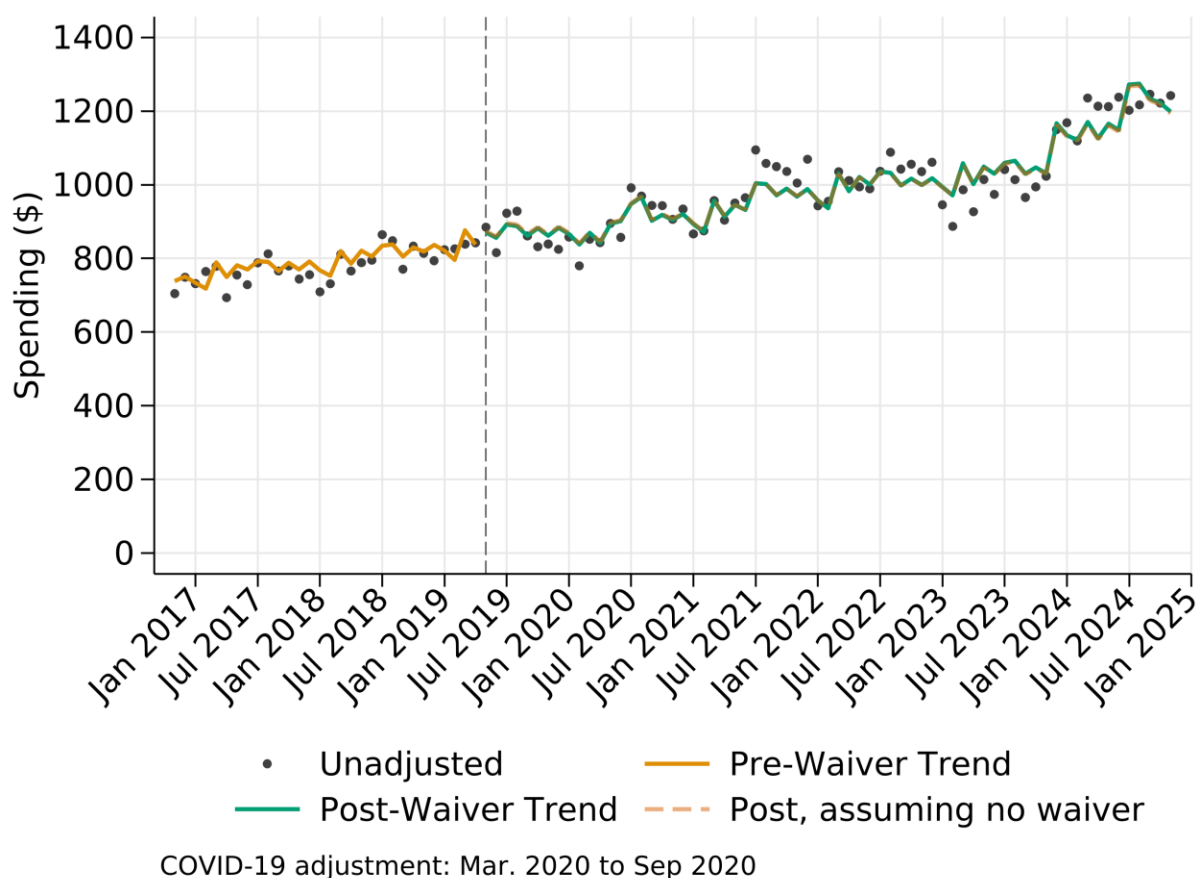
Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from the population of individuals (aged 0-64) in the NC Medicaid population as determined in the metric specifications.

Figure 90: Comparison groups in Proportion of beneficiaries with SUD Expenditures



Notes: Estimates from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Each of the subgroup variables is interacted with the Waiver-specific intercept and slope. The difference in intercept change (for example), is the intercept change for the first subgroup (e.g., 65+) minus the intercept change for the second subgroup (e.g., 18-64).

Figure 91: Trends in SUD spending



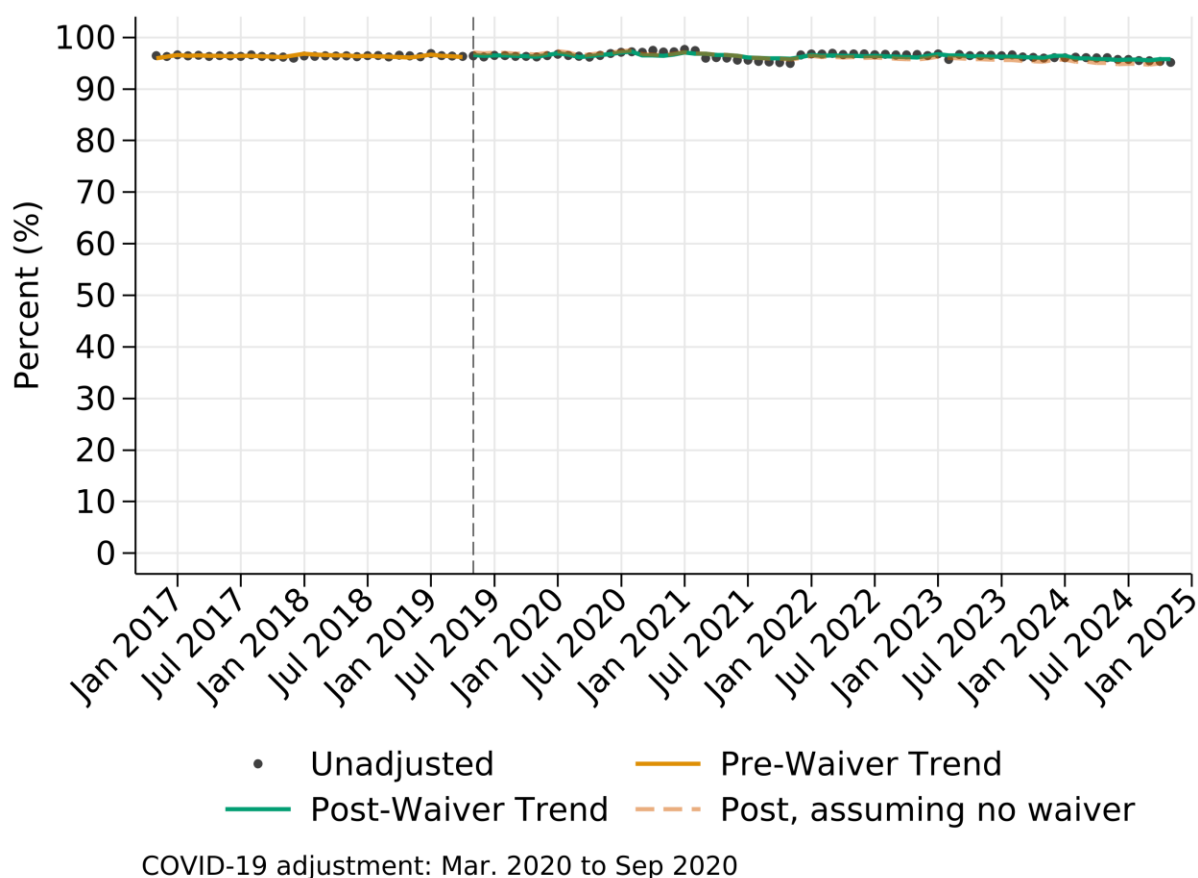
Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a GEE gamma regression with an exchangeable correlation structure at the person-level with person-level fixed effects. Estimates were generated from the population of individuals (aged 0-64) in the NC Medicaid population as determined in the metric specifications.

Table 36: Interrupted time series estimates of SUD spending

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	915.98* (894.88, 937.09)	913.79* (898.14, 929.44)	-2.19 (-22.19, 17.81)
Monthly Change	3.52* (2.52, 4.53)	3.64* (3.16, 4.12)	0.11 (-1.13, 1.35)
Predicted Average Outcome Nov 2024	1181.43* (1089.13, 1273.73)	1189.00* (1154.70, 1223.30)	7.57 (-100.20, 115.34)
N	555,654		

Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a GEE gamma regression with an exchangeable correlation structure at the person-level with person-level fixed effects. Estimates were generated from the population of individuals (aged 0-64) in the NC Medicaid population as determined in the metric specifications.

Figure 93: Trends in Proportion of beneficiaries with SUD who had any expenditures in the month



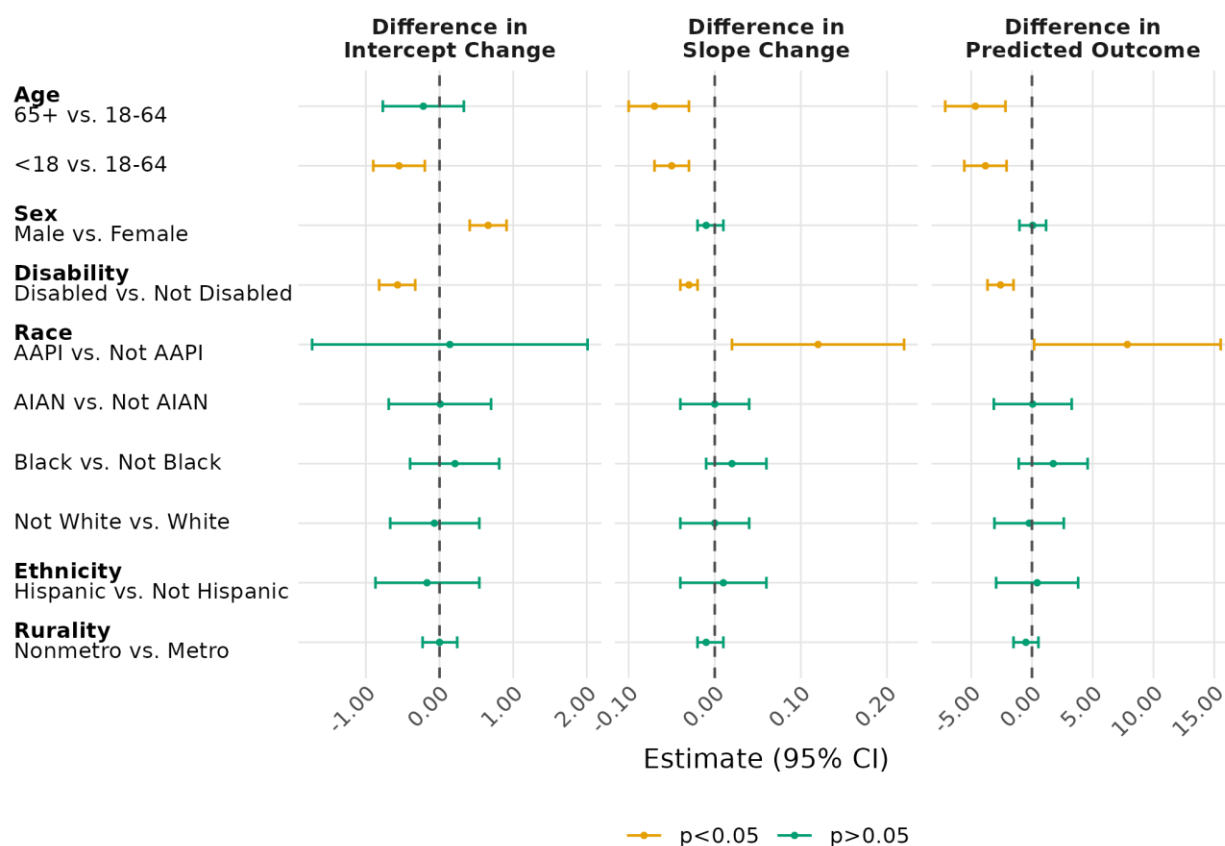
Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population with a substance use disorder.

Table 16: Interrupted time series estimates of Proportion of beneficiaries with SUD who had any expenditures in the month

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	95.72* (95.52, 95.92)	96.13* (95.93, 96.32)	0.41* (0.27, 0.55)
Monthly Change	-0.028* (-0.036, -0.021)	0.022* (0.011, 0.032)	0.050* (0.039, 0.062)
Predicted Average Outcome Nov 2024	93.31* (92.71, 93.90)	97.03* (96.67, 97.38)	3.72* (2.98, 4.46)
N	7,598,315		

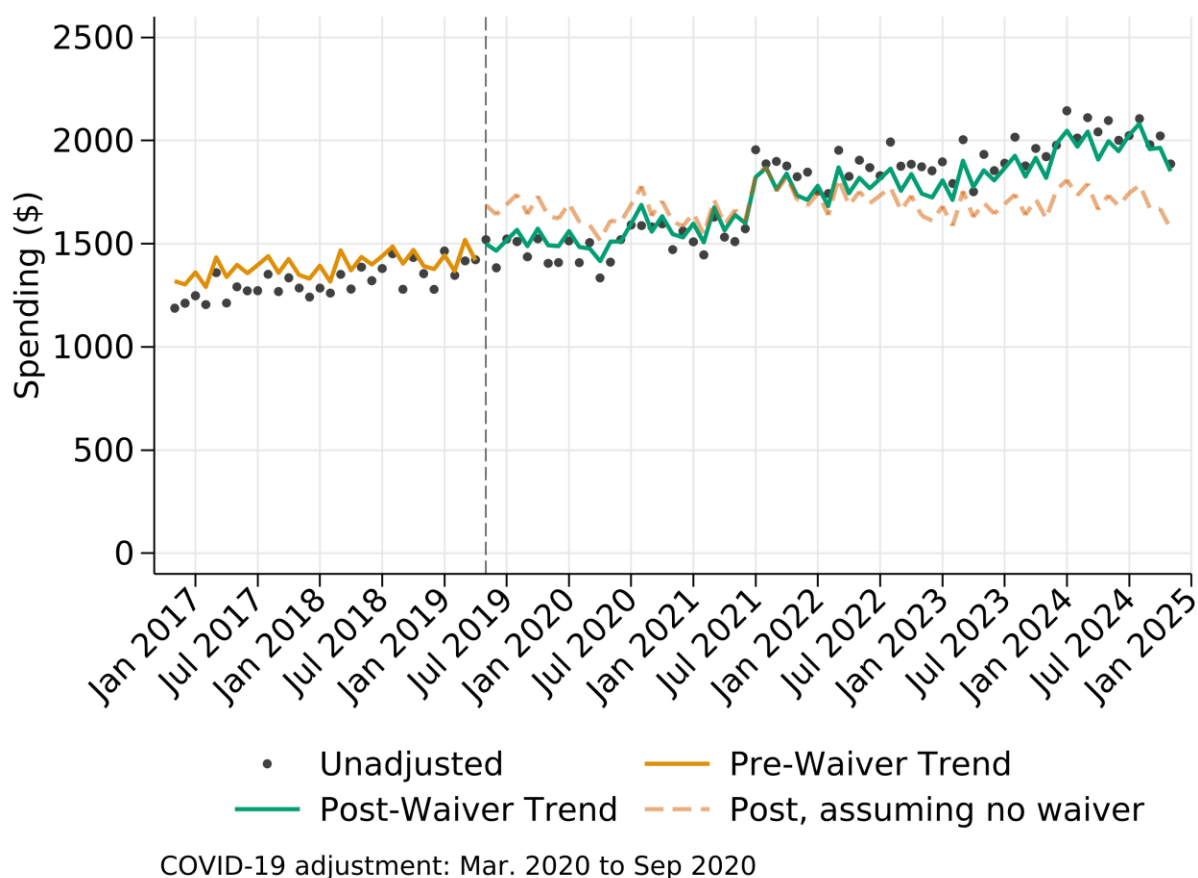
*Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population with a substance use disorder.*

Figure 94: Comparison groups in Proportion of beneficiaries with SUD who had any expenditures in the month



Notes: Estimates from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Each of the subgroup variables is interacted with the Waiver-specific intercept and slope. The difference in intercept change (for example), is the intercept change for the first subgroup (e.g., 65+) minus the intercept change for the second subgroup (e.g., 18-64).

Figure 95: Trends in Total Medicaid Service Expenditures for beneficiaries with SUD who had an encounter



Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a GEE gamma regression with an exchangeable correlation structure at the person-level with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population as determined in the metric specifications.

Table 37: Interrupted time series estimates of Total Medicaid Service Expenditures for beneficiaries with SUD who had an encounter

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	1338.98* (1323.23, 1354.74)	1355.07* (1342.89, 1367.25)	16.09* (1.66, 30.51)
Monthly Change	-0.48 (-1.20, 0.25)	5.34* (4.99, 5.69)	5.82* (4.91, 6.72)
Predicted Average Outcome Nov 2024	1315.02* (1264.54, 1365.49)	1767.17* (1739.59, 1794.75)	452.15* (387.88, 516.43)
N	7,656,186		

Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a GEE gamma regression with an exchangeable correlation structure at the person-level with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population as determined in the metric specifications.

