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Access to Behavioral Health Services: Supply, Coverage, and Health Insurance Literacy

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A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at Virginia Commonwealth University.

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List of Abbreviations

ACA—Affordable Care Act

APRN—Advanced Practice Registered Nurse

AHRQ—Agency for Healthcare Research and Quality

ARCOS—Automated Reports and Consolidated Ordering System

AMI—Any Mental Illness

BH—Behavioral Health

CARA—Comprehensive Addiction and Recovery Act

CHIP—Children's Health Insurance Program

DEA—Drug Enforcement Agency

DID—Difference in Difference

ED—Emergency Department

FOIA—Freedom of Information Act

FPL—Federal Poverty Level

HIL—Health Insurance Literacy

HPSA—Health Professional Shortage Area

HRSA—Health Resources and Services Administration

Linear Probability Model—LPM

ME—Medicaid Expansion

MEPS—Medical Expenditure Panel Survey

MH—Mental Health

NP—Nurse Practitioner

NSSATS—National Survey of Substance Abuse Treatment Services

OP—Outpatient

OTP—Opioid Treatment Program

PROMIS--Patient Reported Outcomes Measurement Information System

Rx—Prescription

SAMHSA—Substance Abuse and Mental Health Services Administration

SMI—Serious Mental Illness

SOP—Scope of Practice

SUD—Substance Use Disorder

TWFE—Two Way fixed effects

VCC—Virginia Coordinated Care

Abstract

This dissertation examines policy and individual barriers to behavioral health (BH) service utilization. The full reach of federal policies like the Affordable Care Act (ACA) and the Comprehensive Addiction and Recovery Act (CARA) may be limited by state policies and the supply of the workforce available to deliver these services. Further, individual factors, such as low health insurance literacy, may influence patterns of behavioral healthcare utilization. Despite efforts to increase access to behavioral health services, treatment rates remain low, suggesting that barriers remain. To explore the effectiveness of these policies and examine remaining barriers, this dissertation explores three main research questions:

1. Does mental health services utilization increase more in Medicaid expansion states, and does MH workforce supply moderate this relationship?
2. Does buprenorphine dispensing increase to a greater extent after CARA in states where nurse practitioners have a broad scope of practice relative to states with a narrow scope of practice?
3. Does health insurance literacy affect subsequent behavioral health services utilization and self-reported unmet need for mental health services?

We find evidence of greater increases in mental health (MH) service visits in Medicaid expansion states but little difference between counties with mental health workforce shortage and areas with adequate supply. However, MH Emergency Department (ED) visits appear to be higher in areas with adequate workforce supply. These findings may be limited by the workforce measure, which relies heavily on psychiatry supply. Following CARA, buprenorphine dispensing increases overall. Increases are greater in states where state laws grant nurse practitioners (NP) more practice autonomy. Finally, we find evidence that low health insurance literacy is

associated with an increased probability of reported unmet MH needs and less access to mental health specialist services. Research should explore other measures of workforce shortage and provider insurance acceptance, which may hinder access to mental health care in Medicaid expansion states. Further, policymakers should consider increasing nurse practitioner practice autonomy to increase access to treatment for individuals with opioid use disorder. Policymakers should consider health insurance literacy's role in accessing behavioral health services and consider these potential general directions: (1) insurance-level efforts to increase the clarity and accessibility of health insurance terms/processes and (2) interventions to increase health insurance literacy at the individual level.

Chapter I: Introduction

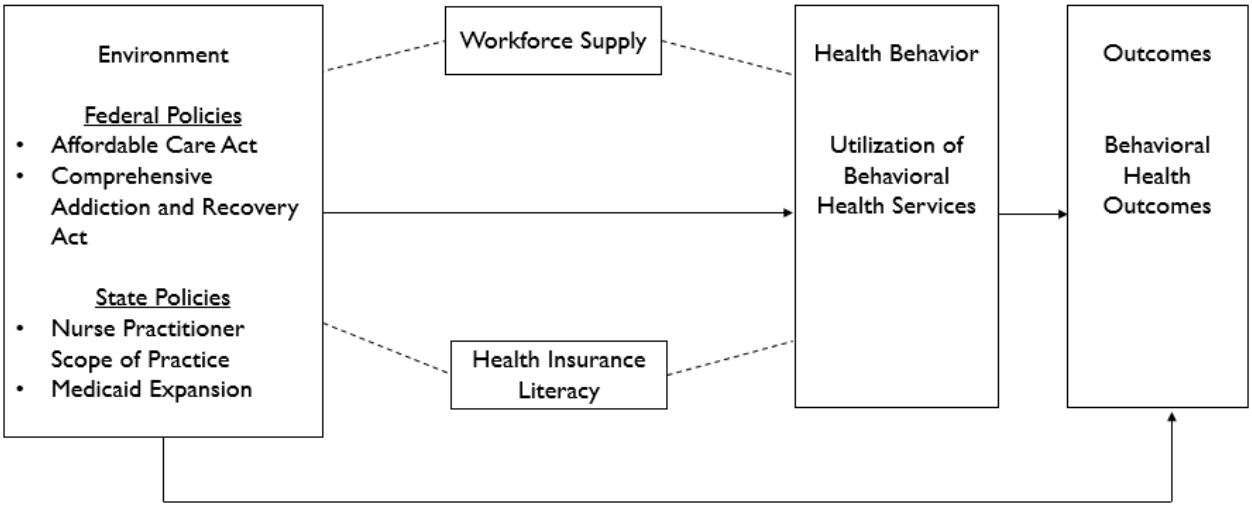
Behavioral health (BH) conditions are prevalent, with approximately 20% of U.S. adults living with mental illness (AMI) and 7.4% with a substance use disorder (SUD).[1] Untreated, symptoms can worsen, sometimes leading to more severe symptoms, additional diagnoses, or increased mortality risk.[2–5] Despite the prevalence and consequences of untreated BH disorders, few receive treatment. Only 44.8% of those with AMI received mental health (MH) services in the past year, and only 10.3% of individuals 12 and older with a SUD received substance use treatment services.[1] Further, less than 35% of adults with an OUD receive substance abuse treatment, and even fewer access effective and life-saving medications, such as buprenorphine, for OUD.[6,7] Increases in opioid-related mortality and suicide are plausibly related to inadequate or unmet BH treatment needs.[4,5,8]

Medicaid expansions in participating states, authorized by the federal Affordable Care Act (ACA), provided coverage for behavioral health services for 14.8 million new enrollees.[9] Despite increased coverage of BH services through ACA, there is little overall change in reported access to BH services.[10] In 2019, 44.8% of those with AMI reported any outpatient MH service in the previous year, compared to 40.9% in 2008. Trends in access to SUD treatment services are flat, with 10.4% accessing SUD treatment in 2015 and 10.3% in 2019.[1] Low treatment rates and slow growth in treatment rates suggest that other barriers remain.[11]

Supply barriers may limit the full potential of reforms, such as Medicaid expansion and CARA, to improve access to behavioral health services. State-level legislation limiting the practice authority of mid-level practitioners may exacerbate workforce shortage problems. Supply shortages may be especially detrimental for public coverage, where provider participation in insurance is notably low.[12] Even when workforce supply is adequate and insurance provides

behavioral health services coverage, individual factors may mitigate demand. Private insurance companies typically administer Medicaid benefits to low-income populations.[13] Limited understanding of insurance jargon can increase confusion about covered services and providers, resulting in limited service utilization, particularly for those with little experience accessing healthcare services using insurance.[14]

Figure 1. Overarching Conceptual Framework



This research seeks to further our understanding of barriers that may reduce access to behavioral health services. Specifically, this dissertation will address three topics. The first paper explores the impact of Medicaid expansion on the utilization of mental health services and the role of the MH workforce. Although Medicaid expansion has increased health insurance coverage, literature showing improvements in access to MH treatment and outcomes is limited and mixed. Access to MH treatment may be further limited in areas with workforce shortages, where people experience greater difficulty finding MH providers to provide treatment. The current study will examine the impact of Medicaid expansion on access to MH services and MH outcomes, focusing on differences between expansion states with and without shortages of MH

providers. Medicaid expansion is expected to increase access to mental health services, with greater access increases in areas with an adequate mental health workforce.

The second paper examines whether buprenorphine prescribing increases following the federal Comprehensive Addiction and Recovery Act (CARA) in states with broad SOP laws. Opioid use disorder is associated with a high risk of mortality, but medications—such as buprenorphine or methadone—reduce that risk.[4,8] CARA extended prescribing authority to mid-level providers, such as nurse practitioners (NP).[15] However, state variations in practice autonomy may impact the supply of waivered nurse practitioners and buprenorphine prescribing. CARA is expected to increase buprenorphine distribution, with the greatest increase in states with broad SOP laws.

The third paper explores whether an individual's health insurance literacy (HIL), or understanding of health insurance and terms, leads to access to behavioral health services in a low-income population enrolled in a safety-net coverage program. Low HIL is associated with more emergency department visits, lack of adherence to prescription drug treatment, delays to care, and poorer overall health.[16,17] Therefore, low health insurance literacy may be a direct barrier to receiving needed care, and this risk is more pronounced in groups with low HIL. Low HIL is expected to be associated with lower subsequent access to BH services and more unmet mental health needs.

Chapter II: The Role of the Supply of Mental Health Workforce on Access and Outcomes of Mental Healthcare in Medicaid Expansion States

In states that expanded Medicaid through the Affordable Care Act, millions of previously uninsured low-income populations gained healthcare insurance that included coverage for behavioral health services.[9] ACA extended the reach of 2008 federal parity legislation to most health plans, including all Medicaid-managed care health plans with behavioral health carved-in.[10,18] Low-income populations experience a higher prevalence of mental health conditions than the general population.[19] In Medicaid expansion (ME) states, where health coverage provides behavioral health service coverage to low-income adults with and without children, we expect to observe the most significant improvements in mental health services utilization and outcomes. In the general population, insured individuals are more likely to report receipt of needed mental health treatment than uninsured.[20]

While the literature examining the effects of early Medicaid expansion in states or state experiments report promising improvements in mental health access and outcomes indicators,[21,22] literature examining the 2014 Medicaid expansion is limited and mixed. Post-expansion coverage gains are observed consistently in individuals with mental health conditions that live in Medicaid expansion states.[23,24] Expansion states experience more reductions in poor mental health days, depression diagnoses, and psychological distress, but no improvements in unmet mental health need due to cost.[25–27] Further, improvements in self-reported mental health findings are often sensitive to the population and not tied to the utilization of mental health services.[25]

Limited evidence finds that mental health outpatient visits increased to a greater extent among those with at least one visit, but this finding is only significant for Hispanics and Non-

Hispanic Whites.[28] Notably, this study finds no significant differences in the share of people who access MH services in Medicaid expansion states.[28] However, a study using a different data source finds evidence of greater increases in mental health prescriptions in Medicaid expansion states.[29]

Despite recent legislative attempts to improve access to mental health treatment, treatment rates remain low.[1] Research from a mental health advocacy organization points to continued problems with access, with less than half of Americans reporting that mental health treatment is accessible and over a third of people reporting difficulty finding a behavioral health provider.[30,31] The time from symptom onset to treatment is an indicator of unmet needs. On average, individuals with mood disorders experience symptoms for 6 to 8 years before accessing treatment, and that time is 9 to 23 years for individuals with anxiety disorders.[32]

Provider Shortage

To complicate matters further, a mental health provider shortage and inequitable geographic distribution of providers create additional barriers to treatment access for many who live with mental disorders.[33] Workforce shortages, particularly acute in mental health, may be an underlying mechanism that helps explain continued challenges in access to mental health care, even in areas with higher insurance rates, such as Medicaid expansion states.[34]

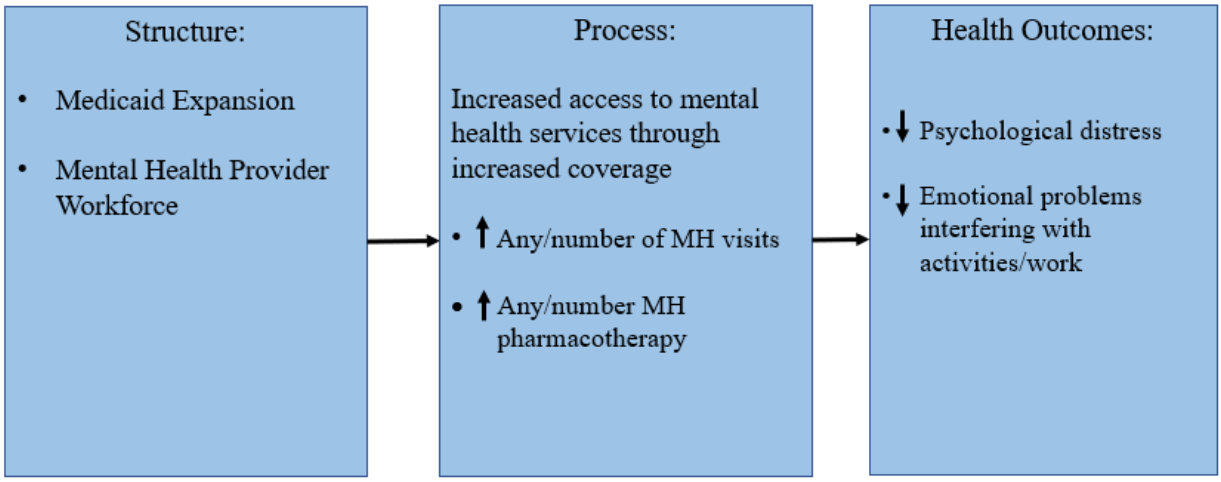
Low insurance acceptance among behavioral health providers exacerbates the MH access problems caused by workforce shortages.[34] In 2010, approximately 38% of psychologists reported that they did not accept any insurance, and 45% of psychiatrists do not take any private insurance. This compares to about 89% of physicians in other specialties.[35] Literature finds behavioral health facilities in expansion states are more likely to accept Medicaid post-expansion, but not psychiatrists.[36,37]

Although efforts in recent years have tried to increase the mental health workforce, the shortage of behavioral health providers impedes access to treatment.[38] As of 2009, almost 20% of all U.S. counties had an unmet need for non-prescriber mental health professionals. Nearly all counties had an unmet need for prescribers of psychiatric medications.[34] More recent estimates of provider supply suggest that this problem persists, particularly in rural regions.[33] A recent analysis revealed that only 4 of 50 states had mental health prescriber levels at or above 50 percent of the estimated need.[11] The aging psychiatrist workforce will continue to exacerbate future workforce shortages.[39,40]

Although Medicaid expansion has increased health insurance coverage, literature showing improvements in access to MH treatment and outcomes are limited and mixed. [28] [25–27] Access to MH treatment may be further narrowed in areas where there are workforce shortages, where people experience greater difficulty finding MH providers to treat them, regardless of their insurance coverage. The current study will examine the impact of Medicaid expansion on access to MH services and MH outcomes, focusing on differences between expansion states with and without shortages of MH providers.

Conceptual Framework

Figure 2. Medicaid Expansion, Workforce, and Access to Behavioral Health Services



The conceptual framework pictured in Figure 2 is adapted from Donabedian's structure, process, and outcome framework.[41] This conceptual framework shows the hypothesized relationship between Medicaid expansion and mental health outcome measures. Under the "structure box" of the conceptual model pictured above, Medicaid expansion (implemented in 2014 in most states) provided healthcare coverage to millions of the previously uninsured low-income population in the U.S. The "process" box depicts how healthcare coverage through Medicaid expansion created an avenue for individuals with mental disorders to access needed mental health services and pharmacotherapy drugs. The "health outcomes box" shows health outcomes associated with access to needed mental health services, including decreases in the average levels of psychological distress. Also shown in the "structure box," Medicaid expansion's impact on process and health outcomes depends on the supply of the local mental health workforce. The goal of this study is to examine the relationship between Medicaid

expansion and MH access and outcomes and to determine whether the mental health workforce supply moderates mental health utilization and outcomes.

Research Aims/Hypotheses

Aim #1: Examine the impact of Medicaid expansion on mental health care access and outcomes.

H1: Access to mental health services and pharmacotherapy will increase to a greater extent in expansion states in the post-expansion period, relative to non-expansion states.

H2: Self-reported mental health outcomes will improve to a greater extent in expansion states in the post-expansion period, relative to non-expansion states.

Aim #2: Examine whether counties in Medicaid expansion states with an adequate mental health workforce supply experience greater increases in mental health access and outcomes compared to counties in Medicaid expansion states that are designated mental health professional shortage areas.

H3: Access to mental health services, pharmacotherapy, and self-reported mental health outcomes will improve to a greater extent in counties in expansion states that have a greater supply of mental health providers, relative to counties in expansion states that have shortages of mental health providers.

Methods

Overview of Design

This chapter will investigate the role of Medicaid expansion in (1) the utilization of mental health services, (2) associated mental health outcomes, and (3) how the supply of mental health providers in local areas moderates the effect of Medicaid expansion on access to services and mental health outcomes. To explore the relationship between Medicaid expansion and

mental health outcomes, I used nationally representative survey data to conduct a quasi-experimental difference-in-difference (DID) analysis.

Data Sources

Medical Expenditure Panel Survey. The primary source of information for this study was the Medical Expenditure Panel Survey (MEPS)[42] data from 2010 to 2018. This national survey of the civilian non-institutionalized population, conducted annually on a nationally representative sample of the U.S. population, provides information about behavioral health visits and diagnoses and includes a psychological distress scale, Kessler 6. For the purposes of linking state and county level measures to the MEPS sample, I obtained access to MEPS restricted data files that include state and county encrypted identifiers, and I conducted the analysis at the Agency for Healthcare Research and Quality (AHRQ) data center, in Rockville, MD.