Figure 96: Trends in Per Member Per Month Medicaid Service Outpatient Expenditures for beneficiaries with SUD

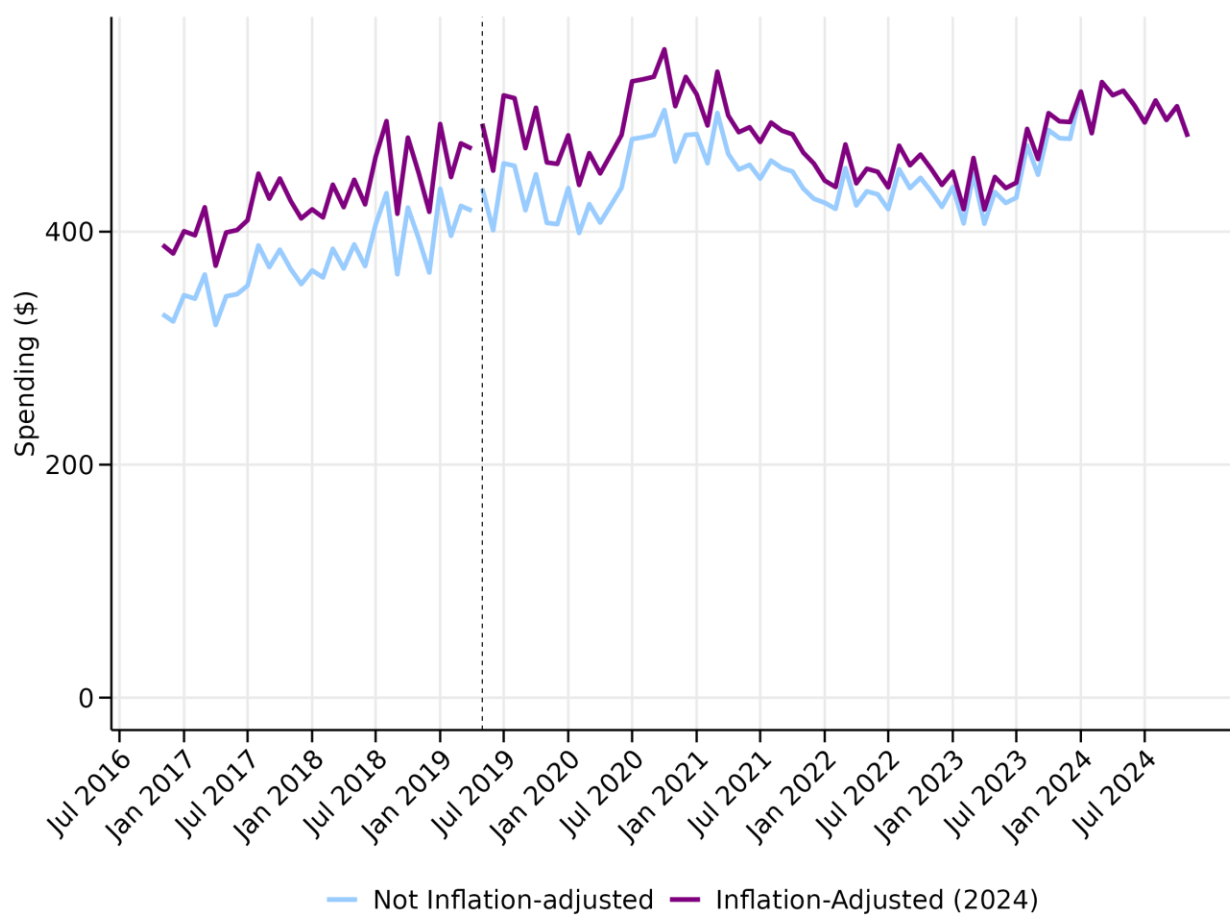
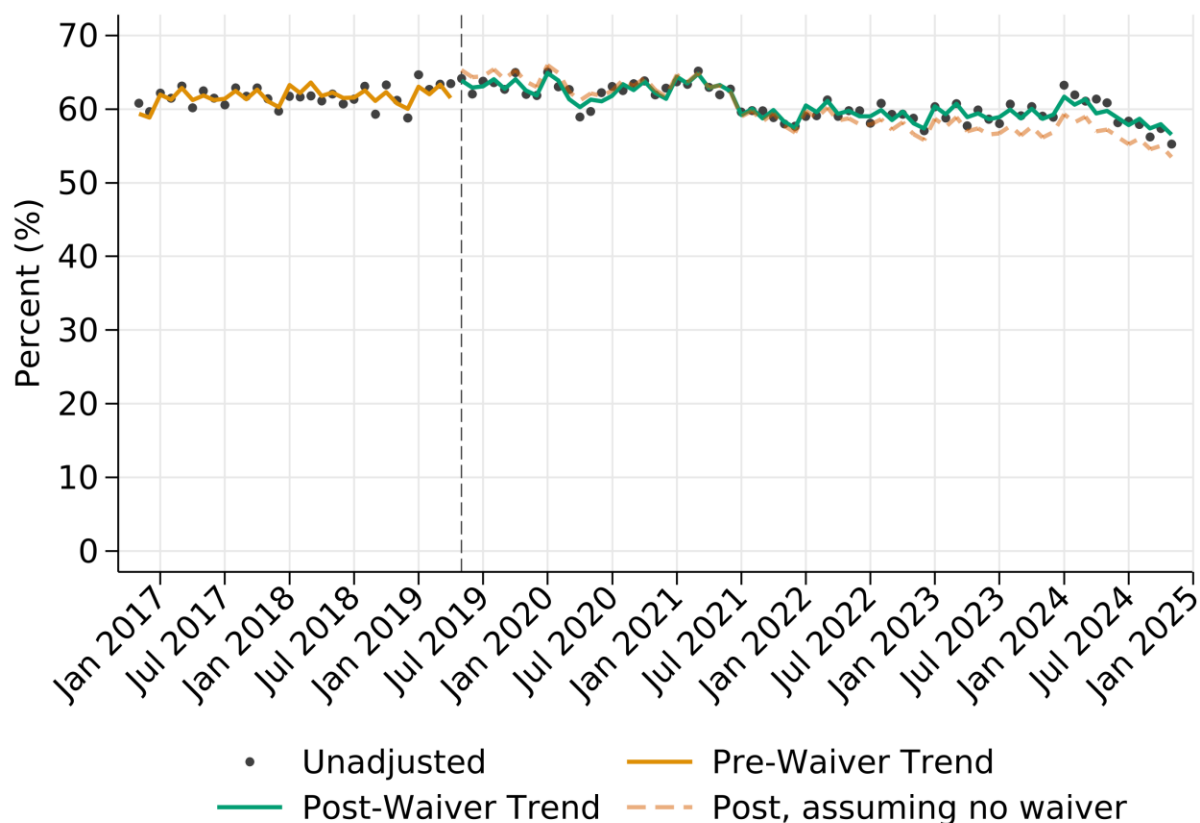


Figure 33: Trends in Proportion of beneficiaries with SUD who had an Outpatient encounter



COVID-19 adjustment: Mar. 2020 to Sep 2020

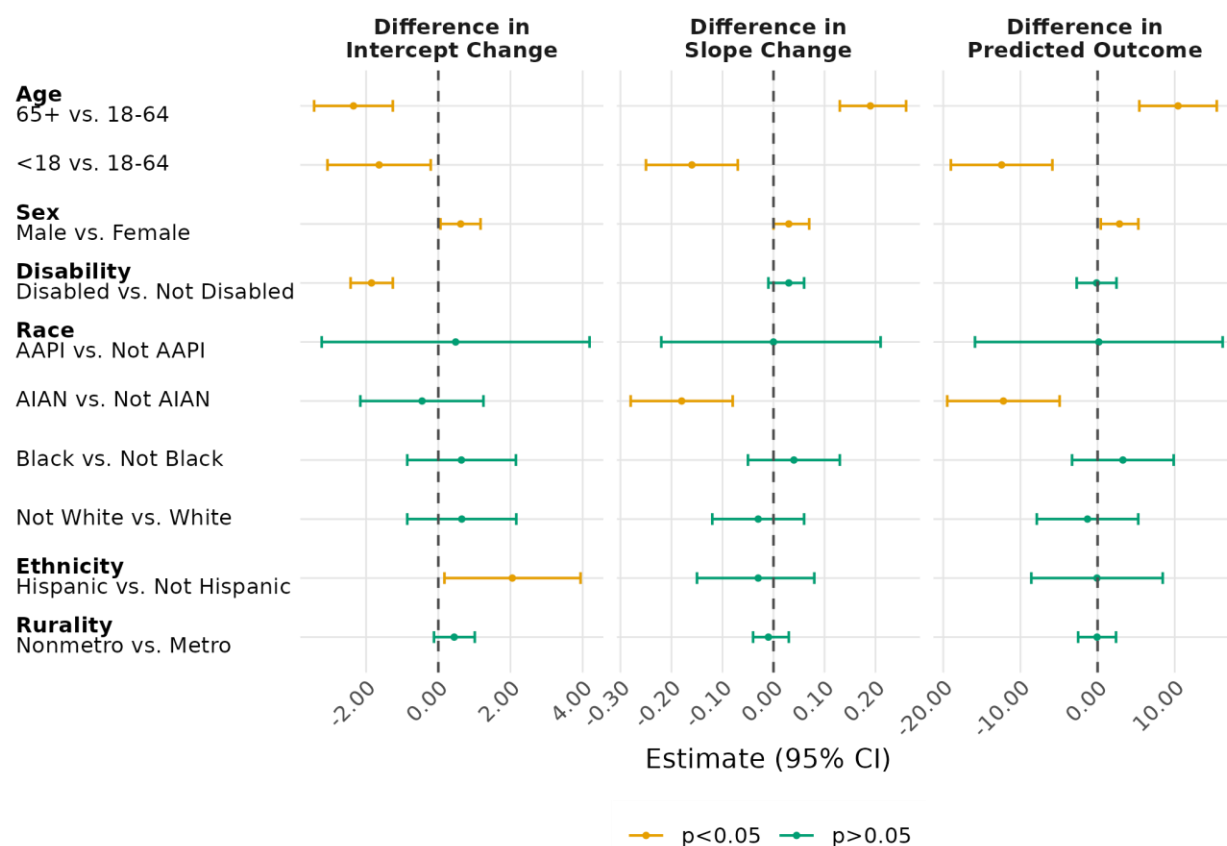
Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population with a substance use disorder.

Table 38: Interrupted time series estimates of Proportion of beneficiaries with SUD who had an Outpatient encounter

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	59.51* (58.84, 60.18)	61.60* (61.11, 62.09)	2.09* (1.59, 2.59)
Monthly Change	-0.16* (-0.20, -0.13)	0.0047* (-0.030, 0.040)	0.17* (0.12, 0.22)
Predicted Average Outcome Nov 2024	47.31* (44.45, 50.17)	60.56* (59.48, 61.64)	13.25* (10.02, 16.47)
N	7,656,186		

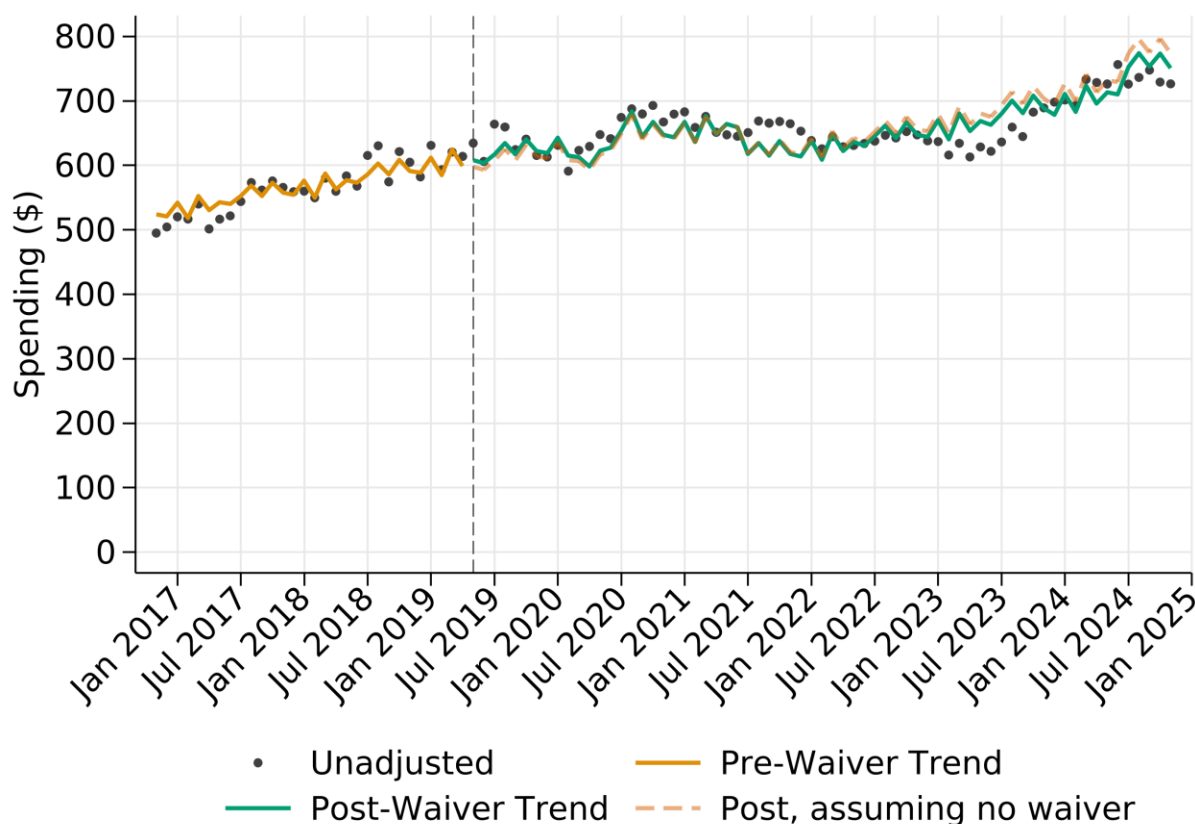
Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population with a substance use disorder.

Figure 97: Comparison groups in Proportion of beneficiaries with SUD who had an Outpatient encounter



Notes: Estimates from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Each of the subgroup variables is interacted with the Waiver-specific intercept and slope. The difference in intercept change (for example), is the intercept change for the first subgroup (e.g., 65+) minus the intercept change for the second subgroup (e.g., 18-64).

Figure 98: Trends in Total Medicaid Service Expenditures for beneficiaries with SUD who had an Outpatient encounter



COVID-19 adjustment: Mar. 2020 to Sep 2020

Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a GEE gamma regression with an exchangeable correlation structure at the person-level with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population as determined in the metric specifications.

Table 39: Interrupted time series estimates of Total Medicaid Service Expenditures for beneficiaries with SUD who had an Outpatient encounter

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	473.84* (470.33, 477.34)	468.91* (466.04, 471.79)	-4.92* (-7.90, -1.95)
Monthly Change	2.39* (2.24, 2.54)	2.03* (1.95, 2.11)	-0.36* (-0.56, -0.17)
Predicted Average Outcome Nov 2024	661.32* (645.99, 676.65)	623.85* (617.64, 630.07)	-37.46* (-55.21, -19.71)
N	4,604,547		

Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a GEE gamma regression with an exchangeable correlation structure at the person-level with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population as determined in the metric specifications.

Figure 34: Trends in Per Member Per Month Medicaid Service Outpatient E&M Expenditures for beneficiaries with SUD

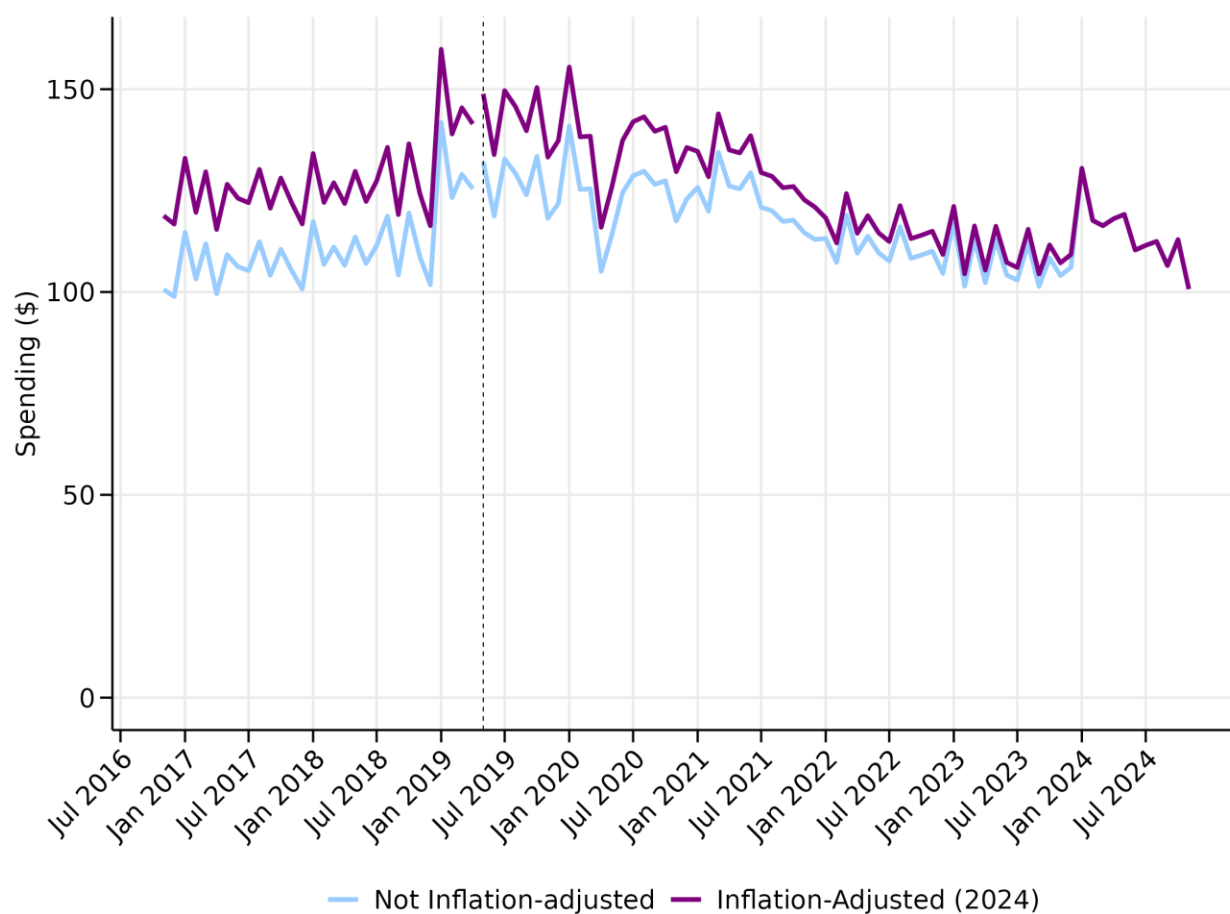
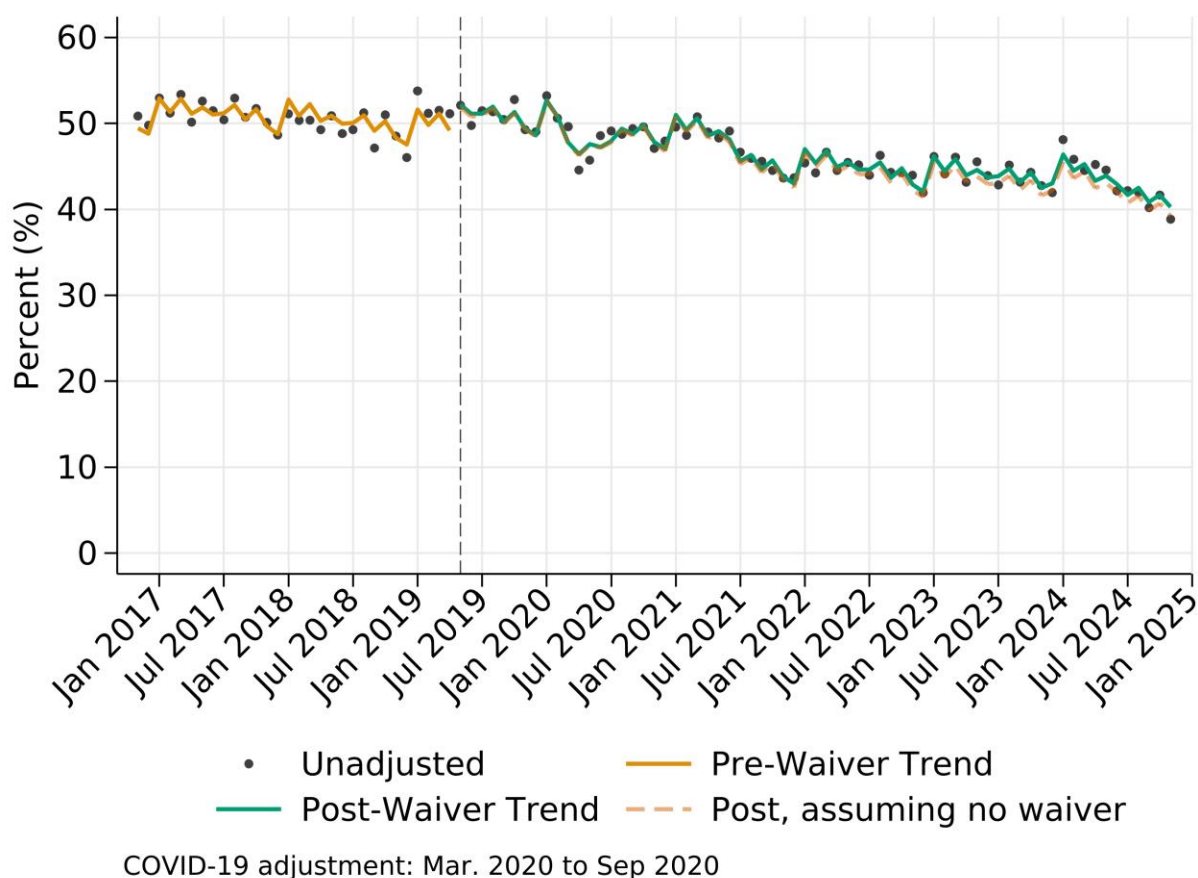