Area Health Resource File. The Area Health Resource File, maintained by the Health Resources and Services Administration (HRSA), is created from a compilation of data sources that provide detailed county-level data about health care provider supply and area-level population characteristics.[43] It contains area-level information about the percent of the population living under the federal poverty level (FPL), the physician workforce data, and the number of psychiatrists. It also includes county-level indicators to indicate mental health professional shortage area (HPSA).

Identification of Study Sample

Age. The sample was limited to individuals between the ages of 19-64, as individuals who are 65+ are eligible for Medicare.[44] Medicaid was available to low-income individuals under 19 before the ACA through Children's Health Insurance Program (CHIP).[45] Therefore, we excluded individuals younger than 19.

Income Levels. We examined the impact of Medicaid expansion across three income groups: (1) below 100% federal poverty level (FPL), (2) below 138% of FPL, and (3) below 200% of FPL.[46] Although most expansion states set Medicaid eligibility at 138% FPL, there is some variation across states in the populations impacted, particularly in early expander states and years.[47]

Mental Health Subsample

We conducted all analyses using the full sample and a subsample that was restricted to individuals with mental health symptoms. To identify the mental health subpopulation in the MEPS data, I included individuals with moderate or high levels of psychological distress. This variable is measured using the Kessler 6 scale, a 6-question scale with Likert-type responses that measures psychological distress. Respondents are asked to indicate how they felt the past four weeks using questions such as: "During the past four weeks, how much of the time did you feel so sad nothing could cheer you up," "During the past four weeks, how much of the time did you feel hopeless?" Response categories are as follows: "all of the time," "most of the time," "some of the time," "a little of the time," and "none of the time." The six items are summed to generate a total scale score, ranging from 0-24, with higher scores indicating higher psychological distress levels. This scale has high reliability and high internal consistency and is used for diverse populations.[48,49] Studies that have used the Kessler 6 compared to clinical diagnostic interviews have found high specificity in detecting serious mental illness (SMI) at a cut point equal to 13 or more.[49] Moderate levels of mental illness can also be detected using a threshold of 5-12.[50]

Outcome Measures. A summary of measures is located in the appendix (Appendix A, Table 1).

MH Pharmacotherapy

We used prescribed medicines in the MEPS event files to generate a binary variable to indicate any MH pharmacotherapy and a continuous variable to count the number of prescriptions, conditional on having any prescriptions. MEPS classifies prescriptions into therapeutic class codes. We identified MH pharmacotherapy using the Multum therapeutic sub-class #1 for TC1 including stimulants, anxiolytics, antidepressants, antipsychotics, and mood stabilizers (Appendix A, Table 2). Any use of MH prescriptions was coded as 1 and otherwise 0, and a continuous variable of the total number of prescriptions (conditional on any) was created. We used AHRQ documentation to use the relevant therapeutic sub-class codes, as codes change slightly across years.[42]

Emergency Department and Outpatient MH Utilization

MEPS obtains detailed information on all health care encounters, including outpatient visits, emergency department visits, and acute inpatient stays. We followed AHRQ linking instructions to merge event files, conditions files, and appendix files to generate person-level utilization datasets for 2010-2018. Using the relevant ICD-9, ICD-10, and clinical classification software codes for each year, we created a variable to flag for any visit with an MH code. The number of visits, conditional on any, is summed for each person and year. This procedure identifies outpatient and emergency department visits. MEPS separates outpatient utilization into two categories (outpatient visits and office-based medical provider visits). We combined these two outpatient visits into one outpatient variable and summed the visits to generate the outpatient count variable. Details of codes used can be found in the appendix (Appendix A, Table 3).

Self-Reported Outcomes

We examined the severity of psychological distress using the Kessler-6 (K6) scale. This scale is administered to adults through the self-administered questionnaire. Although we used Kessler-6 as a cutoff for the MH subsample (above 5), there is variation in responses as the remaining scale ranges from 6-24. The K6 is analyzed as a continuous variable for all study years.

To examine the impact of the mental health symptoms on an indicator of functional outcomes, we used the question, "Accomplished less than you would like (due to emotional problems)," from the self-administered questionnaire as a self-reported measure of MH status. Responses "some of the time," "most of the time," and "all of the time," were coded as 1. Responses "a little of the time" and "none of the time" were coded as 0.

Primary Independent Variables

Medicaid Expansion. We present study results using two specifications of the Medicaid Expansion variable: (1) a binary Medicaid expansion variable and (2) a time-varying Medicaid expansion variable.

The first specification that uses a binary Medicaid expansion variable that only includes states that expanded in 2014. We excluded states with early ACA expansions with upper-income thresholds of at 75% FPL or above (CA, DC, MN, WA).[47] Similar to Hoehn,[51] we divided the study period into pre-Medicaid expansion (2010-2013) and post- Medicaid expansion (2016-2018) periods. The years 2014 and 2015 are considered acclimation periods and were excluded from the analysis.

We included all states and years in a two-way fixed effect DID regression in the second Medicaid expansion specification. This analysis allowed the incorporation of the differential

timing of the Medicaid expansion rollout by creating a single time-varying DID estimator variable.[52] In this analysis, the DID variable of interest is a time-varying Medicaid expansion variable. State years with Medicaid expansion were coded as "1." State years without Medicaid expansion were coded as "0." For example, the DID variable for a state that expanded Medicaid in 2015 was coded as "0" for 2010-2014. It was switched to a "1" when the Medicaid expansion treatment started in 2015 and remained a "1" for the remainder of the study since the expansion status does not change after 2015. In instances when states expanded Medicaid late in the year (past July 1), the DID variable was coded as "0" for the current year and "1" for the following year and years thereafter. We always coded states that have never expanded Medicaid as "0."

Mental Health Workforce Measures

We stratified models by mental health workforce shortage areas. The Health Resources and Services Administration (HRSA) designates shortage areas for mental health professionals, known as MH health professional shortages (HPSA). Counties are categorized into three groups based on the level of MH workforce shortage: (1) whole county is a shortage area, (2) part of the county is a shortage area, (3) or none of the county is a shortage area.[53] The shortage area categorization uses the following information to create its designation: mental health professional workforce, the proportion of the population living in poverty, population age, and behavioral health disorder prevalence. It is important to note that the HRSA shortage area formula only systematically accounts for the supply of psychiatrists.[12] Although other MH professionals provide MH treatment services (psychologists, social workers, counselors etc.), their inclusion in the HRSA designation is optional and often not reported.[12,54]

Current HRSA methodology considers one psychiatrist per 30,000 residents adequate supply unless high needs are indicated, in which case the adequate supply is defined as 20,000

residents to 1 psychiatrist. [12,54] There are few counties with no shortages, so we combined non-shortage and partial shortage areas. We created a binary variable and coded it as 1 to indicate a shortage area for the entire county and 0 if the area is considered "non-shortage area" or a "partial shortage area."

Covariates

To control for individual factors that may influence care-seeking behaviors, we included the following covariates: age (19-24, 25-35, 36-50, and 51-64), sex (male/female), number of chronic health conditions (0, 1-2, 3+), race (White, Black/African American, Alaskan/Native American, Asian, and Multiple races/Other), ethnicity (Hispanic/non-Hispanic), education (less than high school, high school, more than high school, other/unknown), marital status (married/not married), and the percent of the population residing in the county that lived under the FPL (continuous). In models that were not stratified, we controlled for the county-level supply of psychiatrists per 100,000 residents.

Statistical Analysis

The study examined the relationship between Medicaid expansion, MH treatment, and mental health outcomes. We stratified models by MH HPSA to examine the role of MH workforce supply. All models used a quasi-experimental difference-in-difference (DID) design. In all models, binary outcomes were estimated using linear probability models (LPM). Count utilization outcomes, conditional on any utilization, were estimated using Poisson regression models and reported as incidence rate ratios.

In the first model, we estimated the impact of expansion in a reduced sample using a 2x2 DID.

(i) $$Y_{ict} = \beta_{0+} \beta_1 Expansion_s + \beta_2 Post_t + \beta_3 Expansion_s * Post_{ts} + B_4 X_{ic} + State + Year + \varepsilon_{sy}$$

Y_{syi} represents dependent variables for individual *i* in county *c* and year *t*. $\beta_1 Expansion_s$ is a state-level binary variable that was set to 1 for expansion states and 0 for non-expansion states. $\beta_2 Post_t$ is a binary variable to indicate post-expansion years, 2016-2018. $\beta_3 Expansion_s * Post_{ts}$ is the DID term of interest and measured the relative change in dependent variables for expansion states in the post-period, relative to non-expansion states and the pre-period. $B_4 X_{ic}$ represents a vector of controls including individual characteristics and supply variables. *State* and *Year* represent state and year fixed effects and ε_{ist} the error term. All regressions incorporated survey weights and corrected the standard errors to account for the complex survey design.

To incorporate the MH workforce supply and following prior literature,[56] we used the MH HPSA shortage designation at a county-level to stratify counties and ran the following three regression models: (1) Model (i) as shown above (2) Model (i.a) restricted samples to shortage areas, and (3) Model (i.b) restricted the samples to non-shortage or partial shortage areas. We generated DID estimates for the total sample and the MH subsample. We tested for differences of coefficients between stratified models, (i.a) and (i.b), using z-tests.[57]

Sensitivity Analyses

We used a two-way fixed effect DID quasi-experimental design to incorporate all years and states in the analysis. This analysis allowed us to incorporate the differential timing of the Medicaid expansion rollout by creating a single time-varying DID estimator variable. In this analysis, the DID variable of interest was a time-varying Medicaid expansion variable, where state years with Medicaid expansion were coded as 1. State years without Medicaid expansion were coded as 0.

(ii) $$Y_{ict} = \beta_{0+} \beta_1 Expansions_{st} + B_2 X_{ic} + State + Year + \varepsilon_{sy}$$

Y_{syi} represents dependent variables for individual *i* in county *c* and year *t*. $\beta_1 Expansion_{st}$ is a time-varying DID estimator, where states and years with Medicaid expansion present were coded as 1 and otherwise 0. $B_2 X_{ic}$ represents a vector of controls including individual characteristics and supply variables. *State* and *Year* represent state and year fixed effects and ε_{ist} the error term. All regressions incorporated survey weights and corrected the standard errors to account for the complex survey design. Estimates were generated for the full sample and the MH subsample.

Results

Descriptive Statistics

Table 1 reports descriptive measures for the states that expanded and never expanded Medicaid. Within both groups, results were broken into a pre- and post-expansion period (2010-2013 and 2016-2018, respectively). Mirroring the primary regression analysis, early and late expanders were excluded in the years 2014 and 2015. Any MH access increased in both Medicaid expansion and non-Medicaid expansion states, with MH outpatient and MH prescriptions increasing to a greater extent in Medicaid expansion states (18.7% increase in Medicaid expansion for OP MH compared to 11.3 for non-ME; 13.1% increase in MH prescription in Medicaid expansion states compared to 7.2 for non-Medicaid expansion states). However, any ED visit increases were larger in non-Medicaid expansion states (28.9% increase in non-Medicaid expansion states compared to 7.7% increase in Medicaid expansion states). MH OP and ED utilization counts, conditional on any visit, fell in non-Medicaid expansion states and rose in Medicaid expansion states (10 and 14.4% decrease in non-Medicaid expansion states compared to a 25.8 and 30.8% increase in Medicaid expansion states, respectively). However, MH prescription counts decreased in both non-Medicaid expansion and Medicaid expansion states but reduced to a greater extent in Medicaid expansion states. Self-reported measures of

mental health status improved from pre-to post periods in Medicaid expansion and non-Medicaid expansion states, with a larger improvement in non-Medicaid expansion states.

Age distribution was similar across periods, with a decrease in individuals aged 19-24 years across both groups. Educational, marital, and chronic health trends were similar across groups, except that Medicaid expansion states reported a greater decrease in those who reported zero chronic conditions over periods. Supply variables also trended together in Medicaid expansion and non-Medicaid expansion states. Notably, the proportion of people in counties located in a full MH HSPA decreased by about 30 percent in Medicaid expansion and non-Medicaid expansion states.

Table 1.

Characteristics and MH Outcomes by Expansion Status and Expansion Periods.

	Non-ME States			ME States		
	2010-2013	**2016-2018**	**Difference(%)**	**2010-2013**	**2016-2018**	**Difference(%)**
Sample	14,870		-	11,209		-
Weighted population	98,817,195		-	84,627,906		-
Any MH utilization						
Any outpatient MH	10.6	11.8	11.3	13.9	16.5	18.7
Any MH Rx	20.9	22.4	7.2	24.5	27.7	13.1
Any MH ED visit	0.76	0.98	28.9	1.3	1.4	7.7
Utilization count						
Rx count	12.6	12.3	-2.4	14.1	12.9	-8.5
ED count	1.39	1.19	-14.4	1.3	1.7	30.8
MH outpatient count	6.11	5.50	-10.0	8.9	11.2	25.8
Self-Reported						
K6sum	4.93	4.05	-17.8	5.2	4.6	-11.5
Did less due to MH	46.0	35.2	-23.5	48.4	38.7	-20.0
Age						
Age 19-24	21.7	16.9	-22.1	20.1	16.2	-19.4
Age 25-35	26.5	28.2	6.4	25.7	28.8	12.1
Age 36-50	29.1	26.6	-8.6	28.6	28.3	-1.0
Age 51-64	22.5	28.2	25.3	25.5	26.6	4.3
Sex						
Male	43.0	39.9	-7.2	44.2	43.9	-0.7
Female	56.9	60.1	5.6	55.7	56.1	0.7
Race/Ethnicity						
White	70.1	65.2	-7.0	70.2	71.5	1.9
Black/African American	24.6	25.9	5.3	21.4	18.9	-11.7
Alaskan/Native American	1.7	1.9	11.8	0.74	0.76	2.7
Asian	2.6	2.9	11.5	4.0	4.5	-12.5
Other/Multiple	.81	3.9	381.5	3.7	4.4	18.9
Hispanic	24.3	25.2	3.7	19.1	19.1	0
Marital status						
Married	30.1	28.6	-5.0	33.0	30.8	-6.7
Education						
Below high school	29.2	25.9	-11.3	27.4	22.7	-17.2
High school	34.3	38.1	11.1	35.5	41.8	17.7
Above high school	31.2	26.3	-15.7	32.2	27.2	-15.5
Other/Missing	5.3	9.7	83.0	4.9	8.3	69.4
Chronic health conditions (no.)						
0	48.9	48.7	-0.4	45.2	41.3	-8.6
1-2	32.7	31.1	-4.9	34.9	36.9	5.7
3+	18.2	20.1	10.4	19.9	21.8	9.5
Psychiatrist/100k	8.0	7.9	-1.3	14.8	13.4	-9.5
HPSA shortage	41.3	28.8	-30.3	32.3	22.9	-29.1

Regression Results

In adjusted DID models that examined the impact of ME on access to any MH utilization (OP, ED, and prescription), we did not observe any significant differences, and this was consistent across all income groups, the full sample, and the MH subsample. This means there were no statistically significant changes in utilization in ME states relative to non-Medicaid expansion states. Similarly, we did not find evidence that Medicaid expansion led to significant changes in self-reported outcomes. However, we did find evidence that Medicaid expansion increased the number of MH OP and MH ED visits, conditional on any visit. Specifically, estimates from the 138% FPL sample show the expected rate of MH OP visits was 1.41 times greater ($p<0.05$) in the post-period in ME states, relative to non-Medicaid expansion states.

Further, the expected rate of MH ED visits was 1.55 times greater ($p<0.01$) in the post-period in ME states, relative to non-Medicaid expansion states. These results were consistent across all income groups, the full sample, and the MH subsample. Although we did not test differences in estimates across regressions, we observed that the expected rate of MH OP and ED counts were highest in the 100% FPL MH subsample (Table 2). Full results are reported in the appendix (Appendix A, Tables 2-7).

To examine the parallel trends assumption, we plotted each outcome by ME status across years and observed acceptable parallel trends in the pre-period except any ED visits, number of ED visits, and number of MH prescriptions. Violations to the parallel trends assumption may bias estimates, so these estimates should be viewed with caution (Appendix A, Figures 1-8).[58]

Table 2.

Difference-in-Difference Analysis of the Impact of Medicaid Expansion on MH Utilization and Self-Reported MH Outcomes Among All Individuals and a MH Subsample Across Three Income Groups. Standard DID (ME * Post)

	100% FPL	**138% FPL**	**200% FPL**
All levels of MH symptoms			
Any Utilization			
Any MH Rx	0.011[-0.024, 0.047]	0.009[-0.021, 0.040]	-0.004[-0.030, 0.021]
Any MH related ED	-0.005[-0.014, 0.002]	-0.001[-0.008, 0.004]	-0.001[-0.006, 0.003]
Any MH outpatient	0.005[-0.023, 0.034]	0.010[-0.014, 0.034]	0.013[-0.007, 0.033]
Utilization count , IRR			
Conditional on Any			
Rx count	0.897[0.749, 1.075]	0.946[0.810, 1.106]	0.978[0.848, 1.128]
ED count	**1.837[1.303, 2.59] *****	**1.55[1.181, 2.038]*****	**1.599[1.272, 2.010]*****
MH outpatient count	**1.594[1.155, 2.199]*****	**1.410[1.036, 1.918]****	**1.469[1.108, 1.948]*****
Self-reported outcomes			
Kessler 6 Scale (continuous)	0.230[-0.269, 0.729]	0.123[-0.264, 0.511]	0.094[-0.231, 0.419]
Accomplished less due to MH	0.004 [-0.038, 0.045]	0.004[-0.032, 0.040]	0.001[-0.028, 0.031]
MH subsample			
Any Utilization			
Any MH Rx	0.006[-0.059, 0.071]	0.012[-0.046, 0.072]	0.006[-0.045, 0.057]
Any MH related ED	-0.007[-0.029, 0.015]	-0.006[-0.023, 0.010]	-0.005[-0.019, 0.008]
Any MH outpatient	0.017[-0.044, 0.079]	0.022[-0.034, 0.079]	0.027[-0.021, 0.075]
Utilization count , IRR			
Conditional on Any			
Rx count	0.887[0.725, 1.085]	0.953[0.799, 1.138]	0.952[0.815, 1.112]
ED count	**2.138[1.306, 3.501]*****	**1.654[1.167, 2.344]*****	**1.655[1.250, 2.191]*****
MH outpatient count	**1.666[1.222, 2.271]*****	**1.659[1.229, 2.240]*****	**1.676[1.281, 2.192]*****
Self-reported outcomes			
Kessler 6 scale (continuous)	0.583[-0.090, 1.256]*	0.519[-0.074, 1.112]*	0.337[-0.140, 0.816]
Accomplished less due to MH	0.019[-0.036, 0.075]	0.020[-0.028, 0.070]	0.013[-0.028, 0.054]

95% confidence intervals in brackets* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Regression Results, MH HPSA

To explore whether the MH shortage area further impacts access to care, we stratified the model by MH HPSA shortage. In adjusted DID models that examined the impact of ME on access to any MH utilization (OP, ED, and prescription), we did not observe any significant differences in any MH prescription, any MH ED, or any MH outpatient access. This was consistent across the full sample, the MH subsample, and shortage area status.