Figure 99: Trends in Proportion of beneficiaries with SUD who had an Outpatient E&M encounter



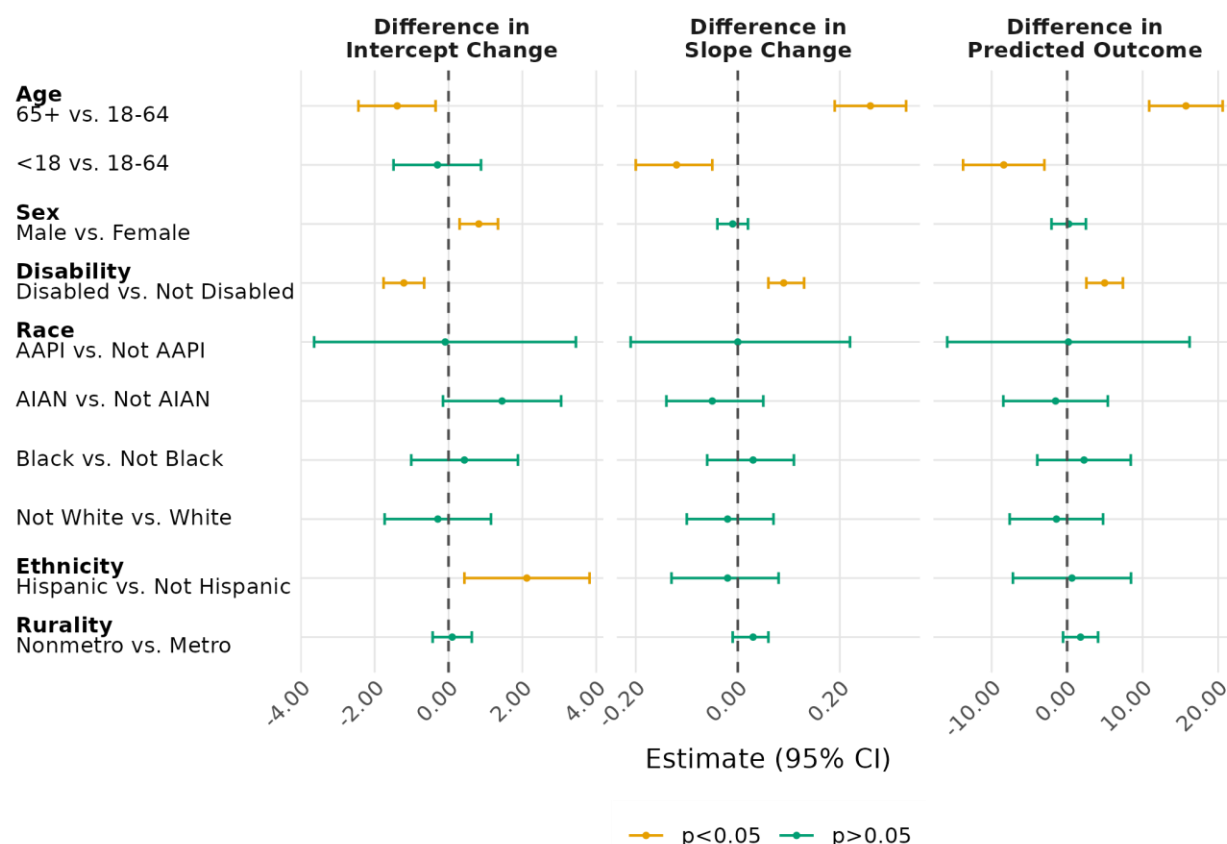
Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population with a substance use disorder.

Table 40: Interrupted time series estimates of Proportion of beneficiaries with SUD who had an Outpatient E&M encounter

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	47.64* (46.88, 48.41)	50.18* (49.50, 50.85)	2.54* (2.12, 2.95)
Monthly Change	-0.19* (-0.22, -0.15)	-0.14* (-0.18, -0.099)	0.048 (-0.0063, 0.10)
Predicted Average Outcome Nov 2024	36.20* (33.26, 39.15)	41.90* (40.63, 43.17)	5.70* (2.12, 9.27)
N	7,656,186		

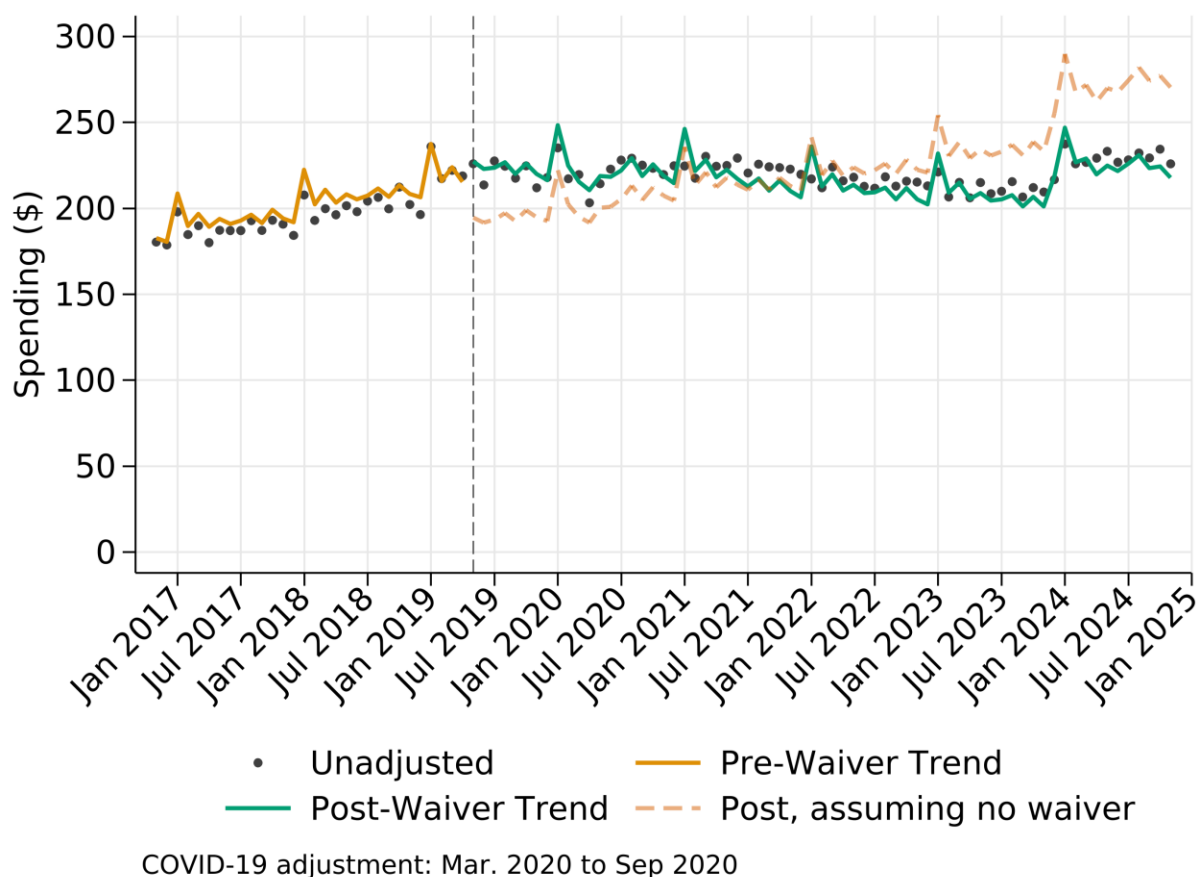
Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population with a substance use disorder.

Figure 100: Comparison groups in Proportion of beneficiaries with SUD who had an Outpatient E&M encounter



Notes: Estimates from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Each of the subgroup variables is interacted with the Waiver-specific intercept and slope. The difference in intercept change (for example), is the intercept change for the first subgroup (e.g., 65+) minus the intercept change for the second subgroup (e.g., 18-64).

Figure 101: Trends in Total Medicaid Service Expenditures for beneficiaries with SUD who had an Outpatient E&M encounter



Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a GEE gamma regression with an exchangeable correlation structure at the person-level with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population as determined in the metric specifications.

Table 41: Interrupted time series estimates of Total Medicaid Service Expenditures for beneficiaries with SUD who had an Outpatient E&M encounter

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	206.96* (205.49, 208.43)	212.70* (211.52, 213.89)	5.74* (4.33, 7.15)
Monthly Change	1.02* (0.95, 1.09)	-0.16* (-0.20, -0.11)	-1.17* (-1.27, -1.08)
Predicted Average Outcome Nov 2024	286.26* (279.36, 293.15)	202.63* (200.55, 204.72)	-83.62* (-91.37, -75.88)
N	3,571,758		

Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a GEE gamma regression with an exchangeable correlation structure at the person-level with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population as determined in the metric specifications.

Figure 36: Trends in Per Member Per Month Medicaid Service Behavioral Health Expenditures for beneficiaries with SUD

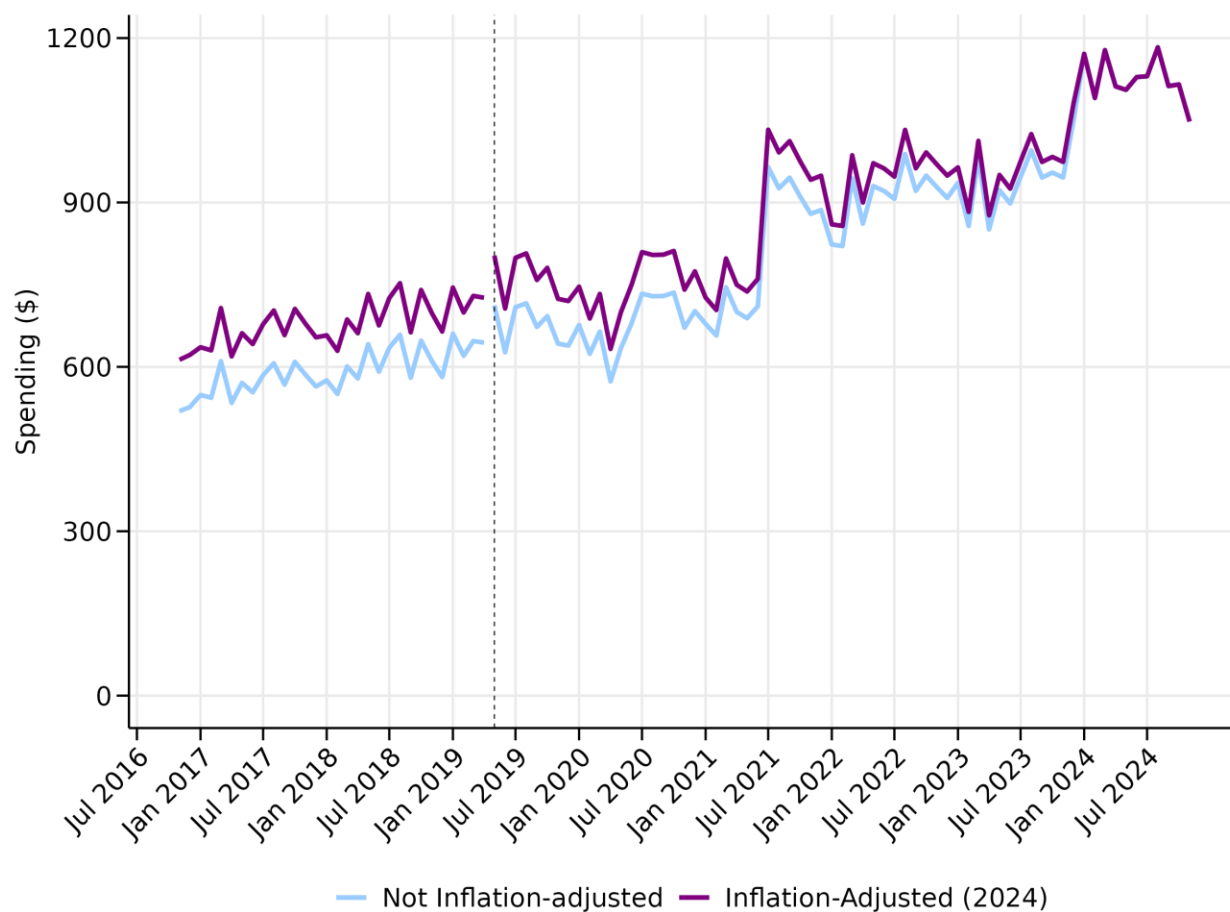
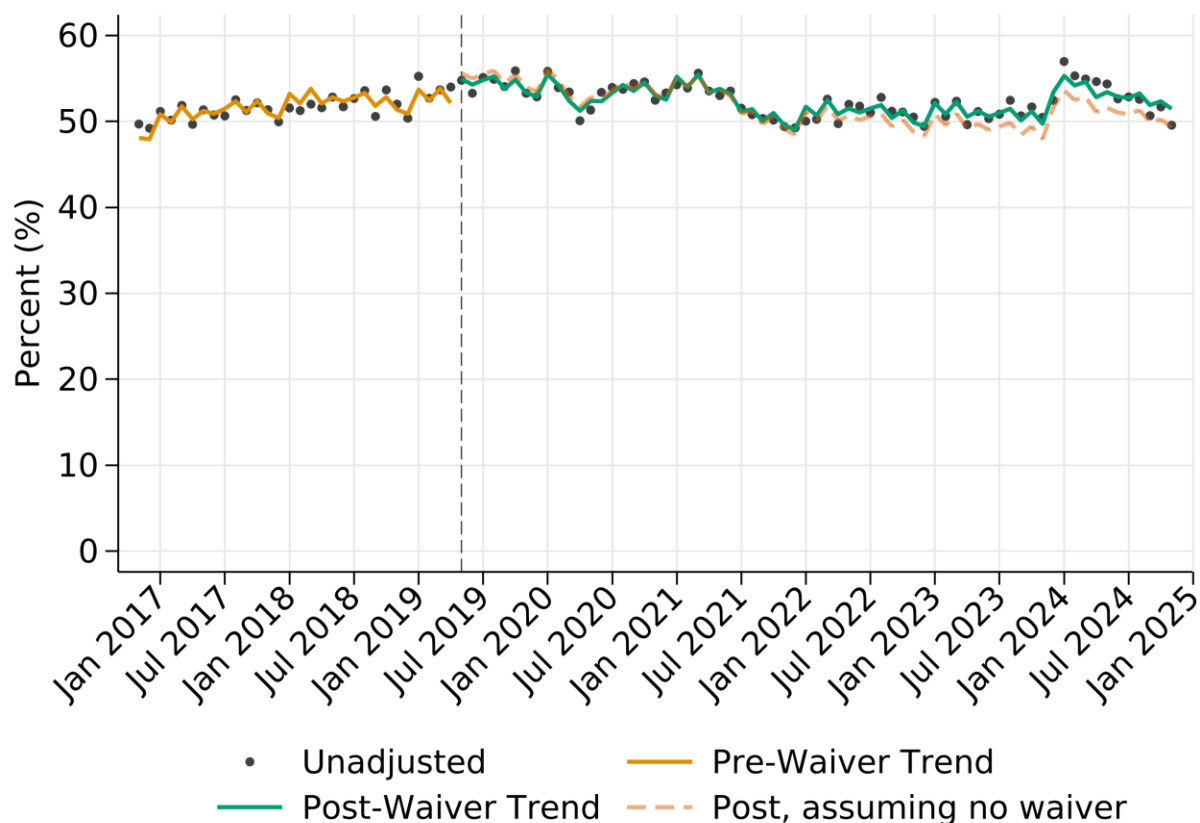


Figure 35: Trends in Proportion of beneficiaries with SUD who had a Behavioral Health encounter



COVID-19 adjustment: Mar. 2020 to Sep 2020

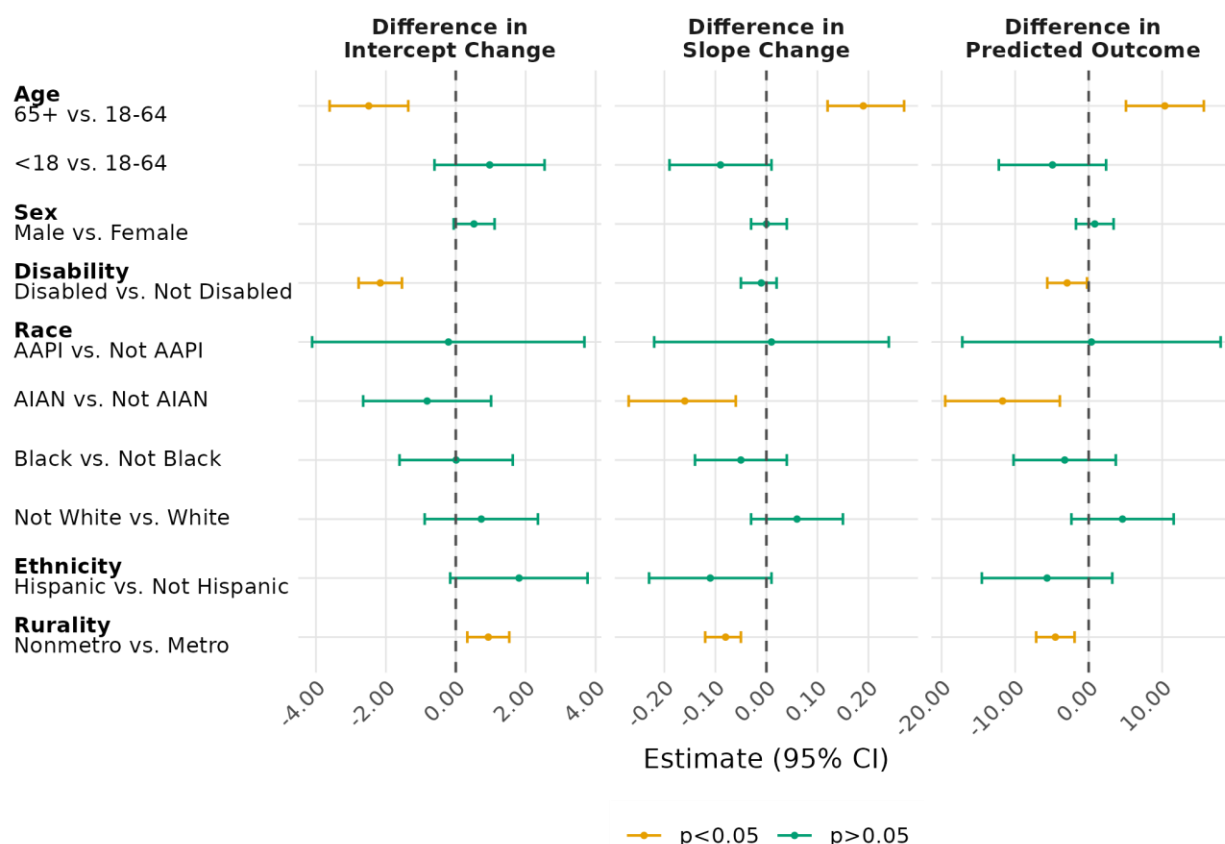
Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population with a substance use disorder.