Descriptively, we observed differences in DID estimates of utilization counts by shortage area. In the full sample, MH ED utilization counts are similar across both groups. However, for the MH sample, we observed lower utilization in MH ED utilization counts in the shortage sample group compared to the group with adequate provider supply (MH ED IRR: 0.606, $p<0.10$ and 1.459, $p<0.05$, respectively) and this difference is statistically significant ($z=-2.72$, $p<.05$). Further, the DID estimate for MH OP utilization count was higher in shortage areas than non-shortage areas for both the full and MH subsample; however, differences by shortage did not reach statistical significance (Table 3). Full regression results are reported in the appendix (Appendix A, Tables 13-14).

Table 3.

MH HPSA Stratification. Difference-in-Difference Analysis of the Impact of Medicaid Expansion on MH Utilization and Self-Reported MH Outcomes Among Individuals at 138% FPL
*Standard DID (ME * Post)*

	HRSA MH Shortage Area (HPSA)	
	Shortage	No or Partial Shortage
All levels of MH symptoms		
Any Utilization		
Any MH Rx	-0.005[-0.07,0.06]	0.020[-0.01,0.05]
Any MH related ED	-0.009[-0.02,0.00]	0.002[-0.00,0.01]
Any MH outpatient	0.018[-0.03,0.07]	0.013[-0.02,0.04]
Utilization count , IRR		
Conditional on Any		
Rx count	1.180*[0.97,1.43]	0.889[0.73,1.08]
ED count	**1.693**[1.12,2.56]**	**1.683***[1.18,2.40]**
MH outpatient count	**2.120***[1.32,3.41]**	1.152[0.77,1.72]
Self-reported outcomes		
Kessler 6 scale (continuous)	-0.316[-1.11,0.48]	0.304[-0.13,0.74]
Accomplished less due to MH	-0.034[-0.11,0.04]	0.015[-0.03,0.06]
MH Subsample		
Any Utilization		
Any MH Rx	0.017[-0.10,0.13]	0.021[-0.05,0.09]
Any MH related ED	-0.022[-0.05,0.01]	0.000[-0.02,0.02]
Any MH outpatient	0.035[-0.06,0.14]	0.028[-0.04,0.10]
Utilization count , IRR		
Conditional on Any		
Rx count	1.161[0.93,1.44]	0.878[0.70,1.10]
ED count	0.606*[0.37,1.00]	**1.459**[1.01,2.11]**
MH outpatient count	**2.618***[1.49,4.60]**	1.374[0.92,2.05]
Self-reported outcomes		
Kessler 6 scale (continuous)	0.496[-0.55,1.54]	0.541[-0.15,1.23]
Accomplished less due to MH	0.056[-0.03,0.15]	0.008[-0.05,0.07]

Notes: Differences in ED counts between shortage and non-shortage areas are statistically significant. No other differences are statistically significant at the 0.05 level. Exponentiated coefficients for IRR estimates; 95% confidence intervals in brackets* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Sensitivity Analysis

We used a two-way fixed effect (TWFE) DID quasi-experimental design in the sensitivity analysis to incorporate all years and states in the analysis. This analysis allowed us to incorporate the differential timing of the Medicaid expansion rollout by creating a single time-varying DID estimator variable. We found that the results were not sensitive to the DID specification or early and late expander exclusion. The main analysis restricted the sample to states that expanded in 2014 and did not include 2014-2015. This sensitivity analysis used the variation across all states and years in a two-way fixed effects difference-in-difference regression. Magnitude, direction, and significance were very similar to the primary model, with two exceptions. In the 200% FPL group, any MH outpatient utilization reached significance (0.016, $p<0.05$). Second, the MH outpatient utilization outcome in the 100% FPL model reached marginal significance but did not reach traditional significance levels (IRR: 1.386, $p<0.10$) (Table 4).

Table 4.

Difference-in-Difference Analysis of the Impact of Medicaid Expansion on MH Utilization and Self-Reported MH Outcomes Among Individuals at 138% FPL
Two Way Fixed Effect Model, Medicaid expansion is time-varying

	100% FPL	138% FPL	200% FPL
All levels of MH symptoms			
Any Utilization			
Any MH Rx	0.006[-0.02,0.03]	0.006[-0.02,0.03]	-0.002[-0.02,0.02]
Any MH related ED	-0.006[-0.01,0.00]	-0.003[-0.01,0.00]	-0.001[-0.00,0.00]
Any MH outpatient	0.013[-0.01,0.03]	0.009[-0.01,0.03]	**0.016**[0.00,0.03]**
Utilization count , IRR			
Conditional on Any			
Rx count	0.936[0.81,1.07]	0.981[0.87,1.10]	1.025[0.93,1.13]
ED count	**1.447***[1.17,1.79]**	**1.330***[1.12,1.57]**	**1.260***[1.08,1.47]**
MH outpatient count	**1.386*[1.06,1.81]**	**1.337**[1.02,1.75]**	**1.318**[1.04,1.66]**
Selfs-reported outcomes			
Kessler 6 cale (continuous)	-0.041[-0.41,0.33]	-0.012[-0.31,0.29]	-0.028[-0.27,0.21]
Accomplished less due to MH	0.008[-0.02,0.04]	0.009[-0.02,0.03]	-0.0004[-0.02,0.02]
MH Subsample			
Any Utilization			
Any MH related ED	-0.011[-0.03,0.01]	-0.007[-0.02,0.01]	-0.006[-0.02,0.00]
Any MH outpatient	0.012[-0.03,0.06]	0.012[-0.03,0.05]	0.023[-0.01,0.05]
Any MH Rx	-0.008[-0.05,0.04]	-0.002[-0.04,0.04]	-0.004[-0.04,0.03]
Utilization count , IRR			
Conditional on Any			
Rx count	0.899[0.78,1.04]	0.968[0.85,1.10]	1.001[0.89,1.12]
ED count	**1.631***[1.25,2.12]**	**1.512***[1.24,1.85]**	**1.393***[1.16,1.67]**
MH outpatient count	**1.338**[1.05,1.70]**	**1.438***[1.14,1.81]**	**1.411***[1.13,1.75]**
Self-reported outcomes			
Kessler 6 scale (continuous)	0.082[-0.39,0.56]	0.133[-0.27,0.54]	0.112[-0.23,0.46]
Accomplished less due to MH	0.011[-0.03,0.05]	0.013[-0.02,0.04]	0.004[-0.02,0.03]

Discussion

Using nationally representative data, we conducted a quasi-experimental study to examine the impact of Medicaid expansion and MH workforce on MH utilization and self-reported outcomes. We find evidence that the number of MH OP and MH ED visits increased to a greater extent in Medicaid expansion states. These findings are robust across three income groups and within the full and MH subsample. Further, findings are closely mirrored in sensitivity tests that include all years and states that expanded before and after 2014 expansions. The number of MH OP and ED visits after expansion is higher in Medicaid expansion states than non-expansion states. However, similar to other literature, we do not find evidence of greater increases in the share of individuals who access MH services.[28] Further, we do not find evidence of improved self-reported MH outcomes in Medicaid expansion states in the post-expansion period relative to non-Medicaid expansion states.

Mental health workforce shortages may help explain the slow growth in access to MH care, even in areas with high coverage rates. Estimates suggest that the current MH workforce can only meet 28% of MH needs and research shows that those seeking MH care have difficulty accessing services.[12,59] In a study examining experiences securing an appointment for MH treatment, callers were unable to reach providers on the first call 77% of the time, and only 26% of inquiries were returned.[59] Securing an appointment for MH treatment with a psychiatrist was particularly difficult in pediatric populations, and the difficulty was greatest for those insured by Medicaid.[60]

To examine the influence of workforce shortages on access to BH services, we stratified our models by HPSA. We found little difference between counties with MH workforce shortage and areas with adequate supply. These findings contrast with literature that examines healthcare

access in primary care and dental workforce shortage areas.[56,61] However, we do find evidence that Medicaid expansion decreases MH ED in areas with a workforce shortage, but increases MH ED in areas without a workforce shortage. This finding may be explained by disparities in insurance acceptance between shortage and non-shortage areas, particularly if shortage areas contain providers that are more likely to accept Medicaid. Further, individuals who reside in MH shortage areas may have greater access to services intended to serve low-income populations, like Federally Qualified Health Centers. To the extent that this is true, it may be easier for Medicaid populations to obtain appointments in shortage areas, which may offset ED care seeking. We do observe descriptive differences between MH OP utilization counts in shortage areas and non-shortage areas, but these differences are not statistically significant.

HRSA methodology, which generates MH workforce shortage area designations, may also explain null findings. HRSA methodology primarily uses the number of psychiatrists located in the geographic area as the provider supply indicator. It considers geographic areas with one psychiatrist per 30,000 residents adequate supply unless high needs are indicated, in which case adequate supply is defined as one psychiatrist to 20,000 residents.[12] Given the nearly 50 percent prevalence of BH disorders in Medicaid recipients, HRSA estimates may understate demand for this population.[62] Further, the HRSA MH shortage designation requires that the supply of psychiatrists is incorporated to determine shortage designation, but reporting other MH provider types is optional.[12,54] MH service delivery is not limited to psychiatrists, as many other provider types also provide MH treatment.[67] For example, literature has demonstrated the positive impact of the psychiatric nurse practitioner (NP) workforce on access to behavioral health services.[68] NPs are more likely to accept Medicaid patients, and literature has documented improvements in MH access and outcomes in states where NP are granted more practice

authority. These improvements are concentrated in areas with greater physician shortages.[69–71] Future research should incorporate psychiatric NP workforce supply and practice autonomy in studies that focus on the impact of Medicaid expansion on access to MH services.

MH workforce shortages may be further exacerbated by low insurance acceptance among psychiatrists and narrow insurance networks for MH providers.[63] The disparity is particularly acute for Medicaid, with only 43% of psychiatrists accepting new Medicaid patients, compared to 73% Medicaid acceptance among other physician types.[35] Low insurance participation may be explained by federal parity violations, including differential reimbursement for psychiatric services compared to medical services, higher administrative burden, and delayed reimbursement.[64–66] Recent literature shows Medicaid acceptance increased in behavioral health facilities in expansion states, but not for psychiatrists.[36,37] Low insurance acceptance among MH providers disproportionately impacts Medicaid recipients, who cannot pay for services out-of-pocket.

Challenges navigating insurance to access care is another mechanism that may help explain why we did not find differences in mental health service utilization in expansion states. Most state Medicaid programs administer benefits to low-income members through private insurance companies, making it essential for Medicaid populations to understand health insurance terminology and how to use health insurance to access needed care and services.[13,72] Low understanding of health insurance terms is prevalent across all populations but more acute in low-income populations. Difficulty understanding insurance can lead to reduced access to MH services, particularly among newly insured, who have little experience using insurance to obtain needed care. Research demonstrates that confusion around out-of-pocket costs will result in delays to needed care, even when those services are fully covered.[13,14,72,73] Because low-income

populations are more likely to experience both MH conditions and low HIL, the role of HIL in accessing MH services may be particularly relevant for this population. Further, mistrust of the healthcare providers, fear of poor treatment by healthcare providers, and community or peer group stigma against care-seeking are additional factors that may deter care-seeking behaviors.[14,74,75]

Limitations

This study has several limitations. First, this study assumes Medicaid enrollment occurs among income-eligible individuals in Medicaid expansion states. However, enrollment gaps exist, as many Medicaid-eligible adults are not enrolled in Medicaid.[76] Further, this study uses multiple cross-sections of nationally representative data but does not incorporate a within-subject longitudinal design. Future studies could use this design type to examine the impact of Medicaid expansion on MH access and outcomes after individuals gain access to Medicaid. In addition, prior experience with insurance or accessing care through a system leads to more referrals for healthcare, but we are unable to control for previous experiences with healthcare or health coverage directly. We do, however, control for the prevalence of chronic conditions in our regression models.

In addition, there are limitations to the HRSA measure of MH workforce shortage. As discussed above, it only systematically accounts for the supply of psychiatrists.[12] Other provider types, such as nurse practitioners, social workers, and psychologists are a part of the treatment landscape. Although they provide MH treatment services, their inclusion in the HRSA designation is optional and often not reported.[54,55] Additionally, current supply measures do not account for the share of the MH workforce that accepts Medicaid insurance. Future studies may consider using Medicare to Medicaid pay ratios as a proxy for insurance acceptance.[77] Further,

this analysis does not include factors, such as health insurance literacy and individual-level beliefs that may keep people from seeking MH care.

Conclusions

The ACA expanded health insurance coverage with MH benefits to millions of previously uninsured low-income individuals residing in Medicaid expansion states.[78] Although nearly 50% of Medicaid enrollees live with a behavioral health disorder, the number of studies examining the impact of Medicaid expansion on access to MH services and outcomes is meager compared to the considerable research examining access to physical health services and health outcomes.[62,79] Limited studies report mixed results on the impact of Medicaid expansion on access to behavioral health services. This impact may be more limited in areas where there are MH workforce shortages, and people have greater difficulty finding MH providers to treat them.[25–27,29,78]

We find evidence that Medicaid expansion leads to an increase in MH outpatient and MH ED visits, but it does not increase the number of people who access care. Findings are similar when we examine outcomes by MH workforce supply. The lack of differences suggests other factors limit access to MH services in Medicaid expansion states, such as provider insurance acceptance, difficulty navigating insurance to obtain services, or individual beliefs or experiences that lead to reduced care-seeking behaviors. Research should examine barriers that suppress access to MH services in Medicaid populations. Future research could examine the following areas: (1) alternate workforce supply measures that account for the supply of psychiatric NP and other MH workforce providers, (2) insurer federal parity violations that make it difficult for providers to accept insurance, and (3) area-level indicators of Medicaid insurance acceptance or proxy measures such as a county-level ratio of Medicaid-to-Medicare fee index.[80]

MH treatment rates, patient reports of difficulty accessing MH treatment, rises in suicide rates, and steep increases in mental health distress during COVID highlight the critical need for additional research and intervention work in this area.[1,60,81]

Chapter III: The Impact of CARA and Nurse Practitioner Scope-of-Practice Laws on Access to Medications for Opioid Use Disorders

Buprenorphine is a safe and effective medication that is commonly used to treat opioid use disorder (OUD).[82–84] OUD is associated with a high risk of mortality, but medications, such as buprenorphine or methadone, reduce that risk.[4,8] Despite the benefits of treatment, less than 35% of adults with OUD receive any substance abuse treatment, and even fewer receive medications for OUD. [1,7]

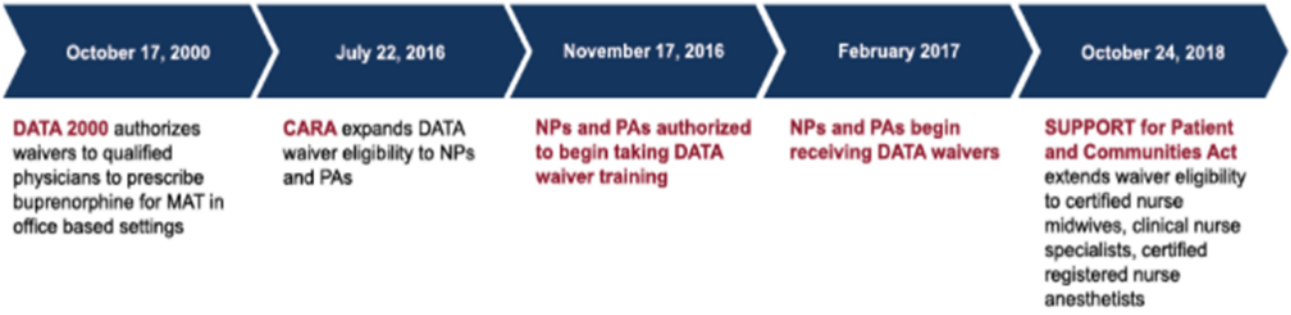
Buprenorphine can be prescribed through physician offices and other outpatient clinics by any buprenorphine waivered prescriber. Waivers to prescribe buprenorphine must be obtained from the Substance Abuse Mental Health Services Administration (SAMHSA). High patient limit waivers (100 or 275 patients) have training requirements, whereas practitioners seeking lower limit waivers (30 patients) are no longer required to complete training.[85]

Although the number of waivered providers has increased in recent years,[86] there is still a significant shortage of providers authorized to prescribe buprenorphine. Over half of all rural counties do not have a single waivered prescriber,[87] and a 2015 national needs assessment determined that 96% of states had opioid prescribing capacities below levels of need.[88] The shortage is exacerbated by low prescribing patterns, as most waivered providers practice well under their patient limit, particularly 30 limit providers.[89,90] This is important because the number of buprenorphine waivers is associated with buprenorphine prescribing, suggesting that increasing supply increases access to treatment.[91] Low concentrations of buprenorphine waivered providers is related to more frequent opioid overdoses.[92]

To address the shortage of buprenorphine waivered providers, lawmakers passed the Comprehensive Addiction and Recovery Act (CARA) in 2016, which extended buprenorphine

prescribing privileges to nurse practitioners (NP) and physician assistants (PA) who obtain SAMHSA authorization. Over 325,000 NPs are licensed to practice in the U.S., with the majority (70%) delivering primary care services.[71] Recent research suggests that NPs/PAs may be filling provider supply gaps for underserved areas and populations. For example, the extension of prescribing authority to NPs/PAs decreased the shortage of prescribers in many rural areas, and waivered NPs are more likely to treat Medicaid patients than waivered physicians.[93–95] Further, national prescription data show that most increases in Medicaid buprenorphine prescribing in the year after CARA was attributable to NPs (see Figure 3 for a timeline of DATA waiver expansion).[15]

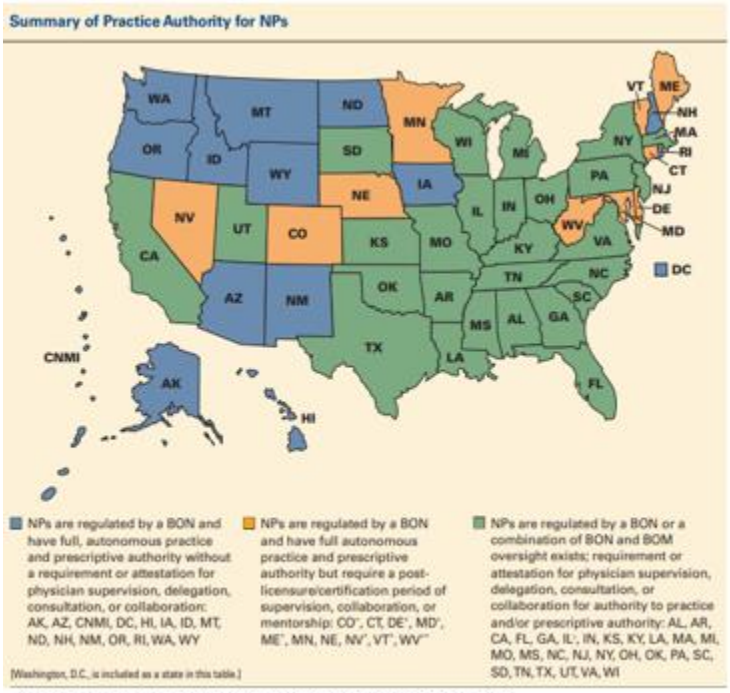
Figure 3. Timeline of Buprenoprhine Waiver Expansion to Mid-Level Practitioners



Source: Johnson, 2019. Health Affairs Blog

While authorized NPs can prescribe buprenorphine in most states, they must operate in the confines of state scope-of-practice (SOP) laws that define the autonomy of their practice. SOP laws vary across states, from states where NPs are granted full SOP practice to states with permanent NP practice restrictions. In full SOP states, NPs practice autonomously without

physician oversight or collaboration whereas NPs who practice in states with restricted SOP must maintain a collaborative relationship or have direct oversight from a physician. Some states have moderate SOP laws that allow the NP to practice autonomously after a defined period of physician oversight or collaboration. To complicate matters further, NPs in some reduced/restricted SOP states cannot prescribe buprenorphine unless the physician providing their oversight or collaborative agreement also has a federal buprenorphine waiver.[96] When CARA was enacted in 2016, 14 states were considered full SOP states, 27 states had restricted SOP, and 10 granted NP autonomy in practice after a period of oversight or collaboration with a physician.[97]



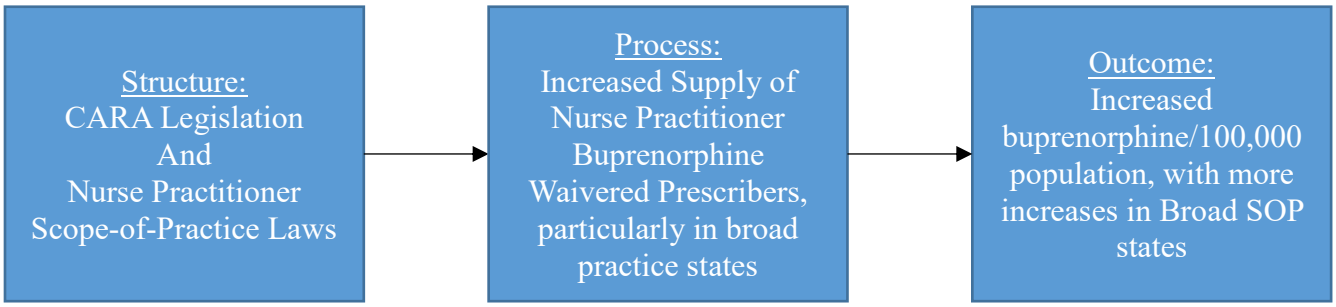
Source: 29th Annual APRN Legislative Update, Phillips (2017)

States with broad SOP laws experienced more growth of NP buprenorphine waivers, and growth in mid-level prescribers was twice as large in rural areas of states with a broad SOP authority.[94,98] Other factors that correlated with growth in waivered provider supply of physicians and NPs/PAs include high overdose death rates in preceding years, opioid treatment programs, and Medicaid expansion.[37,99,100] Research in other areas of medicine, such as mental health, demonstrates improvements in mental health outcomes when nurse practitioners help fill the gaps in provider supply. Growth in NP supply is greater in states with broad SOP.[69,101,102]

No known research has examined whether total buprenorphine dispensing increases after CARA in states with broad SOP laws. This study will examine (1) if CARA is associated with greater buprenorphine prescribing and (2) if buprenorphine prescribing increased following CARA to a greater extent in states with broad SOP, relative to states with narrow SOP.

Conceptual Framework

Figure 4. Conceptual Framework: Nurse Practitioner Scope of Practice, Waivered Prescribers, and Access to OUD Treatment



The conceptual framework, pictured in Figure 4 above, was adapted from the Donabedian structure, process, and outcome framework.[41] Within the structure box is the CARA legislation, enacted in 2017 that authorized NPs to obtain waivers to prescribe buprenorphine. The conceptual framework shows that CARA, listed under structure, should lead to an increased supply of NP buprenorphine waivered prescribers, listed under process. The growth in the supply of NPs will vary depending on the NP state SOP laws. As a result, we expect the volume of buprenorphine prescriptions to increase, particularly in states with broad NP SOP laws.

Aims and Research Questions

Aim #1. Determine the impact of CARA and SOP regulation on access to medication for opioid use disorder.

H1: Grams of buprenorphine dispensed/100,000 increased in the post-CARA period, relative to the period before CARA was implemented.

H2: Grams of buprenorphine dispensed/100,000 increased to a greater extent in the post-CARA period in states with broad SOP, relative to states with narrow SOP.

Study Data and Methods

Summary of Analytic Approach

We conducted a state-level quasi-experimental difference-in-difference (DID) analysis with state and year fixed effects to understand the impact of CARA on access to buprenorphine treatment in states with broad and narrow SOP. We linked multiple data sources to create the analytic file used to answer this question. The outcome, grams of buprenorphine dispensed/100,000, was extracted from the Drug Enforcement Agency's (DEA) Automated Reports and Consolidated Ordering System (ARCOS).[103] The DID estimator was constructed as an interaction of CARA legislation and a time-varying NP SOP variable, extracted from annual legislative updates.[104–110] Covariates included supply, indicators of OUD prevalence, policy, and area-level variables. We controlled for the supply of buprenorphine waivered prescribers, obtained through a Freedom of Information Act (FOIA) request to the Substance Abuse and Mental Health Services Administration (SAMHSA). Policy variables included Medicaid expansion, 1115 substance use disorder waivers, mandatory prescription data monitoring programs, and state laws prohibiting prior authorization for buprenorphine. Finally, we

conducted sensitivity tests and a falsification test using the number of prescriptions from a common blood pressure medication over the same period.

Data Sources

Automated Reports and Consolidated Ordering System (ARCOS). The outcome, grams of buprenorphine dispensed/100,000, was extracted from the Drug Enforcement Agency's (DEA) Automated Reports and Consolidated Ordering System (ARCOS).[103] The ARCOS drug summary reports, available from the Drug Enforcement Agency (DEA) website, summarize transactions of controlled substances dispensed by manufacturers and distributors. ARCOS data reports the aggregate grams of buprenorphine dispensed quarterly at a 3-digit zip code.[103] ARCOS is a comprehensive source of data that presents the total amount of buprenorphine dispensed at each time point, regardless of coverage, payer, or program, or dispensing location. The data is available online in PDF format; the current study utilizes 2014 to 2019. Using an online pdf-to-excel conversion tool, we converted the reports to excel format. Prescriber license type, the reason for prescription, and prescription dose are not available.

Annual Legislative Updates. NP SOP categorization was derived from the Annual APRN Legislative Updates that categorizes state SOP laws into full, reduced, or restricted SOP classifications.[104–110] This report, published at the beginning of each calendar year, also contains updates to NP SOP legislation and the number of Advanced Practice Registered Nurse (APRN) licenses for each year and state.

Policy Variables Sources. We controlled for several state-level policies in this analysis. We obtained the Medicaid expansion variable data from the Kaiser Family Foundation website.[111] Data for the Medicaid 1115 Substance Use Disorder (SUD) waivers variable was obtained from the Kaiser Family Foundation Waiver tracker.[112] State-level laws prohibiting prior

authorization for buprenorphine and state-level mandatory prescription monitoring policies were also incorporated in the analysis.[113,114]

OUD Risks. We extracted opioid prescribing rates from the CDC injury center drug overdose webpage. The data are from INQVIA Xponent data, representing 92% of all retail prescriptions dispensed in the US, and are available at a year and state level for 2014-2018.[115]

Buprenorphine Waivered Prescribers. To measure the supply of buprenorphine waivered prescribers, we obtained an extract of the controlled substances registrant file from the Substance Abuse and Mental Health Services Administration (SAMHSA) from 2002 to 2019 through a Freedom of Information Act (FOIA) request. This file is a de-identified comprehensive list of all current waivered prescribers. Available information includes a unique identifier, provider license type (MD/DO, NP, PA), zip code, waiver patient limit, and the date that waiver was granted. Our study period spans the first quarter 2015 through the fourth quarter 2019.

National Survey of Substance Abuse Treatment Services. The National Survey of Substance Abuse Treatment Services (N-SSATS) is an annual census of all substance abuse treatment facilities.[116] We extracted the total number of Opioid Treatment Program facilities that prescribe methadone for 2014-2018. OTP counts are lagged by one year.

State Health Facts. Kaiser Family Foundation state health facts is a publicly available data source that compiles data at a state and year level from various data sources, including the American Community Survey and the Behavioral Risk Factor Surveillance System (BRFSS). We obtained state-level demographic factors, poor mental health days, and indicators of health from Kaiser Family Foundation State Facts website.[117]

Medicaid State Drug Utilization Data. Medicaid State Drug Utilization tracks and reports all prescriptions that are paid for by state Medicaid programs. Prescription counts are

provided at a quarter, year, state level. We extracted the number of prescriptions for the common blood pressure medication, Metoprolol. To mirror the primary analysis, we used the years 2015-2019.[118]

Measures

Appendix B, Table 1 summarizes study measures.

Outcome

Buprenorphine Prescription Access Outcome Measure. We population-adjusted total buprenorphine dispensing to create a rate of grams of buprenorphine per 100,000 population. To improve interpretability, we created a measure to estimate the number of 90-day buprenorphine prescriptions (1.4 grams of buprenorphine) per state and quarter. This estimate assumes a target maintenance dose of 16mg/day and continuous prescription adherence for the full quarter (90 days).[119] Similar to other studies, we conducted the analysis at state-level data because policies of interest, like NP SOP, are administered at a state level.[98,120] ARCOS data was used to answer other research questions in this area of inquiry.[91,121] We excluded three states from the analysis (OK, TN, and WY) because these states had specific NP buprenorphine prescribing restrictions at some point during the period of interest.[96]

Independent Variables of Interest

Comprehensive Addiction and Recovery Act (CARA) of 2016. CARA, passed in July of 2016, authorized NPs to obtain buprenorphine waivers and authorized them to prescribe buprenorphine in accordance with state laws.[122] NP waivers started to appear in the buprenorphine waiver data in February 2017. A binary variable was constructed to identify quarters in the post-CARA period and were coded as 1 for all periods following quarter 1 2017. Quarters prior to and including quarter 1, 2017 were coded as 0.

NP State Scope-of-Practice Categorization. NPs in full SOP states have full autonomous practice without physician supervision. NPs that practice in reduced SOP environments can reach autonomous practice with prescriptive authority after a period of supervision or collaboration with a physician (transition periods vary from 6 to 60 months). NPs in restricted SOP states are always required to practice with physician collaboration or oversight.

There is no consensus in the literature about the classification of NP SOP.[98,123] Therefore, we explored various scope-of-practice specifications in sensitivity tests. Due to collinearity, the primary analysis uses a classification that groups states into broad or Narrow SOP states. States are grouped into a "broad SOP" categorization if (1) they are considered "full SOP" by the APRN legislative update or (2) they are considered reduced SOP by the APRN legislative update with a transition period to full SOP of 18 months or less. States were categorized as "Narrow SOP" if they (1) were classified as a restricted SOP state by the APRN legislative update or (2) they were a reduced SOP state with a transition period greater than 18 months.

I constructed three other specifications of the SOP term, including (1) a 3-category variable that uses the APRN legislative update categorizations of restricted, reduced, or full SOP, (2) a binary variable that grouped reduced and restricted SOPs together and compares it to the full SOP states, and (3) a variable that grouped full and reduced SOPs and compares it to restricted SOP. Appendix B (Table 7) details these variable groupings and the states contained within each grouping by year. Notably, all specifications produce similar results for DID variable of interest (Appendix B, Table 6).

Control Variables

Policy Variables. To control for the impact of Medicaid expansion on access to buprenorphine, we included a time varying-covariate for Medicaid expansion.[111] States and years

with Medicaid expansion were coded as 1; state years without expansion were coded as 0. To control for the role of Medicaid 1115 Substance Use Disorder (SUD) waivers on treatment access, we included a time-varying indicator to account for the state years with a waiver. This data was obtained from the Kaiser Family Foundation 1115 waiver policy tracker.[124,125] We created time-varying variables to control for state-level laws restricting prior authorization for buprenorphine and state-level mandatory prescription monitoring policies.

Opioid Overdose Deaths and Factors Related to the Opioid Epidemic. To control for differences in the opioid epidemic across states and years, we included the rate of opioid prescribing at the state level. It is important to control for the severity of the opioid epidemic, as the epidemic severity varies widely across years and states. Overdose deaths have been linked to inappropriate prescribing practices,[124,125] and prescription opioids have been associated with the development of opioid use disorder.[126] Given the high comorbidity between psychiatric conditions and opioid use disorder,[127] we controlled for the share of individuals who reported that they spent 14 or more of the past 30 days in poor mental health, using data available from the KFF state facts. To control for the relationship between pain, chronic health conditions, and opioid prescribing, we controlled for the share of the population that report fair or poor health. We lag all OUD risk factors by one year.

Demographic Characteristics. To control for time-varying differences in the health and demographic characteristics of the population that may be related to prescribing, we included state characteristics. When data were unavailable for the corresponding year, the closest year available was used. The following set of controls were derived as a percent of the total: race (White, Black, Hispanic, Other), age (18 or younger, 65+), share of the population that reported

fair/poor health, and the share of the population at or below 100 percent of the federal poverty level.

Supply Variables. To measure the supply of buprenorphine-waivered prescribers, we created a count of the total number of prescribers overall, a physician-specific count, and NP-specific counts for each state and quarter year of interest for 2015 to 2019. We used population counts for each year to create a rate for each waiver group, adjusted for population size (per 100,000 persons). In the regression analysis, we controlled for the rate of physician prescribers, but not the rate of NP waivers, which allows prescribing related to NP waivers to vary in the buprenorphine dispensing outcome of interest. To control for the supply of NP, we extracted the total number of NP for each state year from the APRN Annual Legislative Updates.[104–110] We used yearly population counts to create a rate of APRN, adjusted for population size (per 100,000 persons).

We controlled for the supply of opioid treatment programs (OTP), which are programs authorized to dispense methadone—another medication for opioid use disorder. Although OTPs primarily dispense methadone, some also dispense buprenorphine. Practitioners who work at OTPs are not required to obtain a waiver to prescribe buprenorphine. We controlled for the supply of these facilities to account for OTP buprenorphine dispensing. We used population counts for each year to create a rate of OTPs, adjusted for population size (per 100,000 persons). The OTP rate was lagged by one year.

Falsification Test, Metoprolol Prescriptions

To evaluate the validity of the key finding, we conduct a falsification test, substituting the number of Metoprolol prescriptions as the outcome (instead of buprenorphine dispensing rate). Using data downloaded from the Medicaid state drug utilization data, we extract all Metoprolol

prescriptions at a quarter state level for the time period of interest (2014-2019). We summed the number of Metoprolol prescriptions to the state and year quarter level. We used population counts for each year to create a rate of Metoprolol prescriptions, adjusted for population size (per 100,000 persons).

Statistical Analysis

The primary outcome variable of interest, grams of buprenorphine per 100k, was over-dispersed. To account for this overdispersion, we used negative binomial regressions. Negative binomial regressions are typically used for over-dispersed count data, but they are also used when the outcome is an over-dispersed rate.[128,129] Further, we accounted for time-invariant effects using state and year fixed effects in all models.