Table 42: Interrupted time series estimates of Proportion of beneficiaries with SUD who had a Behavioral Health encounter

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	51.56* (50.88, 52.23)	53.82* (53.30, 54.35)	2.27* (1.71, 2.82)
Monthly Change	-0.17* (-0.22, -0.13)	-0.058* (-0.11, -0.011)	0.12* (0.058, 0.18)
Predicted Average Outcome Nov 2024	39.83* (36.62, 43.04)	49.80* (48.35, 51.25)	9.97* (6.13, 13.81)
N	7,656,186		

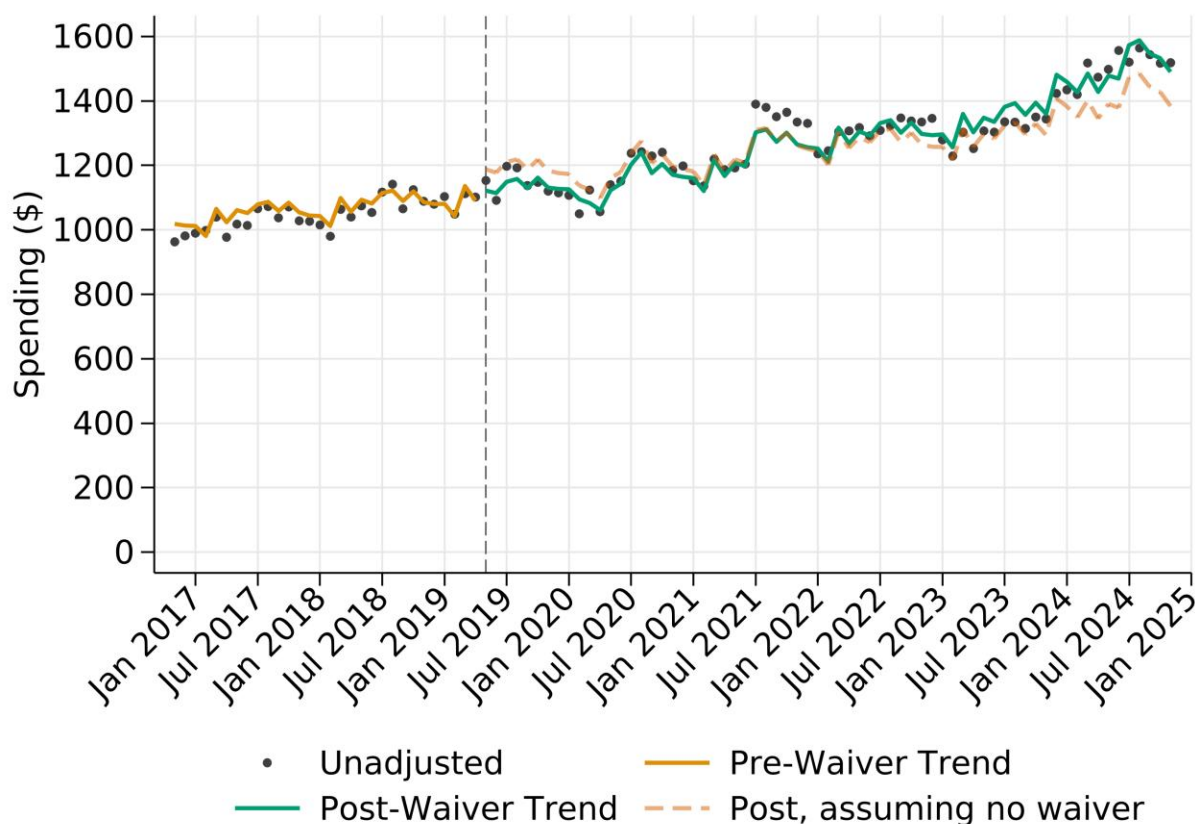
Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population with a substance use disorder.

Figure 102: Comparison groups in Proportion of beneficiaries with SUD who had a Behavioral Health encounter



Notes: Estimates from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Each of the subgroup variables is interacted with the Waiver-specific intercept and slope. The difference in intercept change (for example), is the intercept change for the first subgroup (e.g., 65+) minus the intercept change for the second subgroup (e.g., 18-64).

Figure 103: Trends in Total Medicaid Service Expenditures for beneficiaries with SUD who had a Behavioral Health encounter



COVID-19 adjustment: Mar. 2020 to Sep 2020

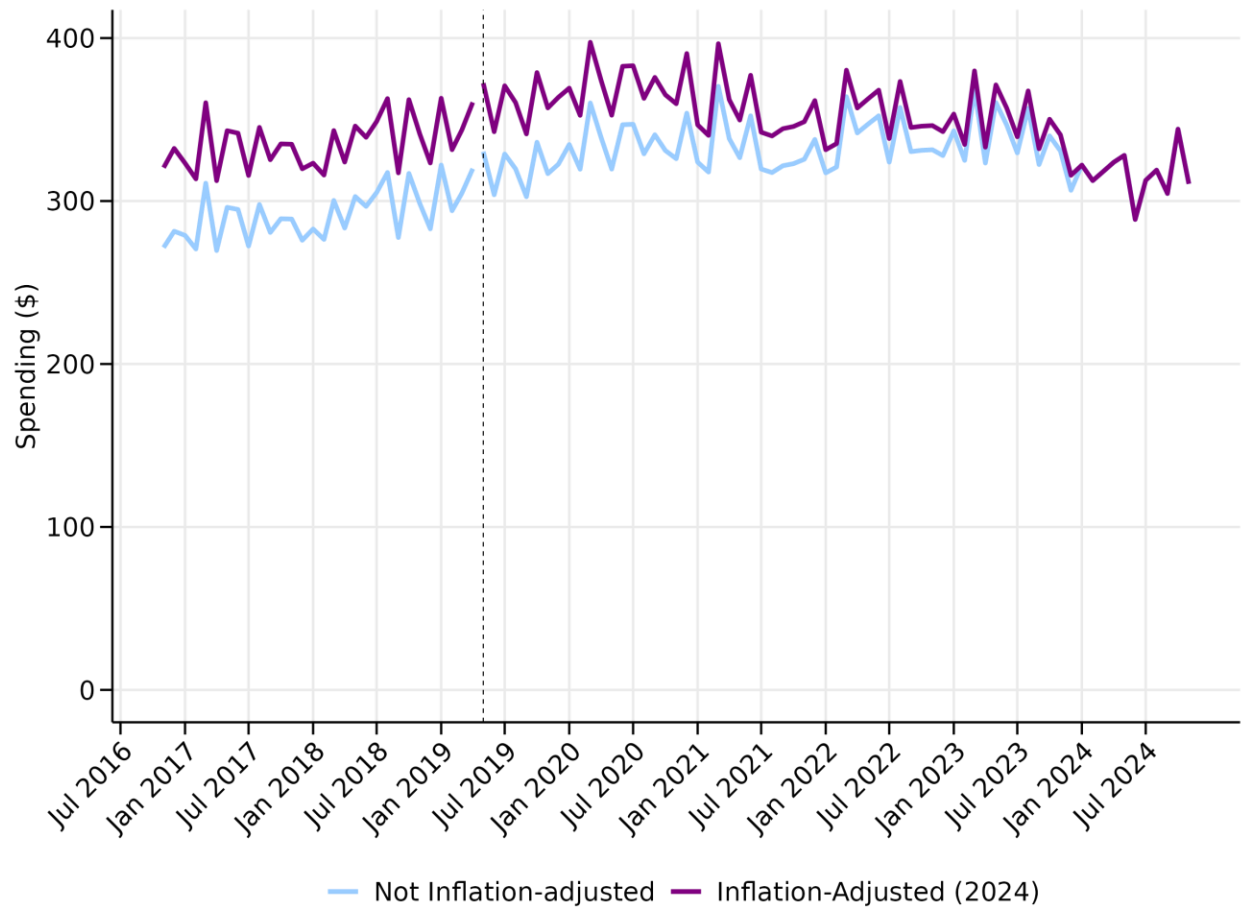
Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a GEE gamma regression with an exchangeable correlation structure at the person-level with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population as determined in the metric specifications.

Table 43: Interrupted time series estimates of Total Medicaid Service Expenditures for beneficiaries with SUD who had a Behavioral Health encounter

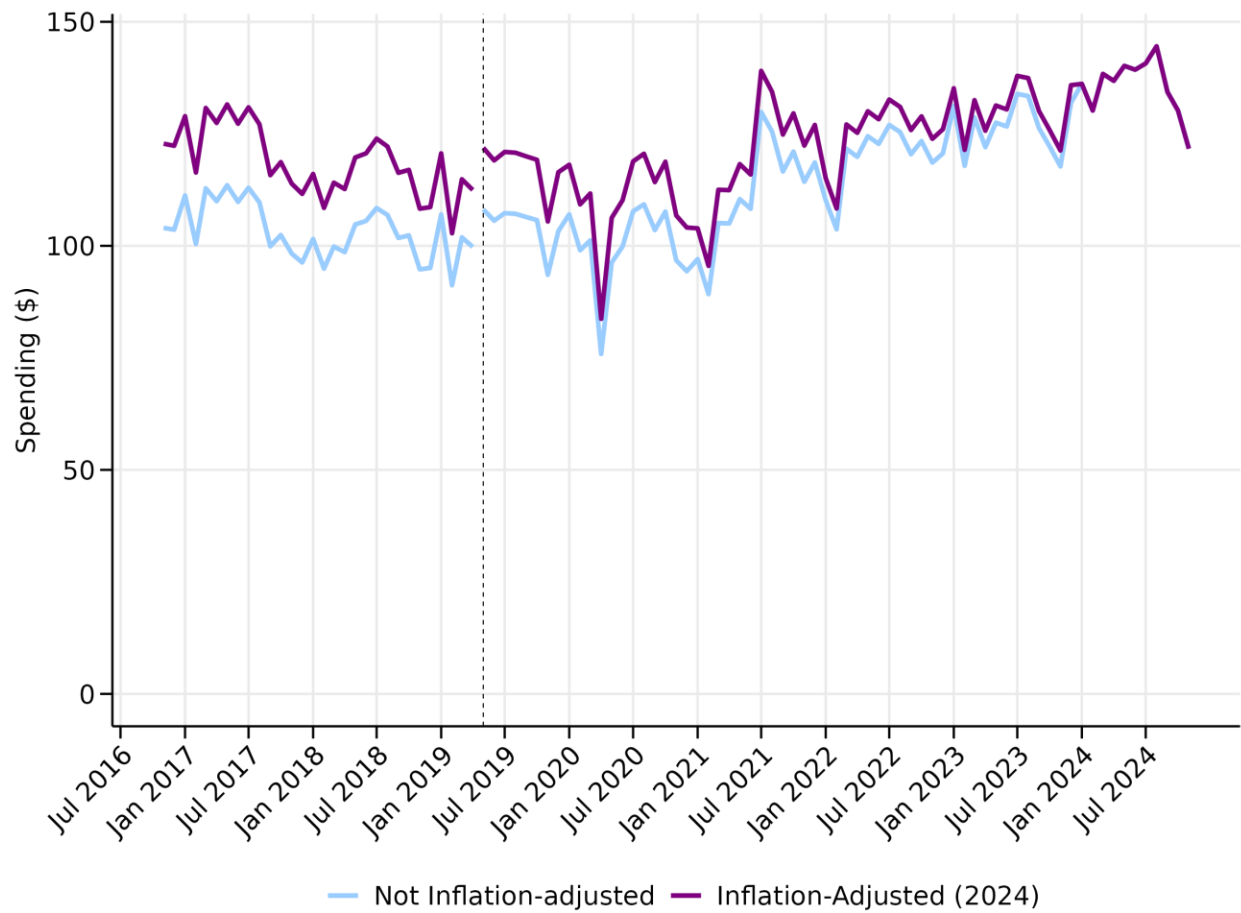
	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	1081.03* (1070.42, 1091.64)	1074.99* (1066.93, 1083.05)	-6.04 (-15.98, 3.90)
Monthly Change	1.96* (1.46, 2.45)	4.07* (3.82, 4.32)	2.11* (1.49, 2.74)
Predicted Average Outcome Nov 2024	1218.72* (1178.49, 1258.95)	1380.81* (1362.88, 1398.75)	162.09* (113.43, 210.75)
N	3,955,646		

Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a GEE gamma regression with an exchangeable correlation structure at the person-level with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population as determined in the metric specifications.

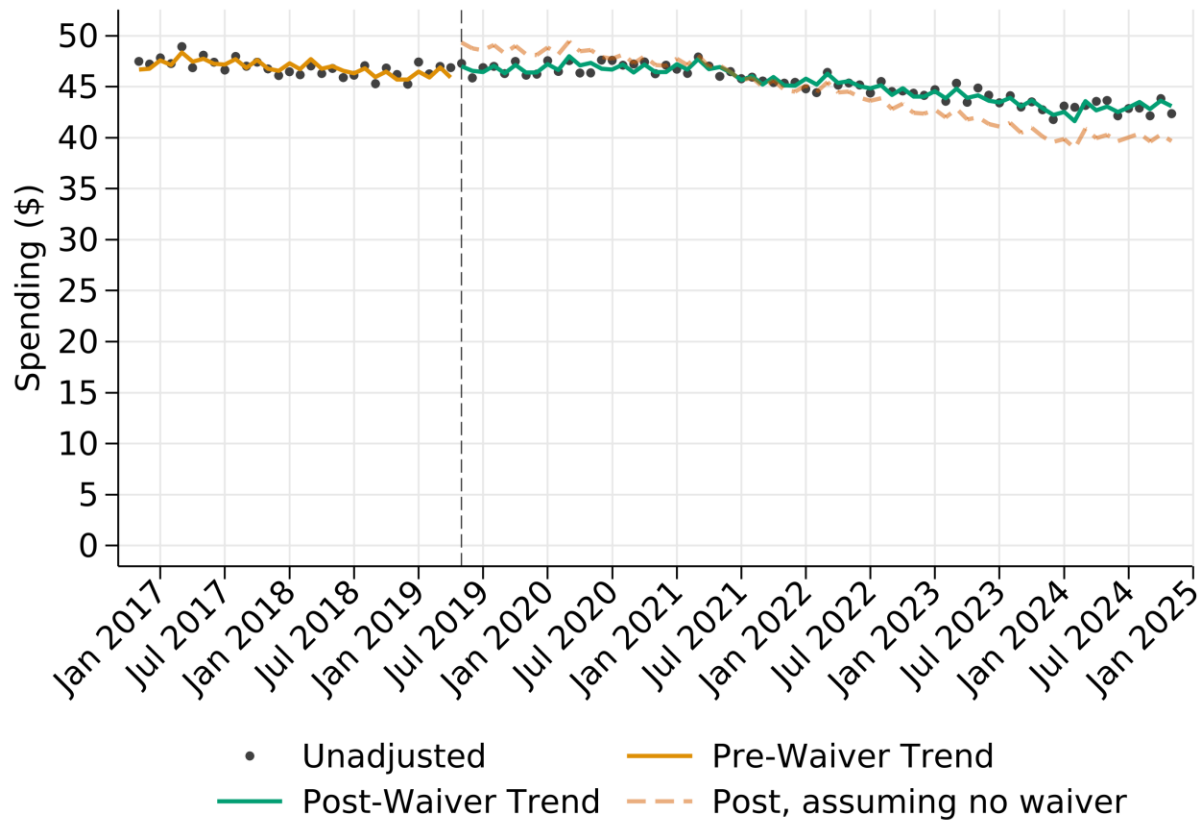
[Figure 38](#): Trends in Per Member Per Month Medicaid Service Pharmacy Expenditures for beneficiaries with SUD



[Figure 40](#): Trends in Per Member Per Month Medicaid Service ER Expenditures for beneficiaries with SUD



[Figure 37](#): Trends in Proportion of beneficiaries with SUD who had an prescription



COVID-19 adjustment: Mar. 2020 to end of study period

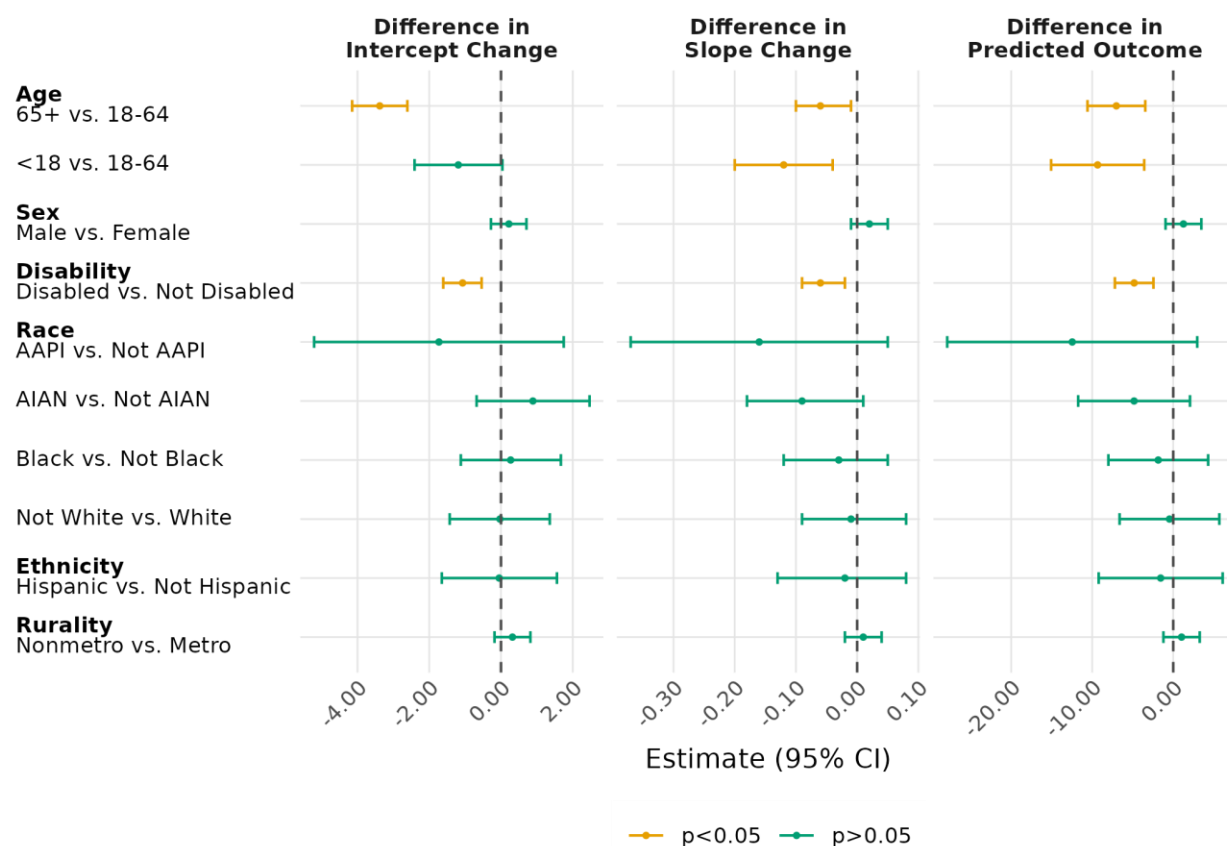
Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population with a substance use disorder.