Preliminary Analyses

In preliminary analyses and as a check of data validity, we ran models to replicate previous literature findings to examine whether (1) NP waiver rates increase more in broad SOP states, relative to Narrow SOP states during the post-CARA period[98] (2) there was a greater increase in overall waiver growth in broad SOP states after CARA implementation,[94,98] and (3) an increase in buprenorphine waivers was associated with an increase in buprenorphine prescribing.[91]

Primary Analysis

For the primary analysis, we estimated a difference-in-difference model with state and year fixed effects to estimate whether buprenorphine dispensing increases in broad SOP states relative to Narrow SOP states following CARA legislation. In addition to the primary outcomes of interest, grams of buprenorphine dispensed/100,000 persons, we transformed the outcome data to represent the number of continuous 90-day buprenorphine prescriptions (16mg/day). In all

models, we used cluster robust standard errors at the state level to account for unaccounted heteroskedasticity and autocorrelation. In sensitivity analyses, we explored various specifications of the SOP term and a falsification test.

Model Specification

The study analysis sought to examine whether buprenorphine access, as measured by buprenorphine dispensing, increases following CARA to a greater extent in broad SOP states relative to narrow SOP states. We estimated the following negative binomial model using a difference in difference framework.

$$Y_{ist} = \beta_{0} + \beta_1 CARA_{st} + B_2 SOP_{st} + B_3(CARA_{st} * SOP_{st}) + B_4 X_{st} + State + Year + \varepsilon_{ist} \quad \text{(i)}$$

The dependent variable *Y* represents the individual observation ($_i$), at quarter-year ($_t$) and state ($_s$). $\beta_1 CARA_{st}$ represents the post-CARA period and $B_2(SOP_s)$ is a time-varying variable that represents the scope-of-practice in each state and year. Broad SOP state years were coded as 1. $B_3(CARA_{st} * SOP_{st})$ is the difference-in-difference term of interest that measures the relative increase of buprenorphine dispensing in broad SOP after CARA, relative to narrow SOP states. $B_4 X_z$ represents a vector of controls including policy, OUD risks, demographic, and supply controls. *State* and *Year* represent state and year fixed effects and ε_{ist} the error term. All regressions used robust state-clustered standard errors. Analyses were conducted in STATA 14.

Sensitivity Analyses

Event Study and Parallel Trends. We conduct several sensitivity analyses. To examine how trends in prescribing vary throughout the period of interest, we used event study regressions to examine differences in buprenorphine prescribing in the quarters before and after CARA by SOP. This analysis expands the difference-in-difference analyses by creating a

separate parameter for each quarter of interest. The quarter of CARA implementation is coded as 0 and used as the point of comparison for quarters before and after CARA. Quarters after CARA implementation are coded +1 to +10 following the implementation quarter and -1 to -9 in the quarters before implementation. Predictive margins of the difference in difference estimate were produced and graphed. This analysis was also used as a measure of the parallel trends assumption, which is an assumption of the DID analysis. To meet this assumption, trend lines for both Broad and Narrow SOP states should move in synchrony in the pre-CARA period.

Generate Estimates for a Hypothetical Scenario Where CARA Was Not Passed

We produced predictions of the difference-in-difference to estimate the grams of buprenorphine per 100,000 if CARA legislation had not been not passed. After running the model (i), we used margins to produce the predicted value for the DID term and stored estimates at the state year level. After changing CARA indicator from 1 to 0 for all estimates, we replicated this procedure, and we graphed the average estimates for broad SOP states with and without CARA legislation.

Falsification Test

We incorporated a falsification test using Metoprolol, a common blood pressure medication, to explore whether CARA impacts prescribing more generally and if this differs by SOP in the post CARA period. Using state quarter-level data downloaded from the Medicaid Utilization database, we fit the same regression model (i) described above, but changed the outcome variable to Metoprolol. Observations with fewer than 11 counts were suppressed from public view and unavailable for download. To assess data missingness, we use the Virginia 2019 data and found 421 suppressed observations. Assuming the maximum of 10 prescriptions per suppression, only about 2.6% of Metoprolol prescriptions were suppressed. Similar to

buprenorphine, we examined changes by quarter using an event study and visualized the predicted values. Insignificant findings provided additional evidence that the key finding was not due to other changes in prescription policy that occured at the same time as CARA.

SOP Specifications

To determine if the main findings were sensitive to the SOP specification, we ran 3 additional specifications of the SOP term including (1) full, reduced, and restricted SOP states separately (Phillips, 2014-2020), (2) group reduced/restricted SOP together and full SOP separately, and (3) group full/reduced together and restricted separately. Next, to examine whether the time-varying SOP variable impacts findings, we limited the analyses to states that did not change SOP over the course of the study and ran the analyses only using states with static SOP across the study period.

Study Results

Descriptive Statistics

The outcome of interest, the average logged grams of buprenorphine dispensed/100,000 persons increased 7.9% in narrow SOP states and 3.6% in broad SOP states in the post-CARA period. These averages were not adjusted for state or year within trends. The share of states with Medicaid expansion remained fairly stable over the study period. We allowed SOP designation to vary over the study period, which explains the decrease in Medicaid expansion in broad SOP states post-CARA. We observed substantial increases in mandatory prescription monitoring databases, Medicaid 1115 waivers for SUD, and state laws with buprenorphine prior authorization prohibitions in the post-CARA period in both narrow and broad SOP states. Notably, narrow SOP states are more likely to have mandatory PDMP and Medicaid 1115

waivers in the post-period, whereas there is more Medicaid expansion present in broad SOP state quarters.

Demographic characteristics were relatively stable in both groups and time periods. In both SOP groups, we observed increases in the proportion of the population that was 65+ and decreases in the share of the population that was under 100% of the FPL. Both groups had a similar share of White population (between 66-69%) but varied in the share of Black/AA and Other race groups. Narrow SOP states had a larger share of Black/AA populations (about 13%), whereas broad SOP states had a larger share of Other race populations, such as Asian, Native American, and Pacific Islander (15-16%).

Opioid prescribing rates decreased in both SOP groups in the post-CARA period, with opioid prescribing rates in the broad SOP states decreasing slightly more than narrow SOP states (-17.4% and -21.7% decrease, respectively). The share of the population that reported poor physical and mental health increased across both groups, with the greatest increases in poor mental health in narrow SOP states (12.9% and 8.6%, respectively).

The supply of APRN and waivered physicians increased to a greater extent in the narrow SOP group. OTP and the rate of waivered NP were greater in the broad SOP states (Table 5).

Table 5.

Characteristics of Full and Narrow SOP States Before and After the Implementation of the Comprehensive Addiction and Recover Act (CARA) *(SD in parentheses)*

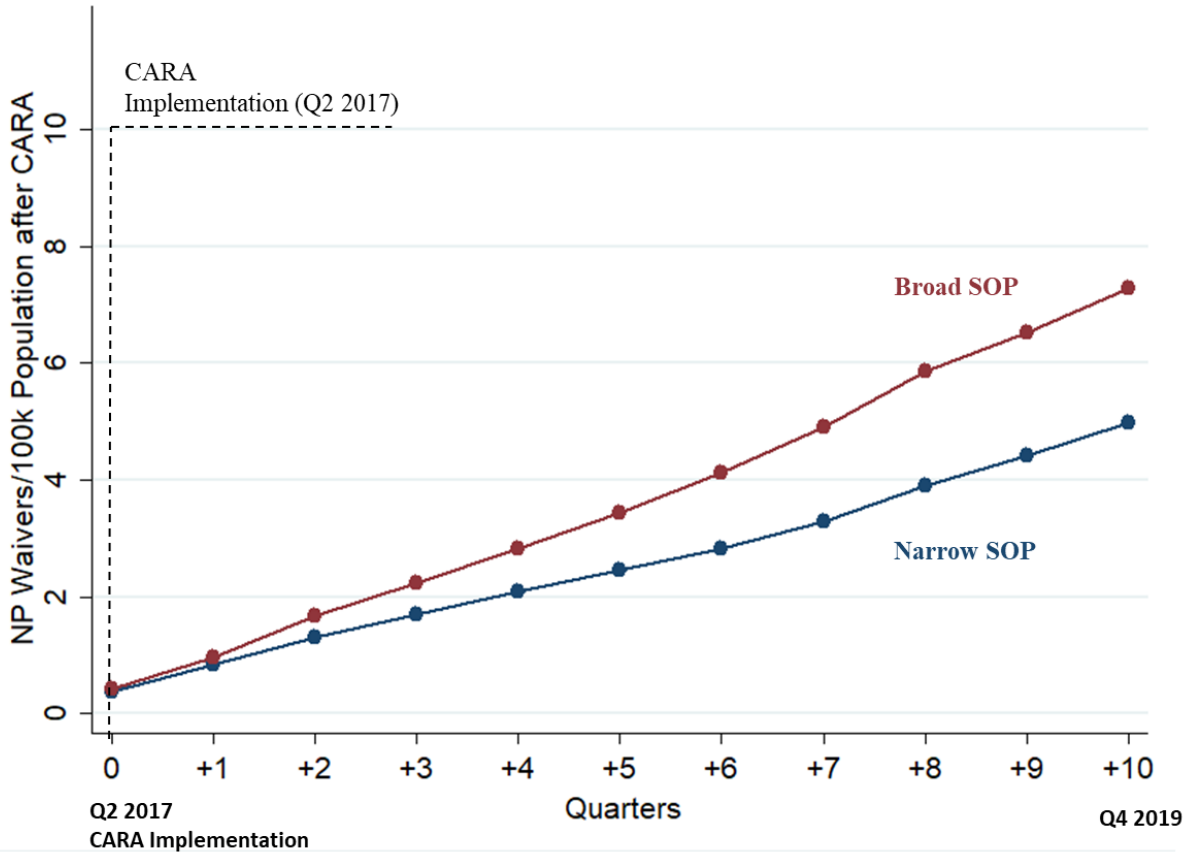
	Narrow SOP			Broad SOP		
	Before CARA	**After CARA**	**Difference**	**Before CARA**	**After CARA**	**Difference**
No. of state-quarters	303	325	%	129	203	%
Buprenorphine						
(per 100k residents)						
Buprenorphine, grams	293.4	422.3	43.9	245.0	304.0	24.1
No. 90-day Rx	209.5	301.7	44.0	175.0	217.2	24.1
Log Buprenorphine, grams	5.42	5.85	7.9	5.29	5.48	3.6
Log No. 90-day Rx	5.08	5.49	8.1	4.95	5.15	4.0
Policy (state-quarters), No.						
Medicaid expansion	54.4	57.5	5.7	89.1	85.2	-4.4
Mandatory PDMP	29.4	69.8	137.4	11.6	33.9	192.2
1115 SUD/IMD waiver	1.9	33.8	1678.9	1.5	18.7	1146.7
State prior auth law	.003	16.9	.	1.5	18.7	1146.7
Population Characteristic						
White	69.3	68.3	-1.4	66.1	66.2	0.2
Black	12.9	13.6	5.4	6.6	6.9	4.5
Hispanic	11.1	11.3	1.8	13.6	13.8	1.5
Other race	6.6	6.6	0.0	13.6	13.1	-3.7
Age: 0-18	24.1	23.6	-2.1	23.6	23.6	0.0
Age: 65+	15.48	16.68	7.8	15.3	16.2	5.9
Under 100% FPL	14.14	13.26	-6.2	13.0	11.6	-10.8
OUD risk factors						
Opioid Rx Rate	79.7	65.8	-17.4	66.9	52.4	-21.7
Fair/poor health	17.7	18.9	6.8	15.3	15.9	3.9
Poor MH	11.6	13.1	12.9	10.5	11.4	8.6
Supply						
(per 100k residents)						
APRN/100k	111.8	131.8	17.9	130.5	143.8	10.2
Waivered MD	9.5	15.06	58.5	9.9	15.2	53.5
Waivered NP	0	2.6	.	0	3.7	.
Opioid treatment program	.47	.55	17.0	.49	.53	8.2

Regression Results

In preliminary analyses, we confirmed data validity by replicating findings in previous literature.[91,94,98] Regression results showed that (1) After CARA, NP waiver rates increased more in broad SOP states, relative to narrow SOP states (Figure 5), (2) there was a greater increase in overall waiver growth in broad SOP states after CARA implementation (Appendix B, Table 4), and (3) an increase in buprenorphine waivers was associated with increases in buprenorphine prescribing (Appendix B, Table 4).

Figure 5.

Association between nurse practitioner scope of practice and NP Waivers/100k population after CARA legislation



Notes This figure shows the interaction between quarter and SOP for narrow and broad SOP states after CARA legislation implementation (Q2 of 2017). Analysis adjusted for state and year fixed effects as well as area level time varying covariates.

Increases in Buprenorphine Dispensing Post-CARA in Broad SOP States

We conducted a DID analysis using a negative binomial regression model to determine if prescribing increased more following CARA in broad SOP states relative to narrow SOP states. We ran the models in two steps: (1) model 1 only adjusts for state and year fixed effects, and (2) model 2 is fully adjusted with policy, OUD risk variables, area-level demographics, and supply variables.

For both fully adjusted outcomes, buprenorphine dispensing was significantly higher in the post-CARA period (16 grams of buprenorphine/100,000 persons and 11.48 more 90-day prescriptions/100,000 persons). These estimates were stable in all models (Table 2).

I found a significant effect of the DID term in both models. Specifically, in the fully adjusted model, 22.01 more grams of buprenorphine/100,000 persons were dispensed in broad SOP states in the post-CARA period, relative to narrow SOP states ($p<.05$). Similarly, when the grams of buprenorphine were converted to the number of 90-day prescriptions, we found more 90-day prescriptions/100,000 persons in the post-CARA period for broad SOP states, relative to narrow SOP states ($p<.05$). The DID estimates across all models were relatively stable in all models.

Medicaid expansion, the supply of waivered physicians, and increases in younger aged populations were associated with greater buprenorphine dispensing rates. Factors associated with lower rates of buprenorphine prescribing rates included Medicaid 1115 waivers for SUD, Hispanic ethnicity, and more poverty (Table 6).

Table 6. Buprenorphine Dispensing in Broad vs. Narrow SOP States Before and After CARA (DID)

	Grams of buprenorphine dispensed/100k		**Number of 90-day buprenorphine prescriptions/100k (16mg/day)**	
Average Marginal Effects	State and Year Fixed Effects	Fully Adjusted	State and Year Fixed Effects	Fully Adjusted
Broad SOP (ref=Narrow SOP)	2.843	5.147	2.234	4.219
	[-30.84,36.53]	[-22.41,32.70]	[-21.23,25.70]	[-14.88,23.32]
Post-CARA	**17.11*** **	**16.00*** **	**12.54*** **	**11.48*** **
	[9.03,25.19]	**[9.05,22.96]**	**[6.92,18.15]**	**[6.82,16.14]**
Broad SOP * CARA	**23.52** **	**22.01** **	**15.83***	**15.86** **
	[0.32,46.71]	**[3.82,40.20]**	**[-1.11,32.78]**	**[3.12,28.61]**
Policies				
Medicaid expansion		16.79**		11.63**
		[0.22,33.36]		[0.36,22.90]
Mandatory PDMP		-4.590		-2.166
		[-18.24,9.06]		[-11.90,7.57]
SUD 1115 waiver		-20.27***		-14.08***
		[-33.30,-7.24]		[-23.07,-5.09]
State prior auth law		-0.994		-1.869
		[-17.13,15.14]		[-12.91,9.17]
OUD risk factors				
Opioid Rx (1yr lag)		0.756		0.590*
		[-0.24,1.75]		[-0.01,1.19]
Fair/Poor health(%)		-1.712		-0.936
		[-6.34,2.91]		[-4.32,2.44]
Poor MH (1yr lag)		0.271		0.169
		[-3.89,4.43]		[-2.80,3.13]
Demographics				
Black/AA(%)		-1.803		-1.940
		[-18.66,15.06]		[-14.11,10.23]
Hispanic(%)		-26.73**		-18.29**
		[-49.87,-3.58]		[-34.62,-1.97]
Other Race(%)		-6.455		-5.181
		[-21.24,8.33]		[-15.52,5.16]
Age 0 to18(%)		15.20***		10.21***
		[4.64,25.76]		[2.92,17.50]
Age 65+(%)		-2.785		-2.055
		[-12.18,6.61]		[-8.98,4.87]
Under FPL(%)		-5.417**		-3.941**
		[-10.27,-0.57]		[-7.16,-0.72]
Supply				
APRN/100k		0.0817		0.0552
		[-0.13,0.29]		[-0.08,0.19]
MD waiver/100k		1.442**		0.924**
		[0.18,2.70]		[0.08,1.77]
OTP/100k		-18.86		-14.72
		[-57.53,19.80]		[-41.62,12.19]
Observations	960	960	960	960