Table 44: Interrupted time series estimates of Proportion of beneficiaries with SUD who had a prescription

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	46.33* (45.88, 46.78)	47.23* (46.79, 47.67)	0.90* (0.57, 1.24)
Monthly Change	-0.18* (-0.20, -0.16)	0.020 (-0.020, 0.060)	0.20* (0.16, 0.23)
Predicted Average Outcome Nov 2024	27.84* (25.41, 30.28)	41.86* (41.16, 42.57)	14.02* (11.72, 16.31)
N	7,656,186		

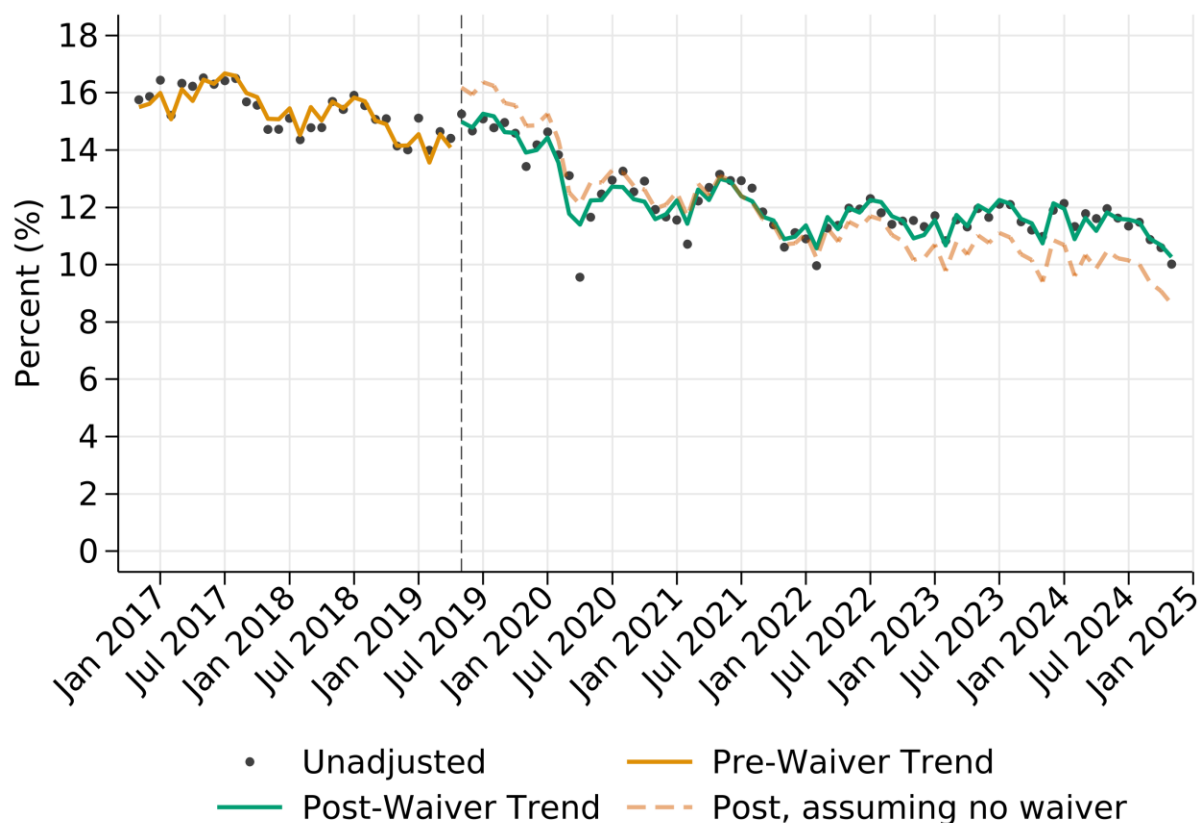
Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population with a substance use disorder.

Figure 104: Comparison groups in Proportion of beneficiaries with SUD who had a prescription



Notes: Estimates from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Each of the subgroup variables is interacted with the Waiver-specific intercept and slope. The difference in intercept change (for example), is the intercept change for the first subgroup (e.g., 65+) minus the intercept change for the second subgroup (e.g., 18-64).

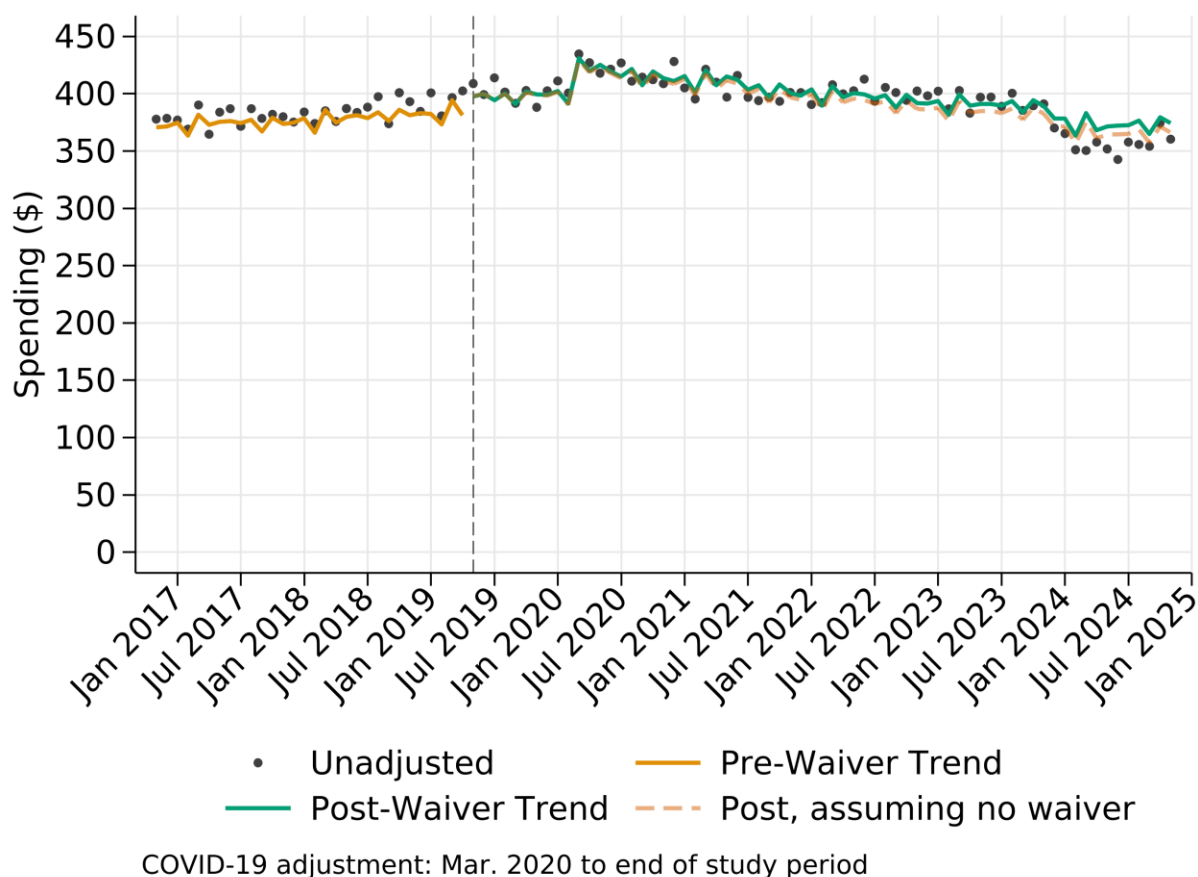
Figure 39: Trends in Proportion of beneficiaries with SUD who had an ER encounter



COVID-19 adjustment: Mar. 2020 to May 2023

Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population with a substance use disorder.

Figure 105: Trends in Total Medicaid Service Expenditures for beneficiaries with SUD who had a prescription



Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a GEE gamma regression with an exchangeable correlation structure at the person-level with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population as determined in the metric specifications.

Table 45: Interrupted time series estimates of Proportion of beneficiaries with SUD who had an ER encounter

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	14.57* (14.29, 14.84)	14.82* (14.48, 15.16)	0.25* (0.048, 0.46)
Monthly Change	-0.11* (-0.13, -0.094)	-0.014 (-0.031, 0.0036)	0.097* (0.077, 0.12)
Predicted Average Outcome Nov 2024	5.30* (4.10, 6.49)	11.94* (11.38, 12.50)	6.64* (5.34, 7.95)
N	7,656,186		

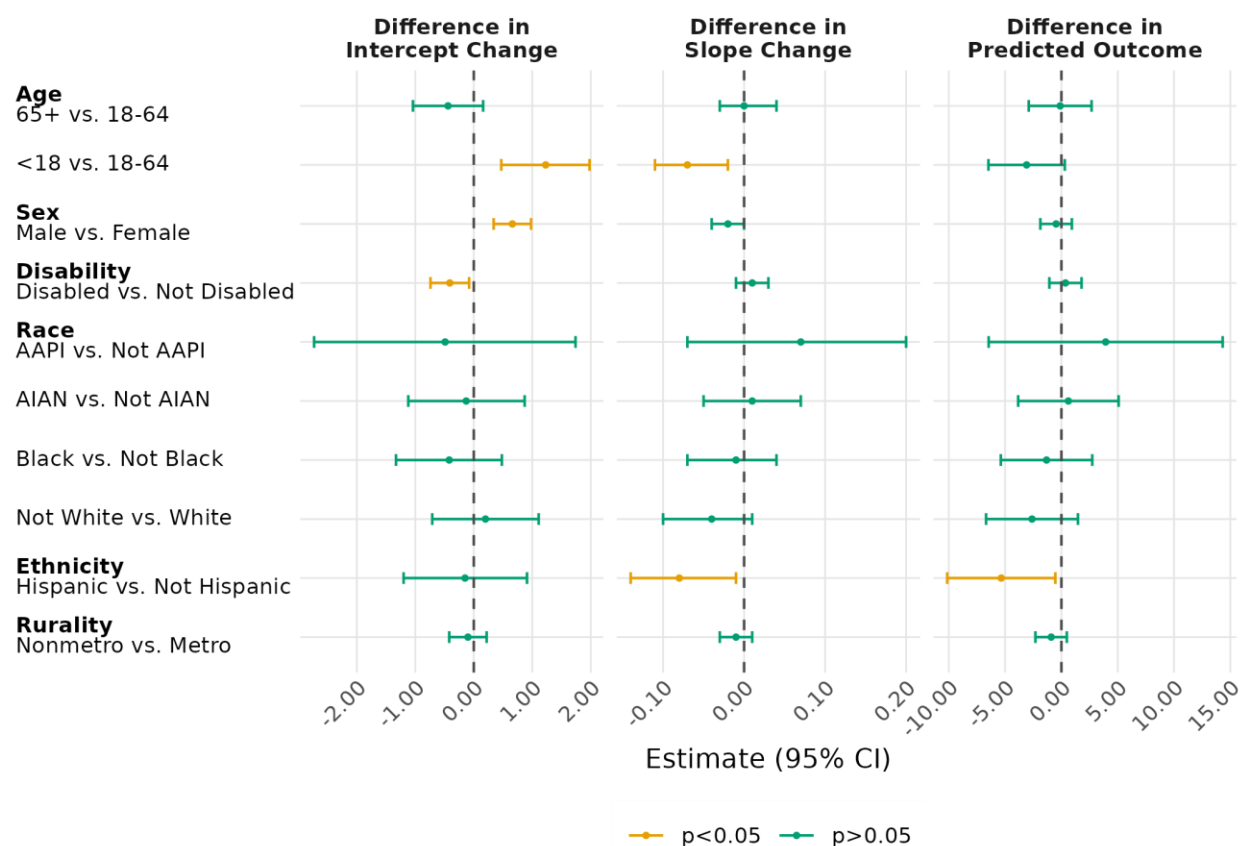
Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population with a substance use disorder.

Table 46: Interrupted time series estimates of Total Medicaid Service Expenditures for beneficiaries with SUD who had a prescription

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	290.80* (287.21, 294.39)	299.01* (294.80, 303.22)	8.21* (4.95, 11.47)
Monthly Change	0.050 (-0.11, 0.21)	0.15 (-0.38, 0.69)	0.10 (-0.43, 0.64)
Predicted Average Outcome Nov 2024	286.36* (253.69, 319.03)	301.14* (294.29, 308.00)	14.78 (-17.23, 46.79)
N	3,308,197		

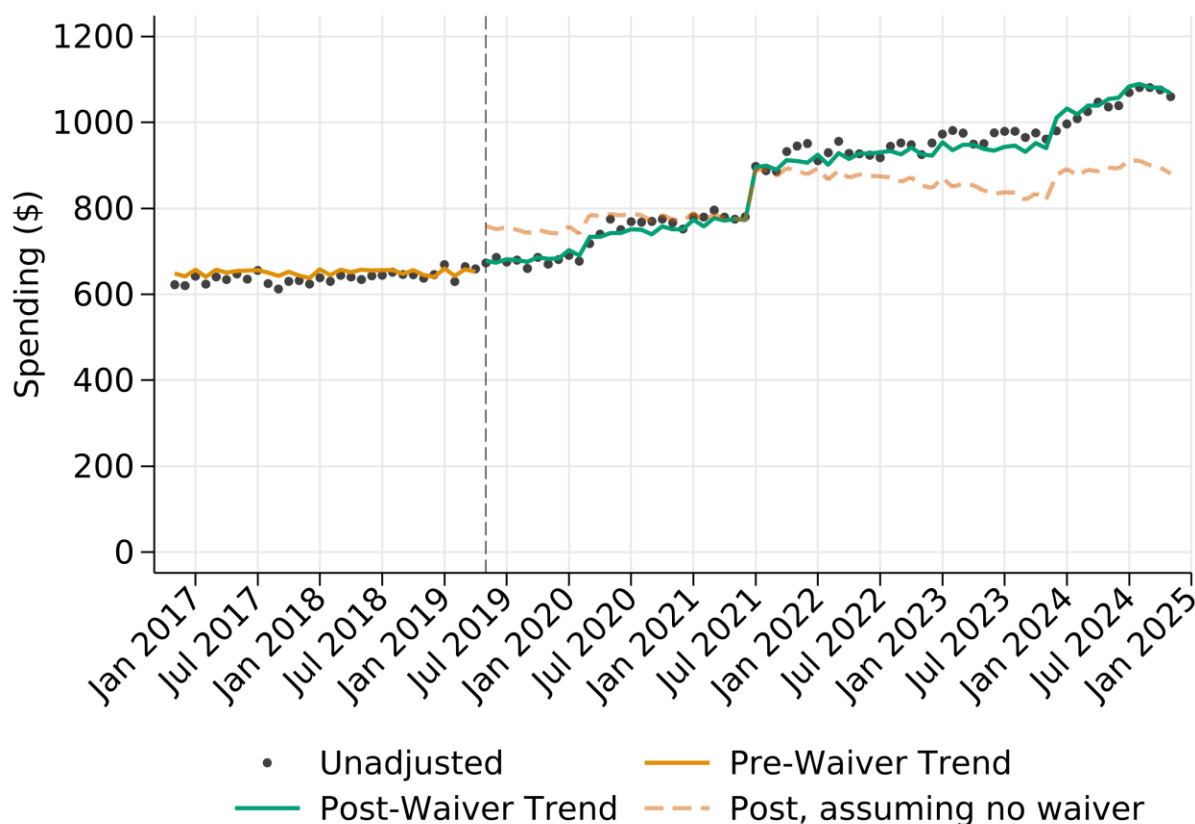
Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a GEE gamma regression with an exchangeable correlation structure at the person-level with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population as determined in the metric specifications.

Figure 106: Comparison groups in Proportion of beneficiaries with SUD who had an ER encounter



Notes: Estimates from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Each of the subgroup variables is interacted with the Waiver-specific intercept and slope. The difference in intercept change (for example), is the intercept change for the first subgroup (e.g., 65+) minus the intercept change for the second subgroup (e.g., 18-64).

Figure 107: Trends in Total Medicaid Service Expenditures for beneficiaries with SUD who had an ER encounter



COVID-19 adjustment: Mar. 2020 to May 2023

Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a GEE gamma regression with an exchangeable correlation structure at the person-level with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population as determined in the metric specifications.

Table 47: Interrupted time series estimates of Total Medicaid Service Expenditures for beneficiaries with SUD who had an ER encounter

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	654.92* (643.51, 666.33)	673.63* (663.52, 683.73)	18.70* (10.81, 26.60)
Monthly Change	-0.16 (-0.66, 0.35)	2.96* (2.69, 3.22)	3.12* (2.43, 3.80)
Predicted Average Outcome Nov 2024	644.70* (614.02, 675.38)	900.39* (874.66, 926.11)	255.69* (206.42, 304.96)
N	979,053		

Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a GEE gamma regression with an exchangeable correlation structure at the person-level with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population as determined in the metric specifications.