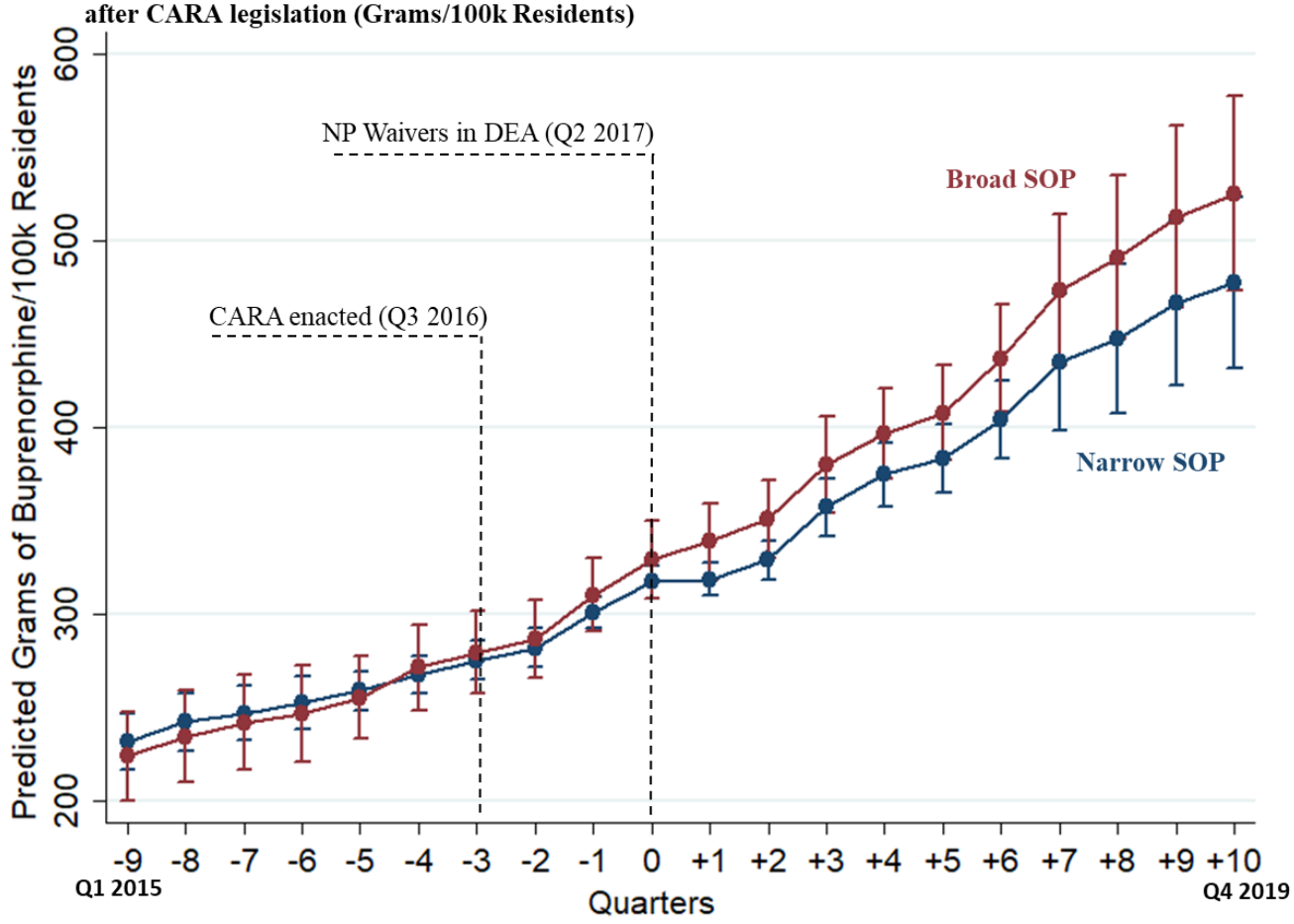
95% Confidence Interval in parentheses. Poor MH is defined as the number of people who report poor mental health for 14 or more days/last 30 days. APRN=Advanced Practice Registered Nurse. OTP=Opioid Treatment Program. PDMP= Prescription Data Monitoring Program. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Appendix B, T2, full output.

Event Study

To further explore how trends in prescribing varies over the period of interest, we used an event study regression and graphed the predicted DID margins for broad and narrow SOP over that time. Figure 6 below shows an increasing trend in DID coefficient as quarters elapsed across the study period. In the regression analysis, we used the quarter before implementation as the comparator and found that most quarters reaching or approaching traditional significance in the post-CARA period (Appendix B, Table 5). Figure 6 shows a slight divergence of SOP difference in difference lines around quarter 3-4 preceding CARA implementation, which aligns with the time of CARA passage and enactment (Q3 2016). Changing the reference quarter to the quarter 4 of 2016, when CARA passed the house and senate in quarter 3 2016 and was enacted, resulted in insignificant quarterly DID estimates for all but two pre-CARA quarters.

Figure 6.

Estimated effects of nurse practitioner scope of practice on Buprenorphine dispensing before and after CARA legislation (Grams/100k Residents)



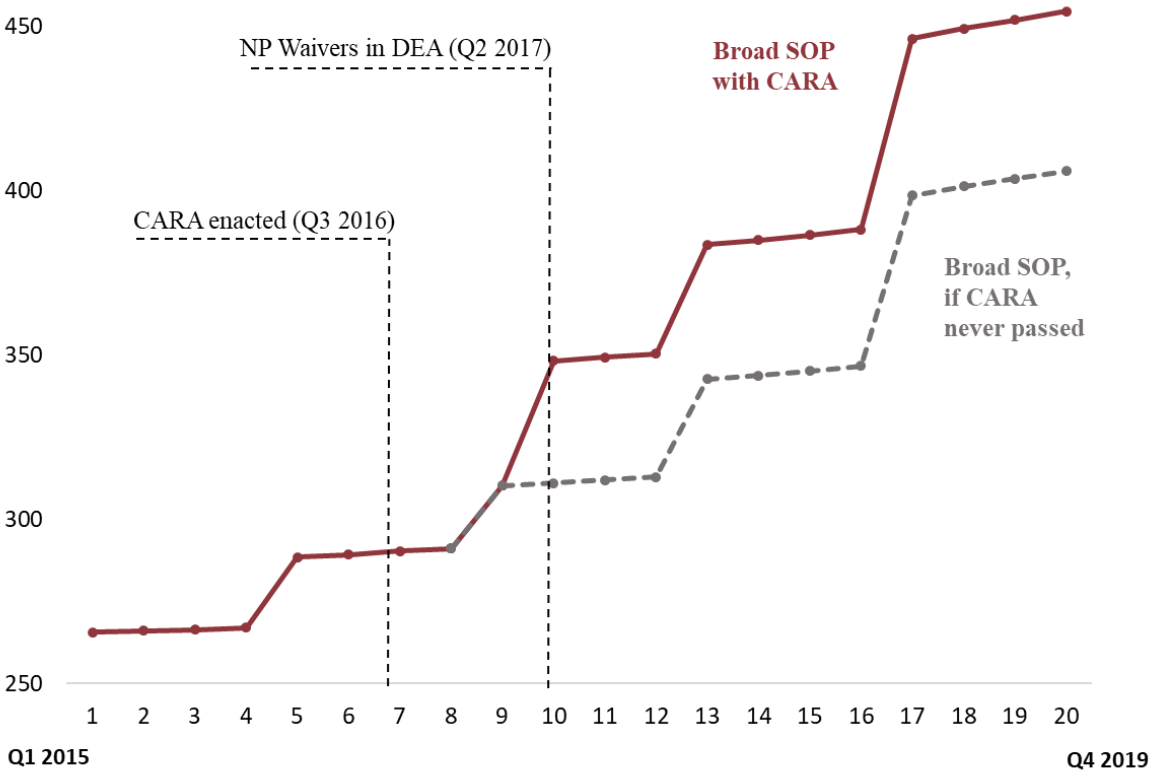
Notes This figure shows the difference in difference coefficient for narrow and broad SOP states before and after CARA legislation implementation (Q2 of 2017). Error bars represent the 95% confidence interval. Analysis adjusted for state and year fixed effects as well as area level time varying covariates.

Sensitivity Results

Generate estimates for a hypothetical scenario where CARA was not passed. We produced predictions of the difference-in-difference to estimate the grams of buprenorphine per 100,000 if CARA legislation had not been passed. After running the model (i), we used margins to produce the predicted value for the DID term and stored estimates at the state year level. After changing CARA indicator from 1 to 0 for all estimates, we replicated this procedure, and we graphed the average estimates for broad SOP states with and without CARA legislation. The dashed line represents the hypothetical scenario to examine what buprenorphine dispensing would have looked like in broad SOP states if CARA legislation was not passed (Figure 7).

Figure 7.

Visualization of DID estimate for Buprenorphine Dispensing in Broad SOP states with and without CARA legislation (Grams Buprenorphine/100k residents)



Notes This figure shows the difference in difference coefficient for broad SOP states before and after CARA legislation implementation (Q2 of 2017). Dashed lines represent scenario where CARA never happened. Analysis adjusted for state and year fixed effects as well as area level time varying covariates.

Falsification Test

I conducted a falsification test using Metoprolol, a common blood pressure medication. There was no significant change in prescribing after CARA, suggesting that CARA legislation did not impact prescribing of the common drug, Metoprolol. Further, the DID estimate measuring the change in prescribing in broad SOP states post-CARA was also insignificant. Insignificant findings provide additional evidence that the key finding is not due to other changes in prescription policy that occurred at the same time as CARA (Table 7). Figure 8 shows trends in the predicted number of Metoprolol prescriptions across the study period. Broad and narrow SOP lines do not vary.

Table 7.

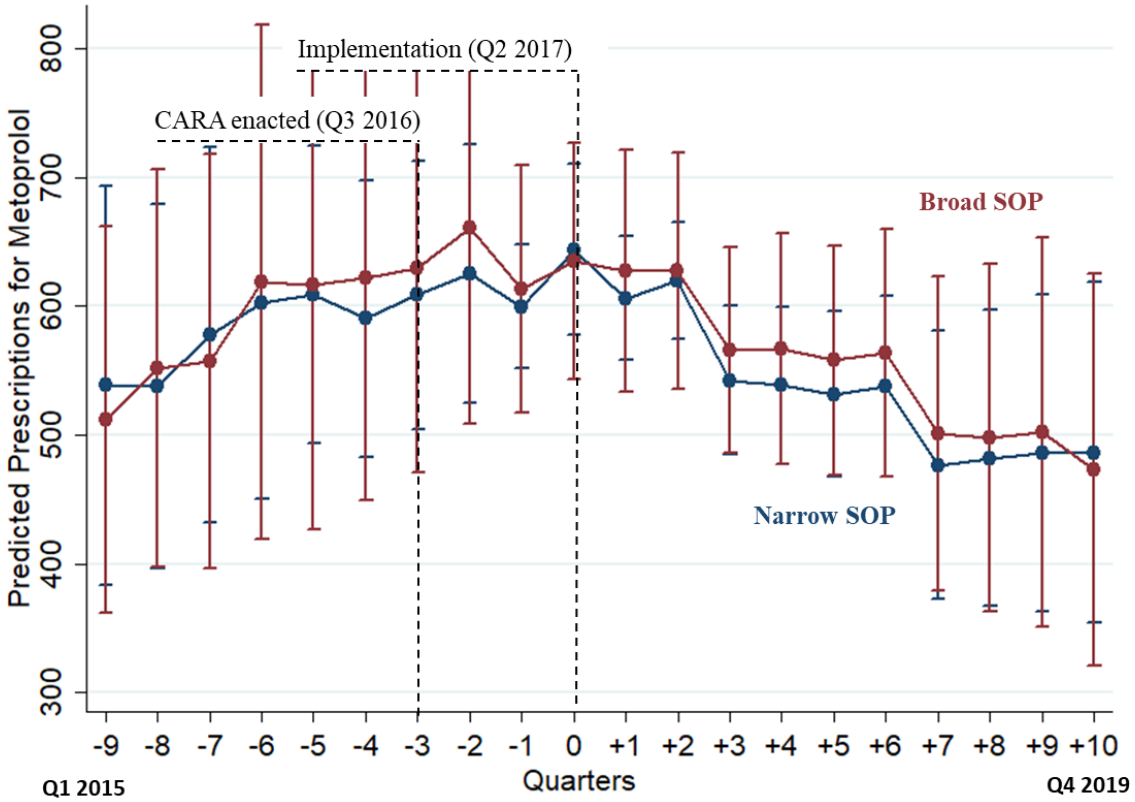
Falsification Test: Prescriptions of Metoprolol (blood pressure) Dispensed in Broad vs. Narrow SOP States Before and After CARA (DID)

	Prescriptions of Metoprolol /100k Marginal Effects
Scope of Practice and CARA	
Broad SOP (ref=Narrow SOP)	11.51 [-106.58,129.60]
Post-CARA (ref=pre-CARA)	17.39 [-10.08,44.86]
Broad SOP * CARA	4.242 [-70.40,78.88]
Policies	
Medicaid expansion	271.3*** [127.80,414.70]
Mandatory PDMP	-35.78 [-87.71,16.16]
SUD 1115 waiver	39.75 [-17.28,96.79]
State prior auth law for BUP	-34.31 [-82.21,13.59]
OUD Risk Factors	
Opioid Rx/100k(1yr lag)	-1.417 [-5.24,2.41]
Fair/Poor Health(%)	-6.880 [-24.03,10.27]
Poor MH (%, 1yr lag)	14.04 [-18.32,46.40]
Supply	
APRN/100k	0.952 [-0.29,2.19]
Waivered MD/100k	-1.773 [-12.58,9.04]
OTP/100k	263.8** [62.77,464.88]
Demographics	
Black/AA (%)	2.903 [-47.99,53.79]
Hispanic (%)	62.75 [-104.73,230.22]
Other Race(%)	35.27 [-37.81,108.36]
Age 0 to 18 (%)	3.434 [-58.56,65.43]
Age 65/+(%)	11.58 [-24.09,47.25]
Under FPL(%)	6.161 [-15.26,27.58]
Observations	960

95% confidence interval in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Full output Appendix B, Table 5.

Figure 8.

Estimated effects of CARA legislation on Metoprolol (blood pressure medication) prescriptions in broad and narrow SOP states.



Notes This figure shows the difference in difference coefficients for narrow and broad SOP states before and after CARA legislation implementation (Q2 of 2017). Error bars represent the 95% confidence interval. Analysis adjusted for state and year fixed effects as well as area level time varying covariates.

Specification of the SOP Term

To determine whether key results were sensitive to the specification of the SOP term, we ran 3 additional models with slight variations in the SOP term and concluded that the key findings were not sensitive to specification of the SOP term. Further, we ran a sensitivity analysis to determine the impact of using a time-varying SOP variable. We only included variables that did not switch SOP categories across the study time period, which dropped 6 states from the analysis. The key findings were nearly identical. Combined, these sensitivity analyses suggest that the key findings are not sensitive to SOP specification or the time-varying SOP variable (Appendix B, Table 4).

Discussion

To address the substantial shortage of buprenorphine waivered providers, CARA extended buprenorphine prescribing privileges to mid-level practitioners who obtained SAMHSA authorization. However, the CARA legislation stipulated mid-level practitioners must prescribe buprenorphine in accordance with state-level SOP laws. This study, using a quasi-experimental difference-in-difference model, found evidence that buprenorphine dispensing increased more following CARA in broad SOP states, relative to narrow SOP states. Further, the post-CARA period was associated with increases in dispensing compared to pre-CARA. These key findings were not sensitive to SOP specification. Results from these sensitivity tests provide additional evidence that key findings are due to CARA, and unlikely related to something that impacts prescribing in general.

Prior literature demonstrated the contributions of mid-level practitioners to the buprenorphine waivered workforce and treatment delivery, particularly for underserved populations. For example, the number of mid-level buprenorphine waivers increased after

CARA, with notable increases in underserved rural areas.[94,98] Among waivered providers, nurse practitioners were more likely than physicians to prescribe to Medicaid patients, another underserved population.[95]

While other studies demonstrated CARA increases the supply of buprenorphine waivered NPs and PAs, they do not provide measures of access to treatment, such as the amount of buprenorphine dispensed for all payers. This study shows that buprenorphine prescribing increases in the post CARA period. Further, it provides evidence that broad SOP combined with CARA improves access to buprenorphine treatment for individuals with OUD at a greater rate than what was observed in narrow SOP states. On average, the increase in 90-day buprenorphine prescriptions post-CARA in broad SOP states is equal to about 16 more 90-day buprenorphine prescriptions per 100,000 persons for each quarter year. Given the high mortality in individuals with OUD,[130] and evidence that medication to treat OUD decreases mortality rates,[131] it is important to assess and remove barriers to treatment. Recent changes to federal policy have reduced barriers to becoming waivered by removing training requirements for those who wish to prescribe under the 30-patient cap.[85] The findings of this study provide evidence of increased buprenorphine prescribing in broad SOP states in the post-CARA period, suggesting that policymakers wishing to increase access to buprenorphine could consider SOP laws as a pathway to do so.

Limitations

The findings in this paper are subject to some limitations. ARCOS data provides an aggregate measure of buprenorphine dispensed across periods of interest, but it does not differentiate between NP and physician prescribing. Literature examining buprenorphine prescribing finds that the post-CARA growth in buprenorphine prescriptions increased

substantially among mid-level practitioners but stayed relatively stable for physicians over the same time period.[15] Further, by incorporating the supply of waivered MDs in the analysis, we control for dispensing related to increases in MD waivers. Although we control for the number of MD waivers, we cannot determine which waivered providers are prescribing. We have not found evidence in the literature suggesting that prescriber engagement varies by state. State and year fixed effects are included in the model and will help control for dispensing that is particular to the state and year.

A limitation of ARCOS is that it is not possible to differentiate between buprenorphine prescribed to treat OUD from buprenorphine prescribed for analgesic reasons. To explore the potential extent of this limitation, we conducted an informal analysis using state Medicaid utilization data and found that buprenorphine products that are typically prescribed for analgesic reasons (Belbuca, Buprenex, Butrans) accounted for 1% of all buprenorphine prescriptions in Virginia in 2019. This suggests that the vast majority of buprenorphine is prescribed for OUD treatment, rather than analgesic reasons.

Full addresses were unavailable for prescribers, so it was not possible to exclude NPs that work at Veterans Affairs (VA) facilities that granted full scope-of-practice privileges. Further, we were unable to identify and remove prescribers who are no longer waivered. When we compared the FIOA prescriber file to another data source without inactive prescribers to for the third quarter of 2019, the number of prescribers was very similar, with less than a 2-percentage point discrepancy. Inactivity in physician-level providers may bias results downward if the rates of inactivity are varying over time and between states, as the increased number of physicians would absorb NP variation in the model outcome. However, we do not suspect variability of inactivity rate across states and year.