Figure 42: Trends in Per Member Per Month Medicaid Service Inpatient Expenditures for beneficiaries with SUD

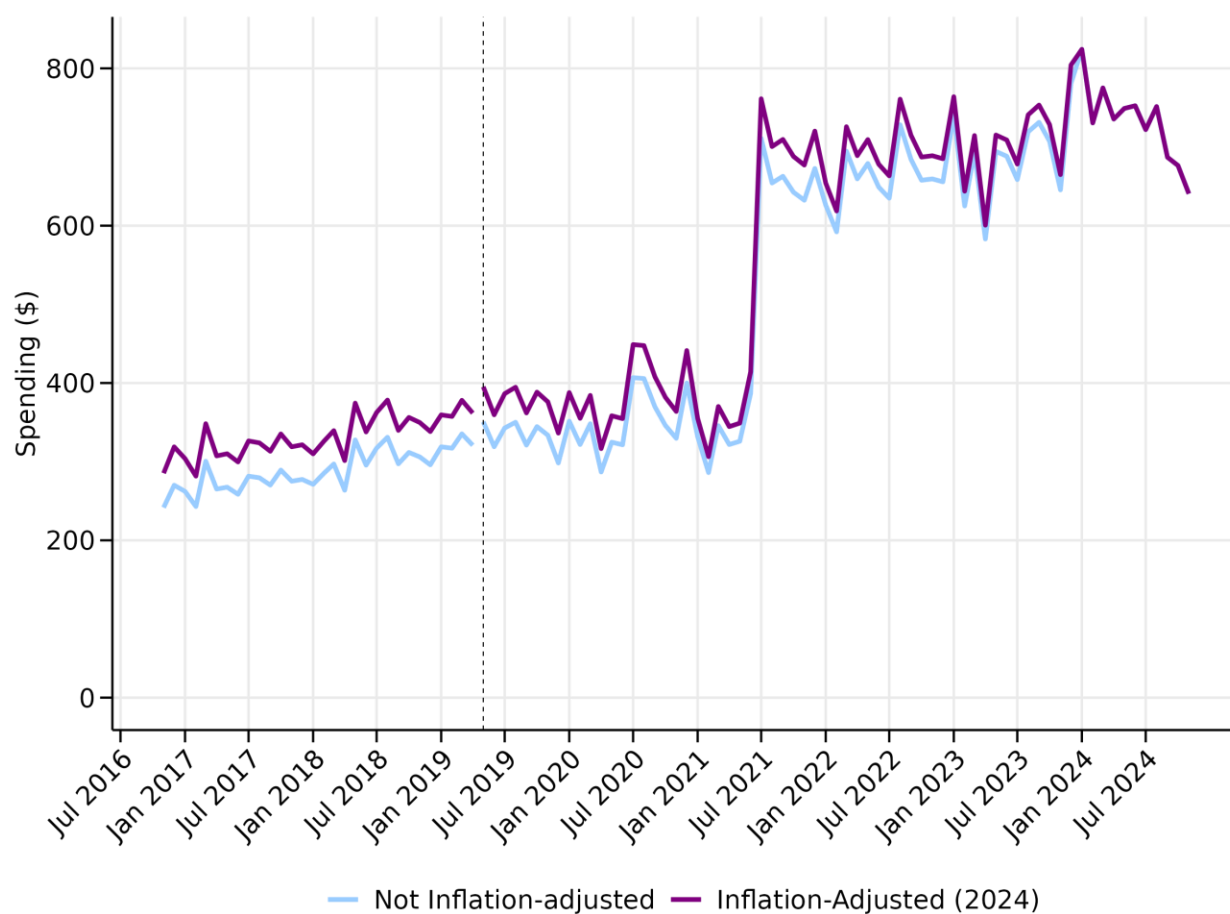
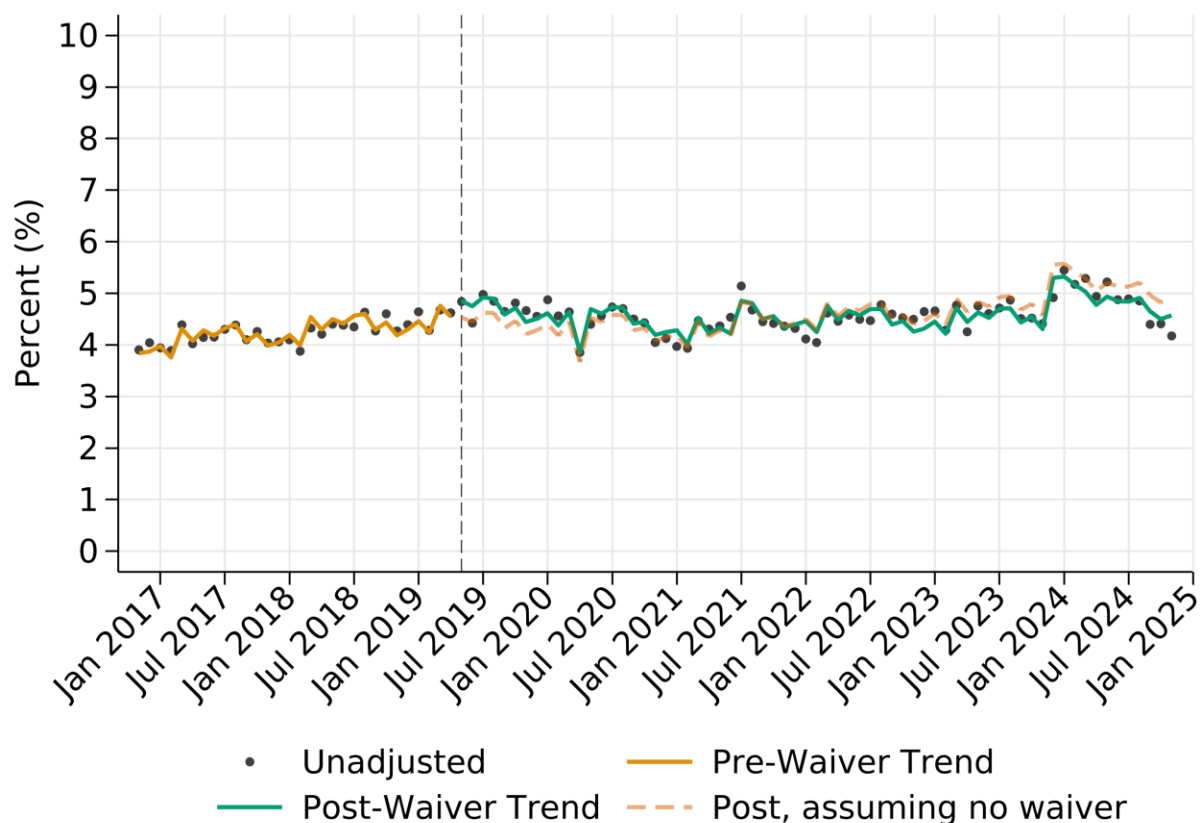


Figure 41: Trends in Proportion of beneficiaries with SUD who had an encounter for Inpatient services



COVID-19 adjustment: Mar. 2020 to May 2020

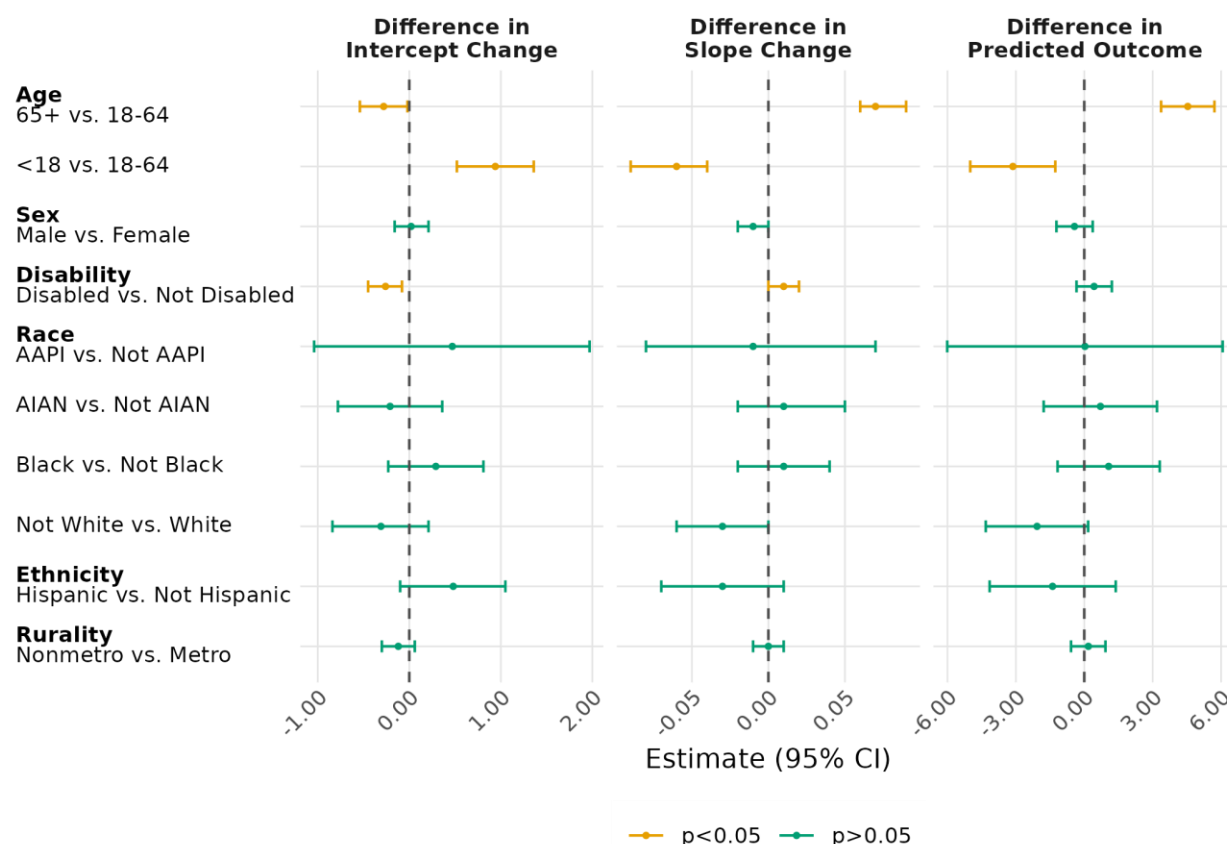
Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population with a substance use disorder.

Table 48: Interrupted time series estimates of Proportion of beneficiaries with SUD who had an encounter for Inpatient services

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	4.48* (4.33, 4.63)	4.60* (4.48, 4.72)	0.12 (-0.0099, 0.25)
Monthly Change	0.012* (0.0026, 0.021)	-0.0090* (-0.017, -0.0012)	-0.021* (-0.029, -0.012)
Predicted Average Outcome Nov 2024	5.56* (4.96, 6.16)	4.32* (4.05, 4.59)	-1.24* (-1.82, -0.66)
N	7,656,186		

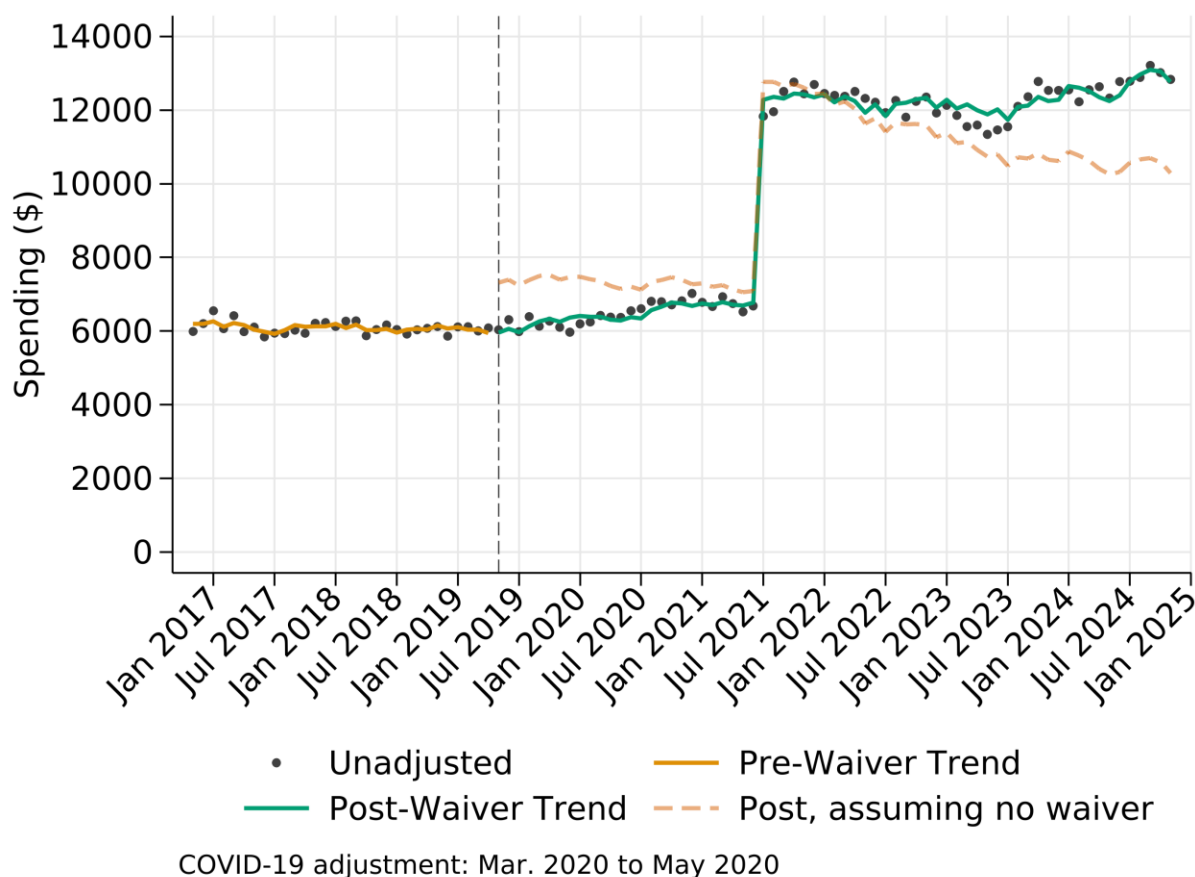
Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population with a substance use disorder.

Figure 108: Comparison groups in Proportion of beneficiaries with SUD who had an encounter for Inpatient services



Notes: Estimates from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Each of the subgroup variables is interacted with the Waiver-specific intercept and slope. The difference in intercept change (for example), is the intercept change for the first subgroup (e.g., 65+) minus the intercept change for the second subgroup (e.g., 18-64).

Figure 109: Trends in Total Medicaid Service Expenditures for beneficiaries with SUD who had an encounter for Inpatient services



Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a GEE gamma regression with an exchangeable correlation structure at the person-level with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population as determined in the metric specifications.

Table 49: Interrupted time series estimates of Total Medicaid Service Expenditures for beneficiaries with SUD who had an encounter for Inpatient services

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	9471.76* (9238.93, 9704.58)	9482.37* (9314.72, 9650.03)	10.62 (-187.62, 208.85)
Monthly Change	-47.75* (-58.78, -36.72)	12.59* (8.21, 16.97)	60.34* (48.04, 72.65)
Predicted Average Outcome Nov 2024	6929.84* (6405.35, 7454.33)	10562.74* (10314.99, 10810.49)	3632.90* (2975.13, 4290.67)
N	341,200		

Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a GEE gamma regression with an exchangeable correlation structure at the person-level with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population as determined in the metric specifications.

Figure 110: Trends in Total Medicaid Service IMD Expenditures for beneficiaries with SUD

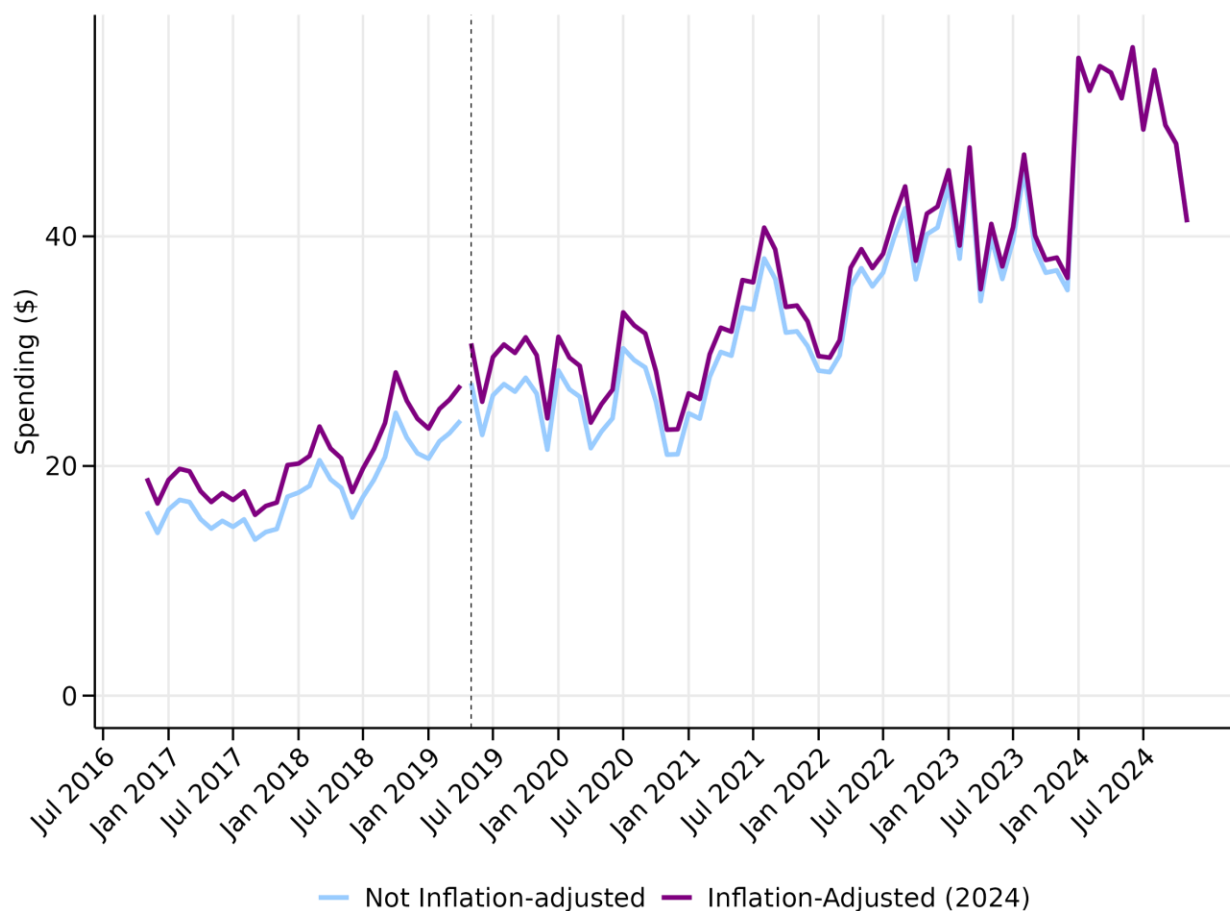
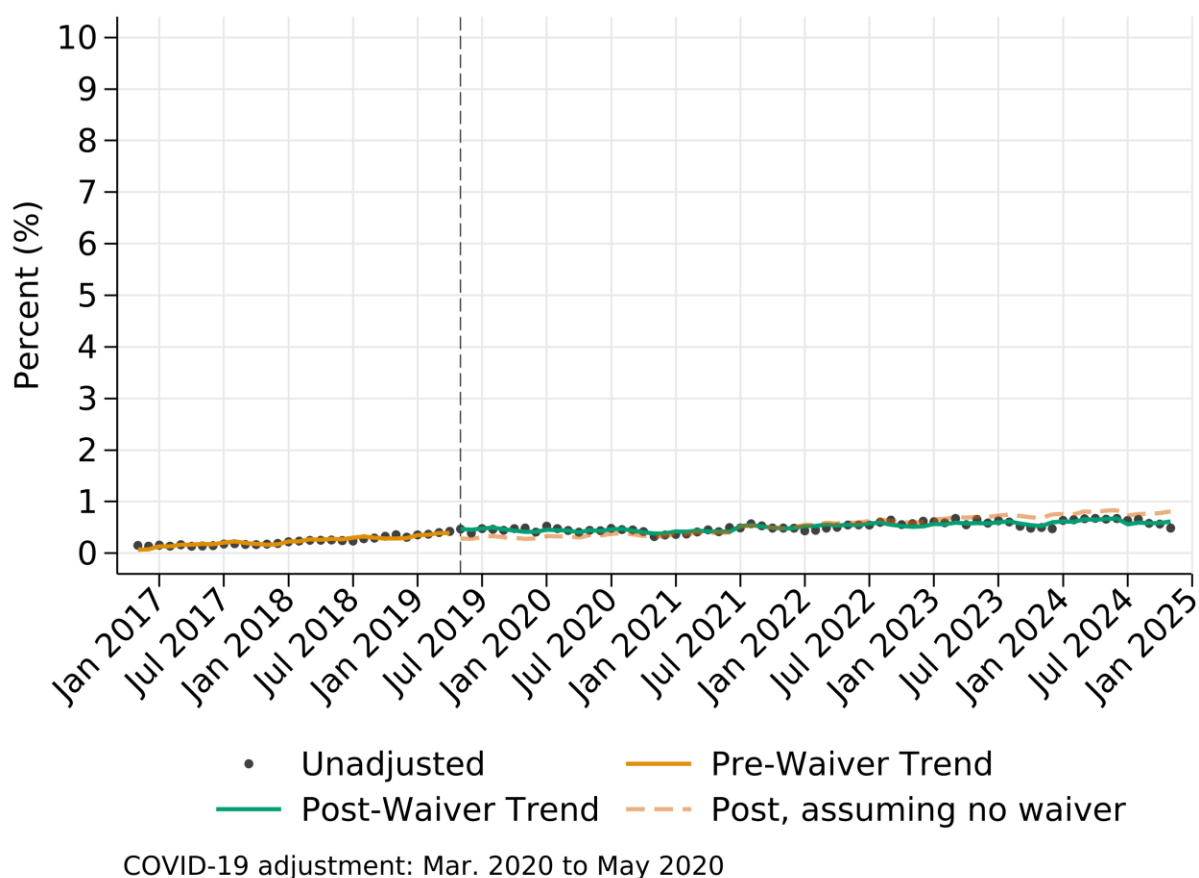
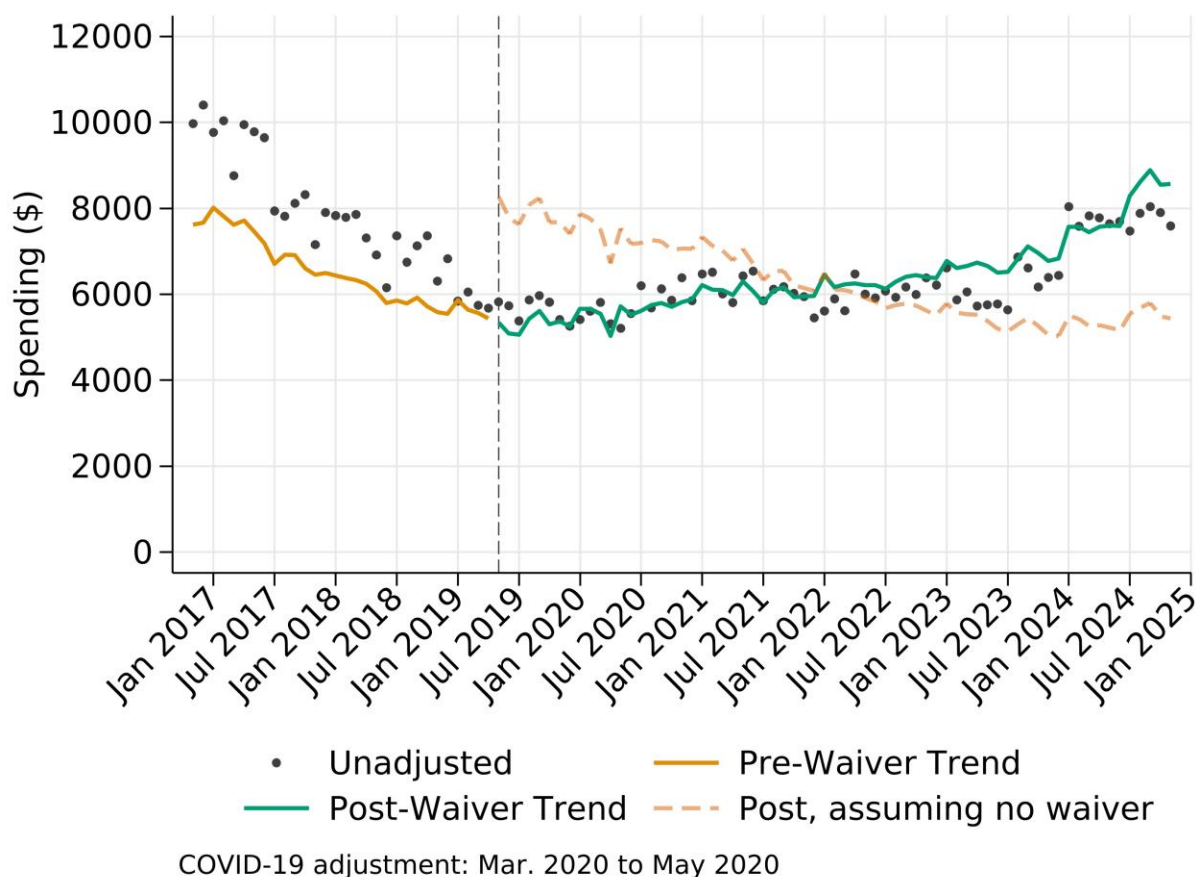