While visual inspection of the parallel trends in the pre-CARA period suggests similar dispensing in broad and narrow SOP states, some event study DID parameters show significance in pre-trends, suggesting some disturbance in the pre-CARA period. Hypothesizing that these pre-period differences could be due to the incident to billing (a physician NPI is used on billing claims, but mid-level providers provide service)[132] following CARA passage, we set the reference point to the quarter when CARA was passed and observed an increase in significance in the post-CARA period and a decrease in the pre-CARA period.

Further, we were unable to control for policy implementation in health systems or local governments. If buprenorphine distribution varies between years and states due to these policies, this could bias key findings upward if these policies are more common in broad SOP states. NPs prescribing higher doses of buprenorphine, relative to physicians, is another potential source of bias. Some evidence suggests that NPs and physicians have different opioid prescribing patterns, with NPs less likely to prescribe any opioids, but slightly more likely to prescribe higher doses of opioids.[133] If this finding generalizes to NP buprenorphine prescribing, it could bias results upwards. However, it is possible that differences in opioid prescribing patterns could be due to relative differences in the medical complexity of the populations that NPs and physicians serve.

Conclusion

This is one of the first studies to examine the intersection of federal and state policies and their combined impact to increase access to treatment for individuals with OUD. Even in the short time period after the CARA legislation was enacted, we observed that states with broad SOP laws prescribe substantially more buprenorphine, compared to the narrow SOP states. Future studies should extend this research by pairing DEA waiver data to national prescription databases to examine NP prescribing patterns in more detail. Further, policymakers working to

address the opioid epidemic in their state should consider whether increasing NP SOP may lead to increased access to medication for OUD, particularly among underserved populations.

Chapter III: Does Health Insurance Literacy Predict Subsequent Access to Behavioral Health Services and Unmet Mental Health Needs?

Introduction

Behavioral health (BH) conditions are prevalent, with approximately 20% of U.S. adults living with a mental illness (AMI) and 7.4% with a substance use disorder (SUD).[1] Untreated, symptoms can worsen, sometimes leading to more severe symptoms or diagnoses.[2,3] Despite the high prevalence of BH disorders, relatively few receive treatment. Only 44.8% of those with an AMI received mental health (MH) services in the past year, and only 10.3% of individuals 12 and older with a SUD received substance use treatment services.[1]

Although there are gains in coverage of BH services through the Affordable Care Act and federal parity legislation, researchers have observed little overall change in reported access to BH services over the last decade. In 2019, 44.8% of those with an AMI reported any outpatient MH service in the previous year, compared to 40.9% in 2008. Trends in access to SUD treatment services are flat, with 10.4% accessing SUD treatment in 2015 and 10.3 percent in 2019.[1] Slow gains in BH treatment rates suggest that other barriers remain.

Health Insurance Literacy

Health insurance literacy (HIL) is concerned with how people understand their health insurance plan and how that health insurance knowledge is used to obtain healthcare services.[134] Most adults have basic or low levels of HIL.[135–138] In a study of commonly used health insurance terms, only 14% of adults could correctly answer four multiple-choice questions about general health insurance terminology.[139] When asked about the basic attributes of their healthcare plans, only about 30% of consumers could correctly answer all four questions.[140] Another area of HIL

research focused on factors associated with how individuals choose health plans. Literature indicates that individuals with low health insurance literacy have trouble choosing health plans that minimize their out-of-pocket costs.[141,142] This is particularly true if the consumer is presented with too many choices, has a low level of plan comprehension, or has low numeracy.[143–145]

Low HIL is associated with more emergency department visits, lack of adherence to prescription drug treatment, and poorer overall health.[17,73] Insured individuals with low HIL are more likely to report putting off care due to perceived costs, even for fully covered services, such as preventive yearly check-ups.[73] Factors correlated with low HIL include young age, low income, male sex, lower numeracy abilities, and low financial confidence.[136,146–148] Some studies find that low HIL is more common in non-white groups, while other research finds no association between race and HIL.[146,149] These findings suggest that low HIL may be a direct barrier to receiving needed care. Further, treatment barriers associated with low HIL may be more detrimental to groups with a higher prevalence of low HIL, like low-income populations.

HIL, Behavioral Health, and Low-Income Populations

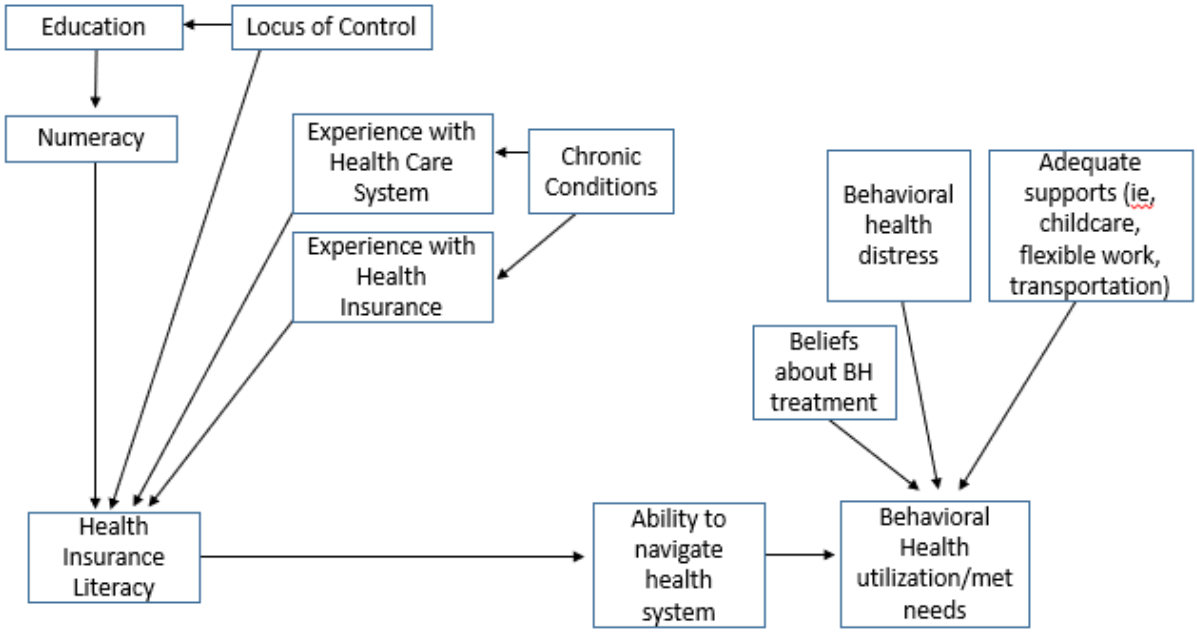
Individuals must navigate complicated and evolving insurance requirements and the healthcare landscape to obtain needed services, medication, and supplies.[150] Barriers to BH services may make these services particularly difficult to access. Widespread BH provider shortages, low insurance uptake among BH providers, slim provider networks, and insurer federal parity violations create barriers to BH services.[12,35,37,64,151] Low HIL may amplify the detrimental impact of these barriers. Most state Medicaid programs administer benefits to low-income people through private insurance companies,[13] making HIL relevant for low-income populations.

Further, BH conditions are more prevalent and associated with more co-occurring physical conditions in low-income populations than high-income.[152,153] Similarly, low HIL is more common among low-income people.[154] Because low-income populations are more likely to experience both BH conditions and low HIL, the role of HIL in accessing BH services may be particularly relevant for this population. Low HIL may influence undiagnosed or untreated BH diagnoses, potentially further exacerbating symptoms and unmet needs.

Prior literature documents disparities in access to general healthcare services among those with low HIL.[17,73] The prevalence of low HIL and BH conditions is higher among low-income populations.[154] Therefore, it is essential to understand how HIL may influence access to BH services in low-income people. Low-income populations often interact with private health insurance companies contracted with state Medicaid programs, potentially making HIL an essential component of care-seeking in low-income individuals.[13] Despite the relevance, no evidence to date examines whether HIL influences access to BH services in low-income populations, suggesting a critical need for research in this area. This paper explores whether HIL, measured at study baseline, is associated with subsequent unmet needs for BH services due to cost and access to BH services in the 12 months following study enrollment.

Conceptual Framework

Figure 9. Health Insurance Literacy and Mental Health Utilization: A Conceptual Framework



This conceptual framework, adapted from Barnes[143] and Andersen,[155] depicts the relationship between HIL and other factors that lead to the utilization of BH services and met BH needs. On the left, the factors leading to HIL include locus of control, education, numeracy, experience with the health care system, and experience with health insurance. HIL leads to an ability to navigate the health care system to make and attend medical appointments within the constraints of the consumer's health care plan. Mental health services utilization may be tempered by factors like beliefs about mental health treatment, level of mental health distress, and whether the individual has adequate supports that allow them to attend medical appointments (ie. transportation, childcare, flexible work schedule). Focusing on HIL, we can interpret the conceptual framework as follows: understanding basic health insurance terms will reduce confusion and enhance the ability to understand their costs and covered networks, increasing

their ability to navigate the healthcare system, ultimately leading to greater access to BH services and reduced unmet need for MH services. For example, in individuals with high HIL and MH needs, we expect to observe an increase in the utilization of BH services and a decrease in unmet need for MH services.

Aims and Research Questions

Aim#1 Does HIL affect access to and utilization of BH services in individuals with mental disorders?

- H1: Individuals with high HIL are less likely to have unmet need for MH services due to cost.
- H2: Individuals with high HIL are more likely to utilize BH services.

Data and Methods

Data Source

Data for this study were collected as part of a larger randomized controlled trial that encouraged primary care visits through small cash incentives to a low-income population enrolled in a hospital safety-net coverage program called Virginia Coordinated Care (VCC).[156] This program, administered through Virginia Commonwealth University Health System (VCUHS), provided enrollees access to a community network of primary care providers. Primary care providers within the VCC network could refer patients to specialty care, including BH treatment services, within VCUHS. For the vast majority of patients enrolled in the trial (>99%), primary care and specialist visits, including BH services, were covered at 100% with no additional out-of-pocket costs to the patient, and prescriptions were provided with a $4 copay. Therefore, VCC enrollees experienced minimal financial barriers to BH treatment services. It is important to note that the VCC program is not health insurance. It is a hospital safety-net

coverage program that offered access to primary care providers and specialists (including BH specialists) through VCUHS and the VCC's network of local community primary care providers.

Recruitment, which began in 2014, focused on enrolling individuals into the study immediately following enrollment into the VCC program. A large majority of study participants were new to the VCC program; however, about 8% were already enrolled in VCC but had no claims for the 9 months preceding study enrollment. During the recruitment period, all initially eligible individuals were sent a study recruitment letter. Study coordinators called potential participants to do a brief phone screening to ensure eligibility and to ascertain their interest in study participation. During this communication, study coordinators informed participants that they could access primary care and subsequent specialty services through a primary care referral. All screening and interviews were conducted over the telephone. Upon completion of the baseline survey, coordinators randomized participants to an incentive group ($0, $25, or $50) and informed those randomized to the $25 and $50 groups that they would receive the incentive following a primary care visit if that visit occurred within the next 6 months. A total of 1,226 individuals were eligible and agreed to participate in this trial. Of those, 1,026 completed a follow-up assessment 12 months later, an 84% retention rate. With the exception of age ($p<0.05$), individuals who completed the follow-up survey were no different than non-completers. Younger participants were less likely to complete follow-up.

Sample Inclusion Criteria

The sample for the study is limited to people who responded to the HIL scale. The HIL scale was added after the start of the study. Early study participants were missing the HIL scale and were not included in the current analysis (n=367). Individuals who did not complete the HIL due to the delayed start of the scale implementation did not significantly differ from those who

completed the HIL scale in terms of age, education, race, and income. An additional 3 observations were dropped due to missing information on the HIL scale. Further, 32 participants completed abbreviated interviews at follow-up that did not include unmet need questions (n=32).

All analyses were conducted using two samples, the full sample and a MH subsample. The subsample was limited to individuals with higher-than-average levels of depression or anxiety. We measured depression and anxiety symptoms for all participants at baseline using the Patient Reported Outcomes Measurement Information System (PROMIS) scales. Participants responded to a 4-item questionnaire for anxiety and depression at baseline. Within each domain, responses were summed and converted to standardized t-scores, as specified by PROMIS scoring guidelines.[157] A score of 50 represented the average level of depression for the U.S. general population, and one standard deviation is equal to 10 t-score points. A person with a score of 60 is one standard deviation above the mean. [157,158] Participants whose score was above the standardized mean of 50 for depression (n=435) and/or anxiety (n=463) were considered to have higher than average levels of MH symptoms. Combined, the final MH subsample for the study was 513. The full sample size was 718.

Survey data were collected at study baseline, shortly after enrollment into the VCC program, and again, 12 months later at follow-up. Administrative claims data were linked to survey data to obtain measures of health care utilization. IRB approval was obtained through Virginia Commonwealth University IRB and the University of Colorado.

Outcomes

Unmet Need for Mental Health Services. The primary outcome of interest was patient-reported unmet MH care due to costs. Although participants had access to BH services at no cost through the VCC program, low HIL may have led to misunderstandings about VCC coverage,

altering care-seeking behaviors. At baseline and follow-up, patients were asked, "During the last 12 months, was there any time you needed mental health care or counseling but couldn't afford it?" The source of this question was the National Health Interview Survey (NHIS), an annual survey that tracks the health of the non-institutionalized civilian population in the United States. The reference period for the follow-up question reflects the time period between the initial survey and follow-up. We conducted a power analysis based on the sample size of 481 patients and 11 covariates and found the sample size was sufficient to allow for the detection of a 5-percentage point difference at p=0.05 in the probability of having an unmet need for MH care due to cost.

Access to Behavioral Health Services. The secondary outcome of interest was outpatient BH services utilization and treatment setting type. BH services were identified through VCC administrative claims data. Outpatient use of BH treatment was defined as having an outpatient visit with an ICD-9 or ICD-10 code for a MH or SUD. The comorbidity between MH and SUD is very high, so we included both in the current analysis.[1] The study period crossed the conversion period between ICD-9 or ICD-10, which required application of the relevant set of codes based on the date of visit (Appendix, C Table 10). Administrative claims notated whether the visit was considered a primary care or specialist visit.

Using these designations, we created a three-level variable to categorize BH utilization into three groups: no treatment, BH treatment in the PCP setting, and BH treatment in a specialty setting. We considered specialty BH services a higher level of care and, accordingly, coded people who had both primary care and specialty BH visits as utilizing "specialty BH care." Individuals with one BH primary care visit and no mental health specialty visits were coded as

"BH utilization in a primary care setting." Individuals without BH utilization in either primary care setting or specialty setting were coded as "no treatment."

Independent Variables

A summary of measures is located in the appendix (Appendix C, table 1).

Health Insurance Literacy Scale. Our primary independent variable, health insurance literacy, is derived from a set of 6 questions that ask participants to identify their level of confidence with various health insurance terms, such as *provider network* or *deductible* (Figure 10). Participants were asked to rate their level of understanding with these terms on a 4-point scale with responses that ranged from *not at all confident* to *very confident*. These questions were from the Health Reform Monitoring Survey, which is administered semiannually by the Urban Institute.[159] Individual items were summed to create a total score with a range of 6 to 24. Higher scores indicate greater levels of confidence in health insurance terminology, or HIL. This scale has not been validated, so we conducted a Chronbach's alpha test to measure the scale's internal consistency. This scale had a Chronbach's alpha of 0.84, suggesting relatively high internal consistency.[160] After summing the health insurance literacy scale, we found the sample median. Scores above the median were coded as 1 and those below the median were coded as 0. In sensitivity analyses, we explore other specifications of the HIL term.

Figure 10. Confidence in Health Insurance Terminology Scale

I will read you a list of health insurance terms. For each term, please indicate how confident you are in how well you understand what each term means.	Response Options
Premiums Deductible Co-payments Co-insurance Maximum annual out-of-pocket spending Provider network	Very confident Somewhat confident Not too confident Not at all confident

Covariates

At baseline, data on the following demographics were collected: age, sex, race, marital status (married, unmarried), education (less than high school, high school, more than high school), monthly income (<$1500, ≥$1501), employment status (employed, not employed). The number of chronic conditions was also assessed via self-report, summed, and categorized into three groups (0 conditions, 1-2 conditions, 3+ conditions). We also assessed whether the participant had any prior health insurance coverage (private, public, or military) and was coded as (history of insurance, no history of insurance). As described above, study data were collected in the context of a clinical trial that sought to increase primary care utilization through cash incentives, so we controlled for randomization to the study treatment arm.[156,161,162] demographic data was sparse but was replaced using multiple imputation methods (n=6). Regressions with and without multiple imputations reveal very similar estimates (Appendix C, Table 7-8).

Analytic Approach

Differences between the characteristics of those with above and below median levels of health insurance literacy were analyzed using χ^2 tests for categorical variables and *t*-tests for continuous variables. A logistic model was used to examine if health insurance literacy at baseline was related to unmet need for mental healthcare at the 12-month follow-up interview.

- $Y_i = \beta_0 + \beta_1(HIL_i) + XA_i + \varepsilon_i$ **(1)**

The dependent variable, Y, represents the outcome, unmet need for mental healthcare, at an individual level ($_i$). $\beta_1(HIL_i)$ represents the independent variable of interest, HIL at baseline. X is a matrix of covariates, A is a vector of parameters associated with those covariates, and ε notates the error term.

A multinomial logistic regression was used to examine hypothesis 2, which measures the relationship between HIL at baseline and access to BH treatment in specialty and primary care locations in the 12-month period following baseline.

- $Y_i = \beta_0 + \beta_1(HIL_i) + X_i + \varepsilon_i$ **(2)**

The dependent variable, Y, represents the outcome, BH service utilization location, at an individual level (i). $\beta_1(HIL_i)$ represents the independent variable of interest, HIL at baseline. X is a matrix of covariates, A is a vector of parameters associated with those covariates, and ε notates the error term.