Figure 111: Trends in Proportion of beneficiaries with SUD who had an IMD Service



Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population with a substance use disorder.

Figure 112: Trends in Total Medicaid Service Expenditures for beneficiaries with SUD who had an IMD Service



Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a GEE gamma regression with an exchangeable correlation structure at the person-level with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population as determined in the metric specifications.

Figure 43: Trends in Per Member Per Month Medicaid Service Acute Care Crisis Oriented Expenditures for beneficiaries with SUD

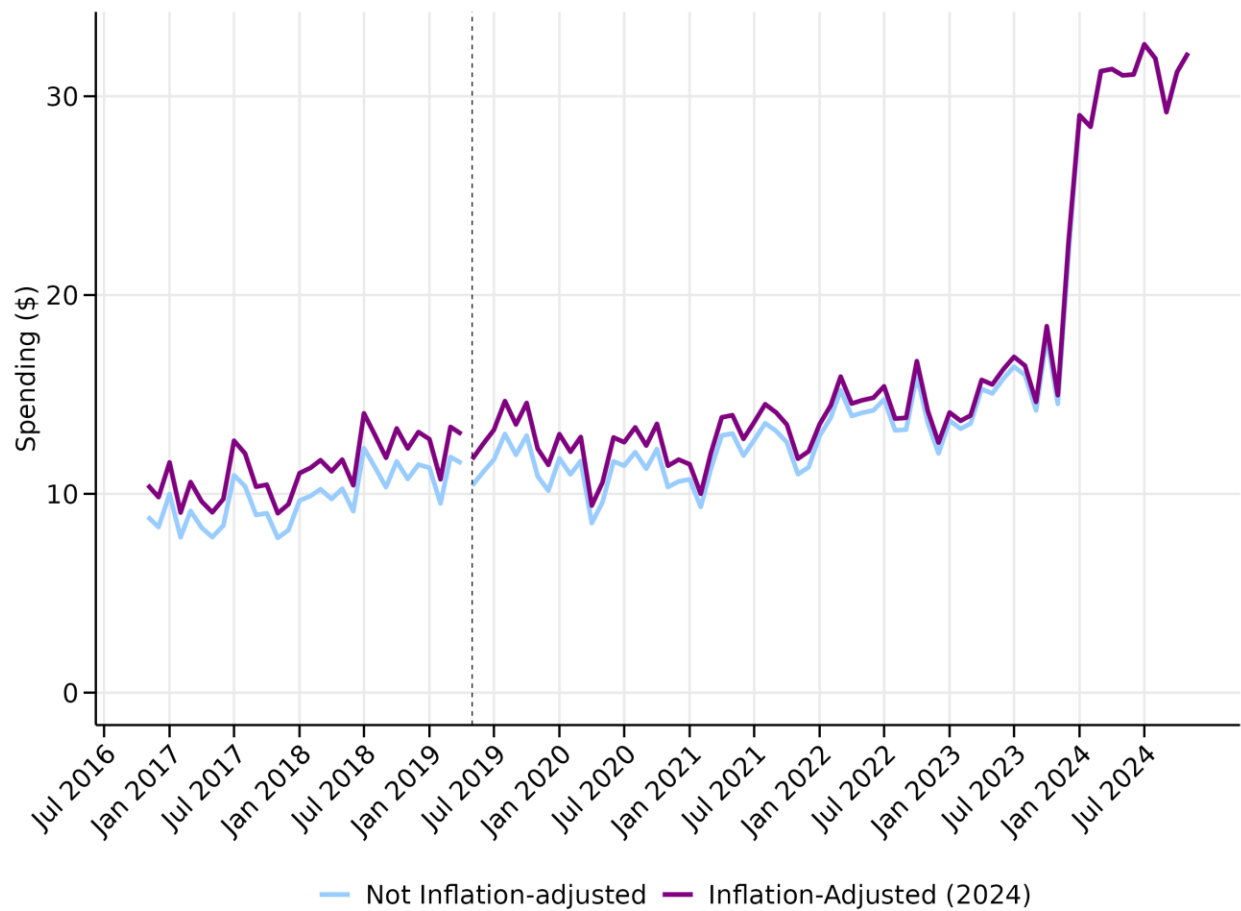
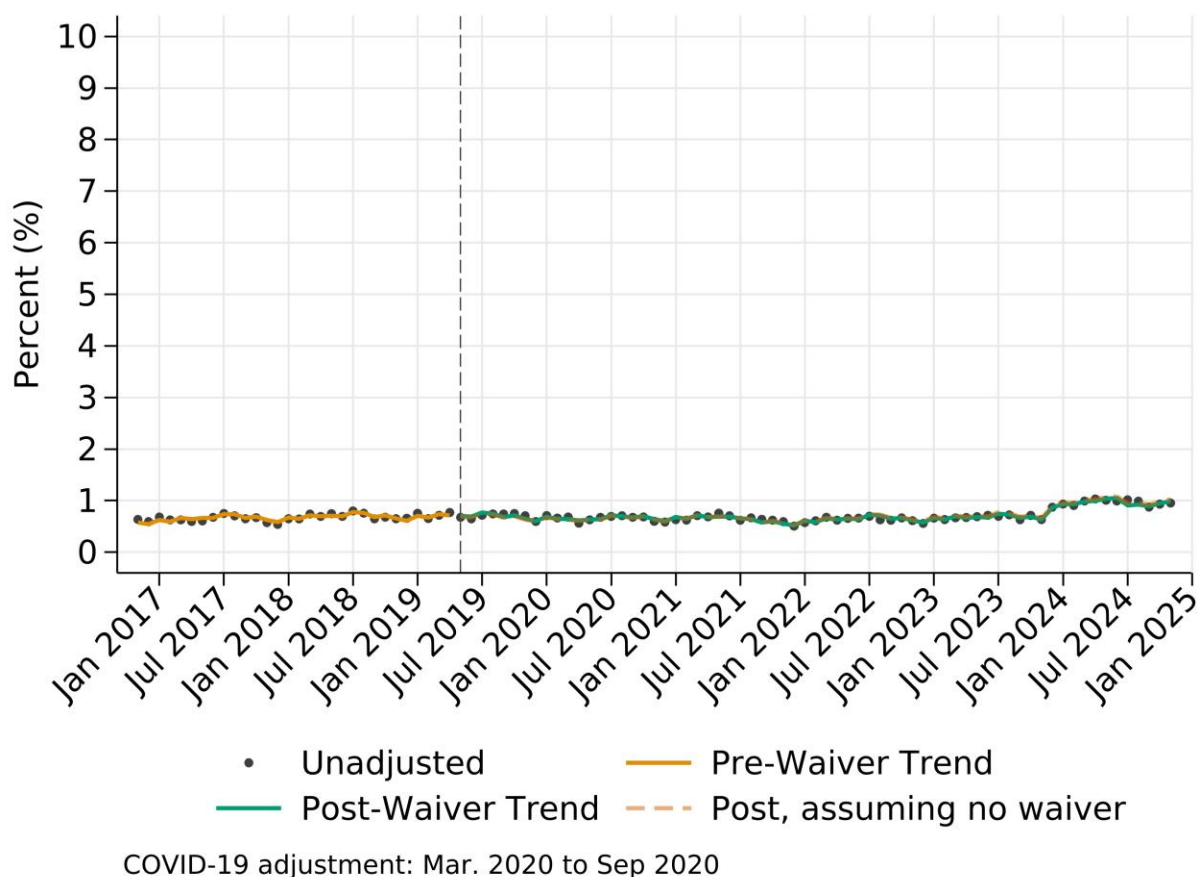


Figure 113: Trends in Proportion of beneficiaries with SUD who had an Acute Care Crisis Oriented encounter



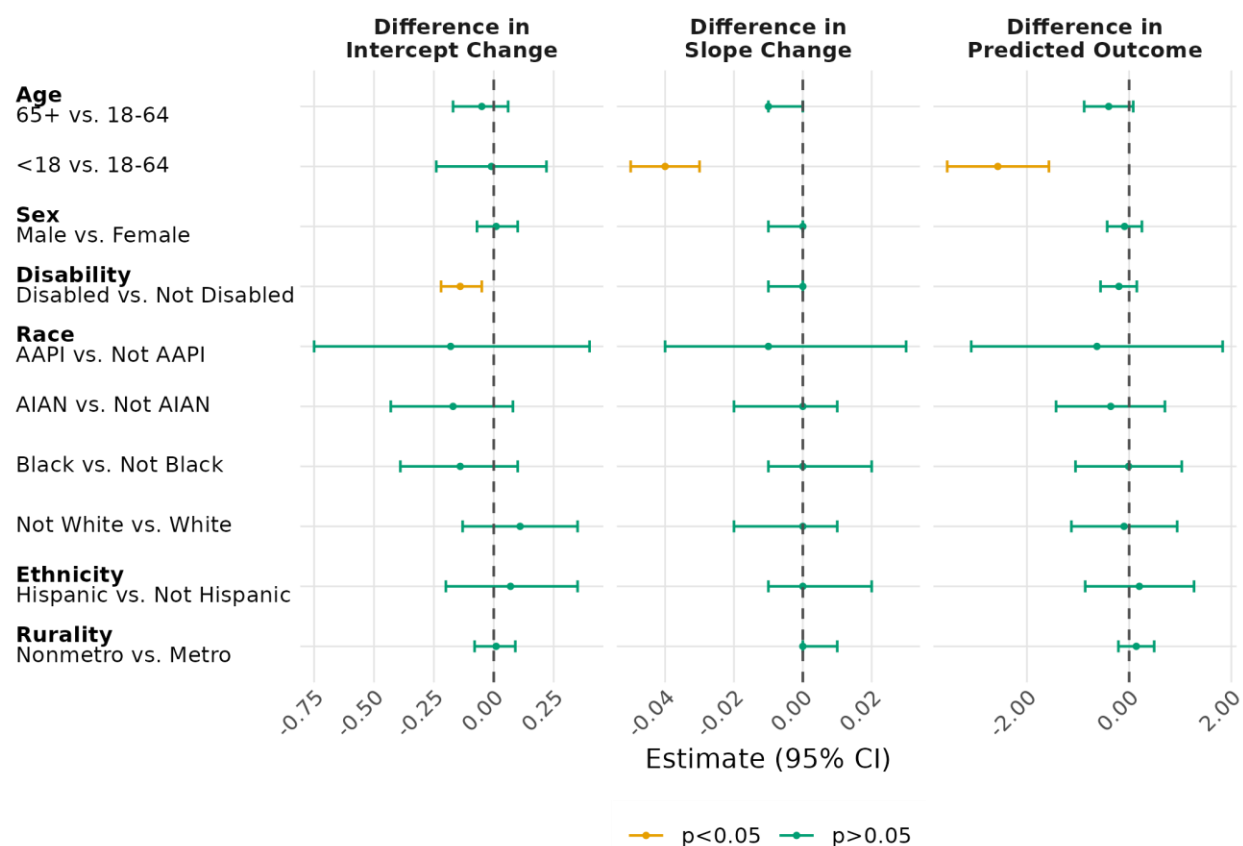
Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population with a substance use disorder.

Table 17: Interrupted time series estimates of Proportion of beneficiaries with SUD who had an Acute Care Crisis Oriented encounter

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	0.68* (0.58, 0.78)	0.65* (0.58, 0.73)	-0.028 (-0.11, 0.058)
Monthly Change	-0.0002 (-0.0045, 0.0041)	-0.0024 (-0.0064, 0.0016)	-0.0022 (-0.0073, 0.0030)
Predicted Average Outcome Nov 2024	0.83* (0.49, 1.17)	0.66* (0.52, 0.79)	-0.17 (-0.55, 0.20)
N	7,656,186		

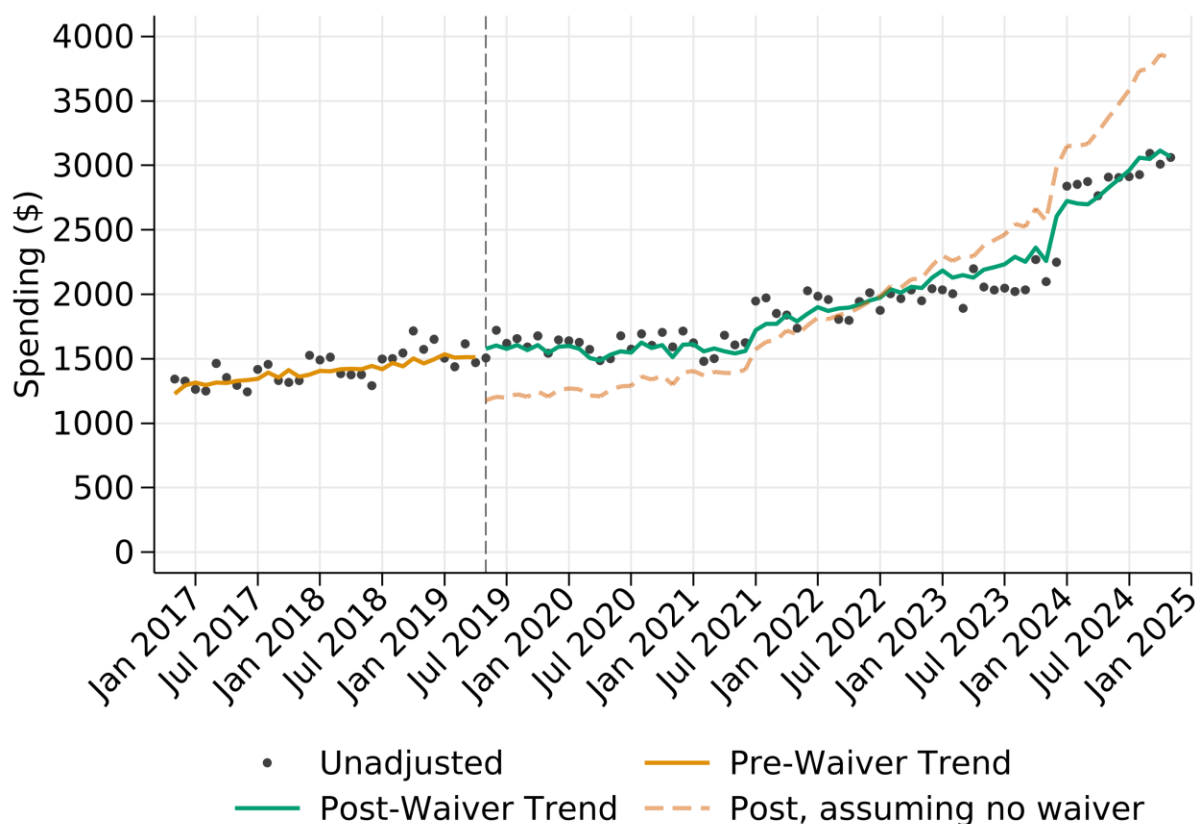
*Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population with a substance use disorder.*

Figure 114: Comparison groups in Proportion of beneficiaries with SUD who had an Acute Care Crisis Oriented encounter



Notes: Estimates from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Each of the subgroup variables is interacted with the Waiver-specific intercept and slope. The difference in intercept change (for example), is the intercept change for the first subgroup (e.g., 65+) minus the intercept change for the second subgroup (e.g., 18-64).

Figure 115: Trends in Total Medicaid Service Expenditures for beneficiaries with SUD who had an Acute Care Crisis Oriented encounter



COVID-19 adjustment: Mar. 2020 to Sep 2020

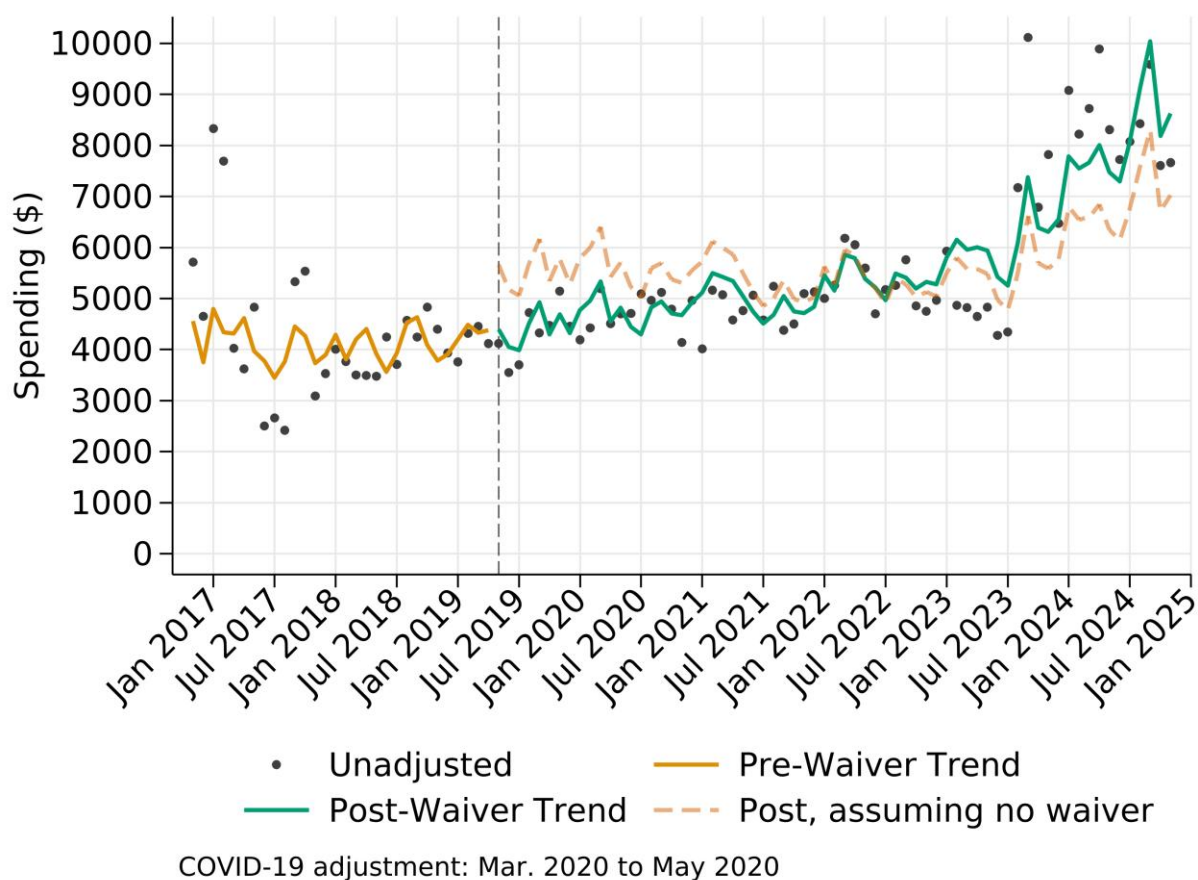
Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a GEE gamma regression with an exchangeable correlation structure at the person-level with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population as determined in the metric specifications.

Table 50: Interrupted time series estimates of Total Medicaid Service Expenditures for beneficiaries with SUD who had an Acute Care Crisis Oriented encounter

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	1429.76* (1359.51, 1500.01)	1453.18* (1399.87, 1506.49)	23.41 (-47.42, 94.25)
Monthly Change	18.03* (14.46, 21.60)	6.97* (5.12, 8.82)	-11.06* (-15.58, -6.53)
Predicted Average Outcome Nov 2024	3538.78* (2898.59, 4178.97)	2147.89* (2049.75, 2246.02)	-1390.90* (-2076.33, -705.46)
N	53,942		

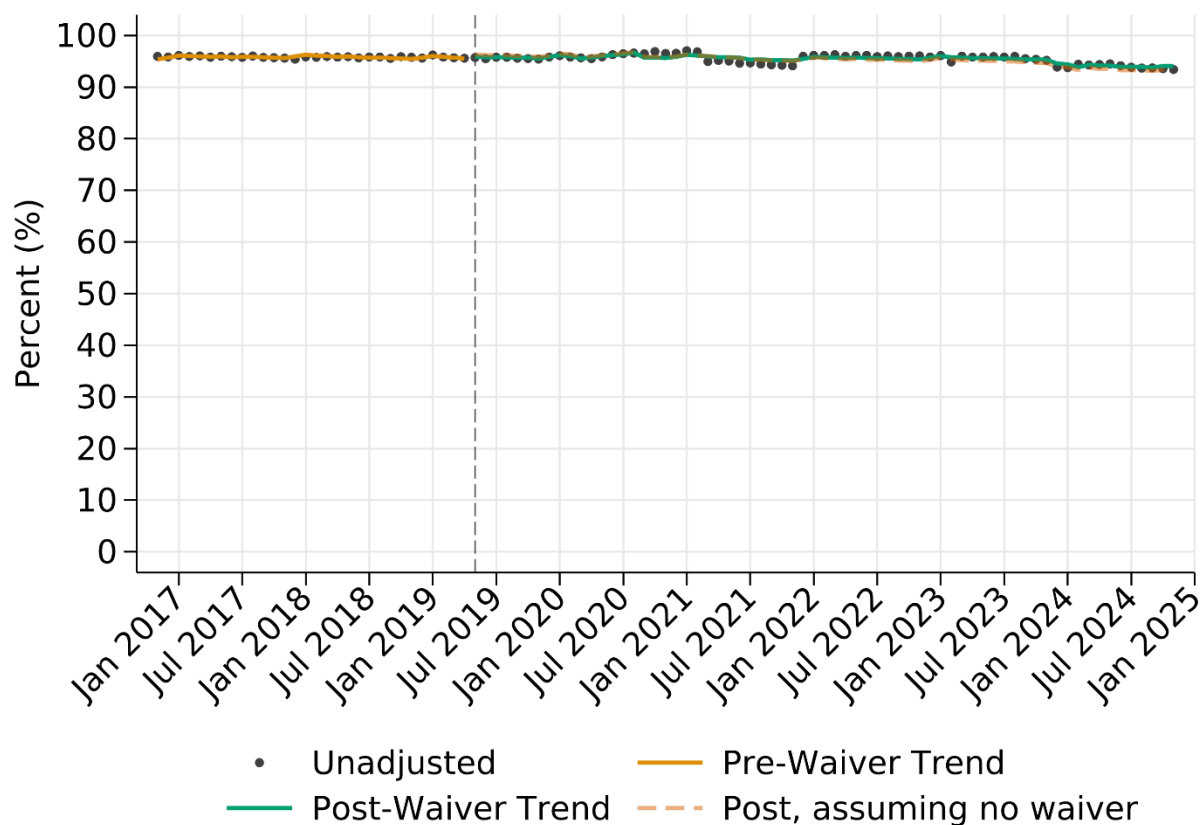
Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a GEE gamma regression with an exchangeable correlation structure at the person-level with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population as determined in the metric specifications.

Figure 116: Trends in SUD spending within IMDs



Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a GEE gamma regression with an exchangeable correlation structure at the person-level. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population as determined in the metric specifications.

Figure 117: Trends in Proportion of beneficiaries with SUD who had a non-SUD encounter



COVID-19 adjustment: Mar. 2020 to Sep 2020

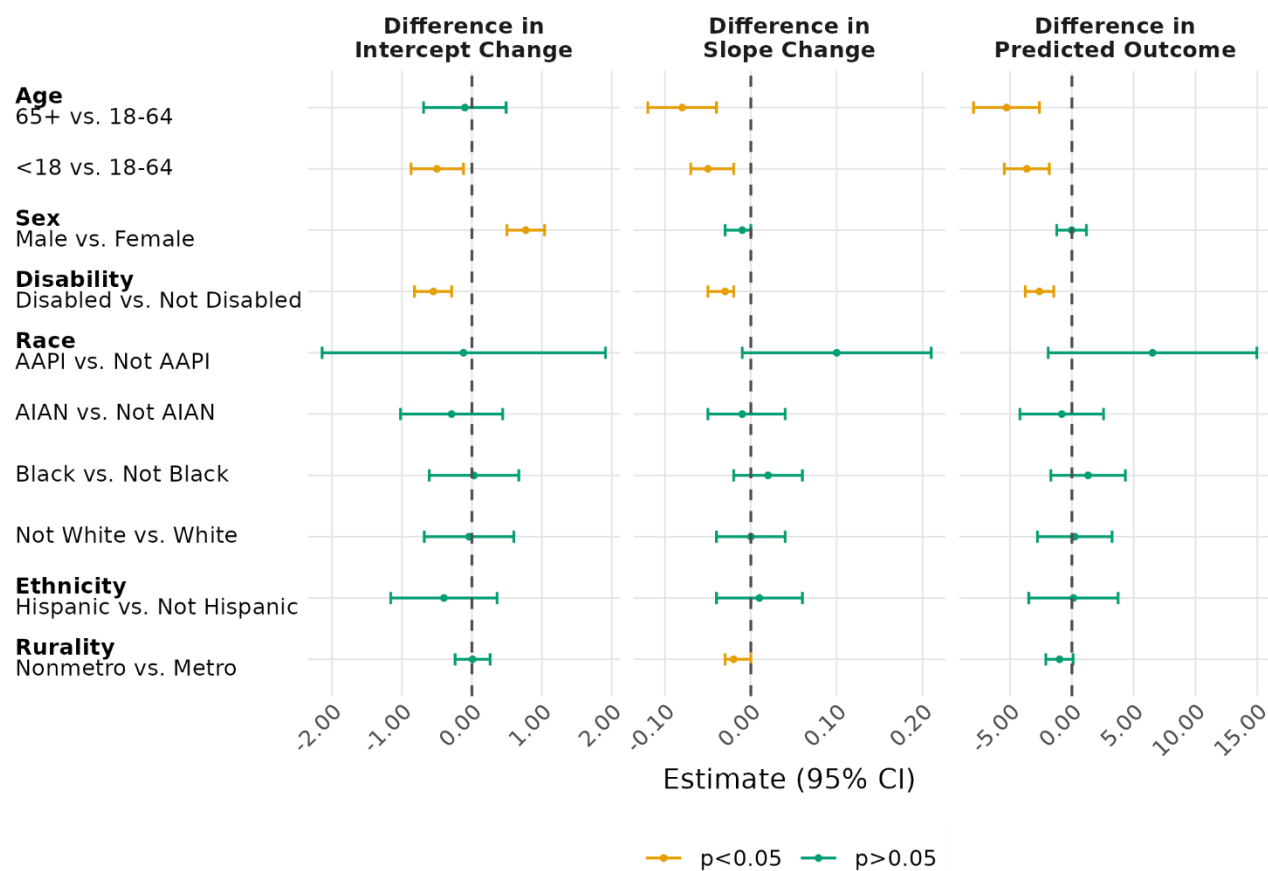
Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population with a substance use disorder.

Table 51: Interrupted time series estimates of Total Medicaid Service Expenditures for beneficiaries with SUD who had a non-SUD encounter

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	94.90* (94.66, 95.13)	95.33* (95.12, 95.55)	0.44* (0.29, 0.59)
Monthly Change	-0.032* (-0.041, -0.023)	0.0097 (-0.0017, 0.021)	0.042* (0.029, 0.055)
Predicted Average Outcome Nov 2024	92.55* (91.88, 93.22)	95.75* (95.37, 96.14)	3.21* (2.40, 4.02)
N	7,656,186		

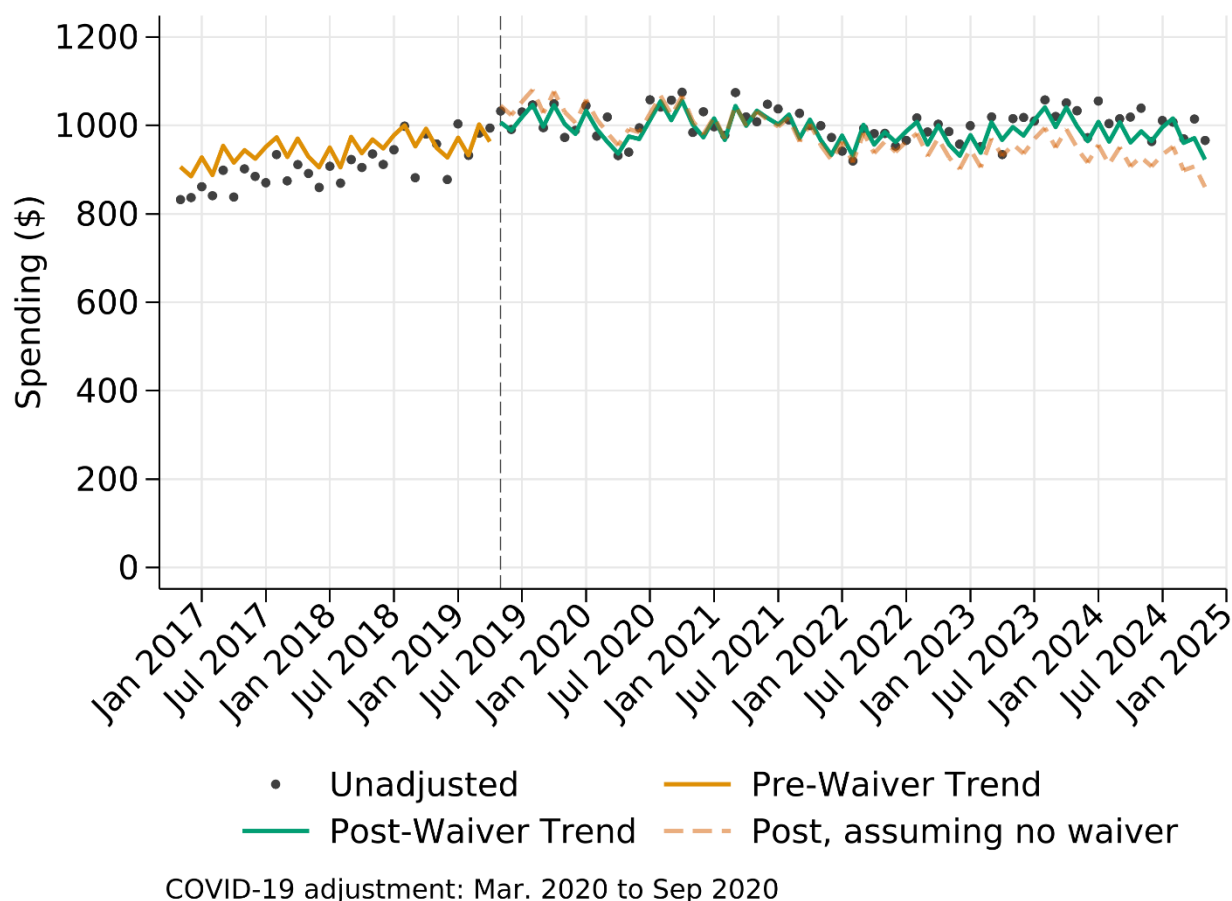
Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population with a substance use disorder.

Figure 118: Comparison groups in Proportion of beneficiaries with SUD who had a non-SUD encounter



Notes: Estimates from a multivariate interrupted time series model as described in Methods. Predictions estimated from a linear probability model with person-level fixed effects. Each of the subgroup variables is interacted with the Waiver-specific intercept and slope. The difference in intercept change (for example), is the intercept change for the first subgroup (e.g., 65+) minus the intercept change for the second subgroup (e.g., 18-64).

Figure 119: Trends in Total Medicaid Service Expenditures for beneficiaries with SUD who had a non-SUD encounter



Notes: Pre-Waiver and Post-Waiver trends are predictions from a multivariate interrupted time series model described in Methods. Predictions estimated from a GEE gamma regression with an exchangeable correlation structure at the person-level. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population as determined in the metric specifications.

Table 52: Interrupted time series estimates of Total Medicaid Service Expenditures for beneficiaries with SUD who had a non-SUD encounter

	Baseline	SUD Waiver Implementation	Difference
Predicted Average Outcome May 2019	839.66* (823.17, 856.15)	853.24* (839.89, 866.60)	13.59 (-1.51, 28.69)
Monthly Change	0.80* (0.058, 1.54)	2.18* (1.77, 2.60)	1.39* (0.43, 2.35)
Predicted Average Outcome Nov 2024	894.82* (837.08, 952.57)	1011.30* (982.96, 1039.63)	116.47* (45.93, 187.01)
N	1,455,090		

Notes: 95% confidence intervals in parentheses. * = $p < 0.05$. Average marginal effects are predictions from a multivariate interrupted time series model as described in Methods. Predictions estimated from a GEE gamma regression with an exchangeable correlation structure at the person-level with person-level fixed effects. Estimates were generated from a random 20% sample of individuals (aged 0-64) in the NC Medicaid population as determined in the metric specifications.

Abbreviations

AMHs – Advanced Medical Homes
APMs – Alternative Payment Models
BRFSS – Behavioral Risk Factor Surveillance System
CDPS Rx – Chronic Illness and Disability Payment System with Prescription Use flags
CMS – Center for Medicare & Medicaid Services
DHHS – Department of Health and Human Services
DiD – Difference in differences
EBPs – Evidence-Based Practices
ED – Emergency Department
FFS – Fee-for-service
HOP – Healthy Opportunities Pilots
I/DD – Intellectual or Developmental Disabilities
IMD – Institute for Mental Disease
ITS – Interrupted time series
MOUD – Medications for Opioid Use Disorders
OUD – Opioid Use Disorder
PHPs – Prepaid Health Plans
PHE – Public Health Emergency
PMPM – Per-member per-month
PUMAs – Public Use Microdata Areas
SDOH – Social Determinants of Health
SER – Summative Evaluation Report
SMI – Severe Mental Illness
SPs – Standard Plans
SUD – Substance Use Disorder
TBI – Traumatic Brain Injuries
TPs – Tailored Plans
VBP – Value-Based Payments