Sensitivity Analyses

We examined the relationship between BH diagnosis in the administrative claims data and anxiety and depression symptoms at baseline to establish whether anxiety and depression PROMIS scales are an appropriate tool to approximate the severity of MH symptoms. We explored other scoring specifications of the HIL measure, including (1) the continuous sum of all HIL questions and (2) splitting HIL responses into three parts, the bottom third of the distribution, the middle third, and those with the highest HIL were in the top third.

Using bivariate probit models, we explore whether the HIL term is endogenous. Factors that explain HIL may also explain treatment-seeking behaviors. The bivariate probit analysis uses maximum likelihood estimation to estimate two models simultaneously. The first model predicts the relationship for the full original regression, and the second estimates the relationship between the primary regressor and the remaining model covariates. The correlation between the standard errors of the joint models is estimated and a Wald test is used to determine whether the correlation coefficient is different from zero. A significant Wald tests suggests the presence of a latent variable and endogeneity of the primary regressor. Four bivariate probit models were

estimated to examine potential endogeneity of the primary regressor (1) unmet need vs. no unmet need, (2) any BH treatment vs. no treatment, (3) any BH treatment in a primary care setting vs. no treatment, and (4) any specialist BH treatment vs. no specialist.

Results

Descriptives

Table 8 reports descriptive measures for the full sample and the mental health subsample. Both samples were stratified by health insurance literacy. On average, the mental health sample was low-income (less than $1500 per month, 94%), non-White (72%), not married (89%), and not working (73%). The majority of individuals reported 2 or more chronic health conditions (71%), with only 10% reporting no chronic health conditions. About a third of the sample reported moderate or high levels of depression or anxiety, while those with symptoms above the standardized mean but below the moderate cutoff accounted for two-thirds of the sample.[157]

Demographic and health characteristics were similar across HIL groups with a few exceptions. Comparing those who reported HIL above the median threshold with those who were below, we observed differences in education, prior health coverage experience, and chronic health conditions. Those with above-median HIL scores had higher educational attainment, had prior health insurance coverage, and were more likely to have more than 2 chronic health conditions.

Table 8. Sample Characteristics by High and Low HIL

	Full Sample			MH Sample		
	All (n=718)	**Low HIL (n=367)**	**High HIL (n=351)**	**All MH (N=513)**	**HIL Median or below (N=269)**	**HIL Above Median (N=244)**
Unmet Needs						
Unmet MH needs (n=481)	23.26	27.38	18.90***	29.31	34.65	23.35***
Mental Health Utilization						
No MH treatment	71.73	73.02	70.37	67.64	69.89	65.16
Any MH PCP Tx	15.88	16.62	15.10	18.71	19.33	18.03
Any specialist Tx	12.40	10.35	14.53	13.65	10.78	16.80
Demographics						
Female	48.75	45.78	51.85*	51.66	47.96	55.74*
White race	27.72	25.07	30.48*	27.68	25.65	29.92
Married/partnered	12.12	11.17	13.11	11.11	10.41	11.89
Age group						
21-35	22.42	24.25	20.51	22.80	25.28	21.72
36-50	38.02	36.24	39.89	40.39	38.29	40.57
51-64	39.55	39.51	39.60	36.81	36.43	37.70
Education						
Less than high school	27.99	33.98	21.78***	29.24	35.69	22.13***
High school	33.33	36.74	29.80	31.97	33.83	29.92
More than high school	38.68	29.28	48.42	37.82	29.00	47.54
missing	0.97	1.36	0.57	0.97	1.49	0.41
Monthly income						
<$1500	92.62	93.73	91.45	93.96	94.42	93.44
$1500+	7.10	5.99	8.26	5.65	5.20	6.15
missing	0.28	0.27	0.28	0.39	0.37	0.41
Employed	27.99	27.79	28.21	26.71	27.88	25.41
History of insurance	76.18	72.21	80.34**	56.73	49.44	64.75***
Health risks						
Chronic conditions						
0	13.65	15.26	11.97	10.33	12.27	8.20**
1	22.42	17.44	27.64	19.10	14.50	24.18
2 or more	63.93	67.30	60.40***	70.57	73.23	67.62
BH at baseline						
Mild MH symptoms	74.51	71.93	77.21	64.72	62.08	67.62
Moderate/High MH	25.49	28.07	22.79	35.28	37.92	32.38
History of MH diagnosis	51.95	53.93	49.86	66.91	63.93	65.50
History of SUD diagnosis	13.65	14.99	12.25	17.84	14.34	16.18
Other						
Incentive group	67.09	66.49	68.09	65.11	65.80	64.34

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Unmet MH Need Reported 12 Months After Study Enrollment

Table 9 reports the likelihood of unmet MH needs due to cost at 12 months in a series of three logistic regressions. We examined whether HIL was related to reported unmet MH need 12 months later.

In the full sample, the unadjusted regression shows a strong relationship between HIL and reports of unmet MH need, with those with higher HIL less likely to report unmet MH needs relative to those with low HIL (OR: 0.618, $p<0.01$). The direction of the influence of HIL on unmet MH need was similar in the fully adjusted model, but it did not reach full significance (OR: 0.71, $p<0.10$). Those with a high school education, relative to a lower education level, were less likely to report unmet needs. Further, moderate MH symptoms at baseline and history of MH diagnosis increased the probability of unmet MH needs.

In the MH sample, high HIL is related to lower unmet need in the unadjusted (OR: 0.57, $p<0.01$) and full adjusted regressions (OR: 0.64, $p<0.05$). Similar to the full sample, having a high school education, relative to those with less education, reduces the probability of unmet MH need, while MH baseline symptoms and history of a MH diagnosis increase the likelihood of unmet MH need 12 months later.

Table 9. HIL and Unmet Mental Health Need Due to Cost 12 Months Later
Logistic Regression, multiple imputation, odds ratio reported

	Full Sample			Subsample		
	Unmet MH Unadjusted	Unmet MH Demographics	Unmet MH Fully adjust	Unmet MH Unadjusted	Unmet MH Demographics	Unmet MH Fully adjust
High HIL	**0.618*** **	**0.615** **	**0.712***	**0.575*** **	**0.578** **	**0.642** **
	(0.115)	**(0.118)**	**(0.143)**	**(0.118)**	**(0.123)**	**(0.141)**
Female		1.228	0.938		1.111	0.942
		(0.238)	(0.195)		(0.235)	(0.211)
White (ref=non-white)		1.000	0.755		1.018	0.820
		(0.215)	(0.170)		(0.245)	(0.202)
Married/Partnered		1.065	1.128		1.204	1.203
		(0.316)	(0.359)		(0.402)	(0.413)
Age group (ref=21-35)						
36-50		1.269	1.206		1.186	1.182
		(0.319)	(0.328)		(0.320)	(0.345)
51-64		0.851	1.027		0.901	1.030
		(0.222)	(0.279)		(0.252)	(0.311)
Education						
High school		0.537***	0.536**		0.535**	0.514**
		(0.128)	(0.142)		(0.139)	(0.145)
More than HS		0.723	0.705		0.742	0.703
		(0.165)	(0.168)		(0.190)	(0.181)
Income, 1500+ (ref=<$1500)		0.530	0.652		0.527	0.568
		(0.251)	(0.330)		(0.301)	(0.347)
Employed		0.746	0.864		0.659	0.825
		(0.168)	(0.211)		(0.169)	(0.223)
Insurance history		1.109	0.974		0.916	0.876
		(0.251)	(0.237)		(0.228)	(0.230)
Chronic conditions (ref=0)						
1			0.553*			0.501
			(0.199)			(0.212)
2+			0.629			0.547
			(0.195)			(0.202)
Incentive group			0.901			0.823
			(0.189)			(0.188)
Moderate MH symptom (ref=severe)			2.040***			1.750**
			(0.448)			(0.393)
Hx drug/alcohol			1.105			1.134
			(0.304)			(0.320)
Hx MH Dx			3.884***			2.705***
			(0.917)			(0.692)
Constant	0.377***	0.463**	0.295***	0.530***	0.782	0.631
	(0.0454)	(0.143)	(0.121)	(0.0700)	(0.262)	(0.283)
Observations	675	675	675	481	481	481

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

No BH treatment, primary care BH treatment, or Specialty BH treatment

Table 10 reports the likelihood of a BH visit at a specialist or primary care location compared to no treatment in those with higher HIL for two samples—the full sample and the MH sample. A multinomial logit was used to produce estimates that are reported as relative risk ratios.

In the full sample, individuals with high HIL are more likely to receive BH care at a specialist compared to no treatment (RRR=1.87, $p<0.05$). We observe no differences between HIL groups in the likelihood of a primary care visit compared to no treatment. A history of MH diagnosis and moderate/high levels of depression or anxiety at baseline were the strongest predictors of receipt of mental health care at a primary care or specialist compared to no treatment. Race was also a strong predictor, with White individuals more likely to receive mental health treatment at a primary care or specialist compared to no treatment, relative to non-White individuals.

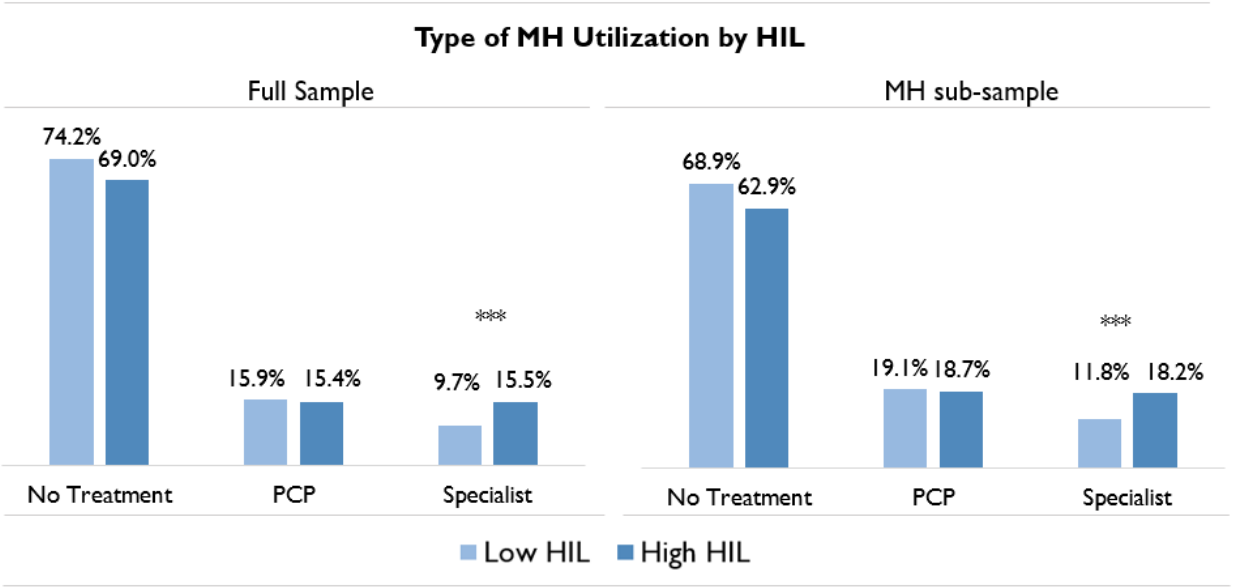
The findings for the MH sample were very similar. Individuals with high HIL were more likely to receive BH care at a specialist compared to no treatment (RRR=1.81, $p<0.05$). We observed no significant effect for the role of high HIL and a subsequent primary care visit compared to no treatment. A history of MH diagnosis and moderate/high levels of depression or anxiety at baseline were the strongest predictors of receipt of BH treatment at a primary care or specialist compared to no treatment. Race was also a strong predictor, with White individuals more likely to receive mental health treatment at specialist compared to no treatment, relative to non-White individuals. Married or partnered individuals, relative to unmarried, were less likely to receive specialty MH treatment than no treatment. Figure 11 shows the adjusted predicted probability for each type of utilization.

Table 10. HIL and BH Service Utilization in the Subsequent 12 Months
Multinomial Logistic Regression, multiple imputation, relative risk ratio reported

	Full Sample			Subsample		
	Reference No Tx	PCP Full	Specialist Full	Reference No Tx	PCP Subsample	Specialist Subsample
High HIL		1.104	**1.875****		1.134	**1.817****
		(0.254)	**(0.501)**		(0.295)	**(0.525)**
Female		1.427	1.458		1.563*	1.423
		(0.317)	(0.397)		(0.390)	(0.423)
White (ref=non-white)		1.326	2.287***		1.053	1.949**
		(0.345)	(0.596)		(0.313)	(0.559)
Married/Partnered		0.693	0.444*		0.677	0.296**
		(0.265)	(0.206)		(0.297)	(0.160)
Age group (ref=21-35)						
36-50		0.921	0.559		0.894	0.753
		(0.291)	(0.198)		(0.311)	(0.294)
51-64		0.823	0.810		0.852	1.011
		(0.280)	(0.277)		(0.307)	(0.398)
Education						
High school		1.088	0.578		1.084	0.635
		(0.322)	(0.195)		(0.354)	(0.237)
More than HS		0.860	0.770		0.825	0.959
		(0.250)	(0.251)		(0.261)	(0.341)
Income, 1500+ (ref=<$1500)		1.030	0.892		0.621	0.928
		(0.535)	(0.582)		(0.421)	(0.696)
Employed		0.698	0.968		0.756	0.838
		(0.198)	(0.305)		(0.255)	(0.305)
Insurance history		1.241	0.499**		1.524	0.593
		(0.373)	(0.153)		(0.517)	(0.202)
Chronic conditions (ref=0)						
1		0.969	1.034		1.130	0.816
		(0.419)	(0.526)		(0.610)	(0.476)
2+		0.915	1.489		0.941	1.128
		(0.349)	(0.706)		(0.442)	(0.606)
Incentive group		1.139	0.802		0.959	0.797
		(0.276)	(0.210)		(0.257)	(0.228)
Moderate MH symptom (ref=severe)		1.937***	2.150***		1.933**	2.243***
		(0.497)	(0.615)		(0.524)	(0.659)
Hx drug/alcohol		1.339	1.446		1.583	1.423
		(0.414)	(0.484)		(0.524)	(0.513)
Hx MH Dx		5.331***	4.786***		6.298***	4.220***
		(1.585)	(1.619)		(2.463)	(1.665)
Constant		0.0469***	0.0609***		0.0369***	0.0653***
		(0.0265)	(0.0364)		(0.0244)	(0.0441)
Observations	718	718	718	513	513	513

Robust SE in parentheses *** p<0.01, ** p<0.05, * p<0.1

Figure 11. Adjusted Predicted Probability of Type of MH Utilization by High and Low HIL. *Predictive margins shown*



* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Sensitivity Analysis

We found that PROMIS anxiety and depression scores at baseline were predictive of BH diagnoses in administrative claims data in the subsequent 12 months (Appendix C, Table 3). Unmet needs results were not sensitive to the specification of the HIL term (Appendix C, Table 4). However, we found evidence that the BH services utilization was sensitive to the HIL term specification (Appendix C, Table 5). Specifically, the HIL term was insignificant in the utilization models when the term was specified as continuous or split into a three-level variable. Further, analyses that used Poisson regressions to examine the influence of HIL on the number of visits for each treatment type suggested that HIL is unrelated to the number of primary care or specialist visits for BH reasons (Appendix C, Table 6).

Further, we examined the potential endogeneity of the HIL term using bivariate probit regressions. In these models, a significant correlation of the standard errors of the jointly

estimated models was interpreted as evidence of endogeneity in the primary regressor. We did not find evidence that the HIL term was endogenous in the model with the unmet MH needs versus no unmet MH needs outcome, the any treatment versus no treatment outcome, or the any MH primary care versus no MH primary care outcome. However, in the model that tests specialist visit vs. no specialist visit, we found suggestive evidence that the naïve association between HIL and specialist treatment may be overstated (Appendix C, Table 9). This approach is limited in that it relies only on the joint distribution of the error terms to identify possible unobserved variables involved in selection.

Discussion

This study examined the influence of HIL on subsequent unmet MH needs due to cost and BH utilization in low-income individuals enrolled in a community safety-net coverage program. Individuals with high HIL at baseline were less likely to report unmet MH needs due to cost 12-months later, compared to those with low HIL. These findings were not sensitive to specification of the HIL term. This is consistent with other literature that suggests that low HIL may be a barrier to care.[73] Further, we found evidence that individuals with high HIL were more likely to receive BH care at a specialist compared to no treatment but not more likely to receive BH services in a primary care setting, compared to no treatment. The specialty utilization findings were sensitive to the specification of the HIL term and may be influenced by an unobserved variable, potentially biasing the findings.

No known literature has examined the influence of HIL in BH utilization, and very little literature examines the impact of HIL on care-seeking patterns.[73,163] However, qualitative work may provide clues to the mechanisms underlying the relationship between HIL and utilization differences. Ali[14] conducted qualitative interviews with newly insured African American

individuals and found that participant's perceived health insurance and the healthcare system as very complex. Study participants reported confusion around health insurance terms, cost-sharing concepts, where to access plan-covered care, and frustration around unexpected bills. Confusion about insurance and cost of care led to reports of individuals not seeking care when they needed it. Perhaps this helps to illustrate how confusion about HIL and how to use health insurance to access services can lead to increases in unmet need. Despite 100% coverage for services provided in the VCC network, study participants with low HIL were more likely to report unmet need for MH services due to cost in the current study, which may be explained by confusion around program coverage and costs.

Although most study participants accessed PCP services during the primary RCT, participants with high HIL were more likely to navigate systems to access BH treatment in specialty settings.[156] These findings suggest that high HIL helps people navigate healthcare systems to obtain care, even after connecting to primary care services. Notably, individuals with low HIL reported more severe MH symptoms (p=.105), suggesting a greater need for a higher level of behavioral health care. Yet, they were less likely to access BH services in a specialty setting.

Limitations

This study has limitations. Importantly, the data source for these findings utilize data that was collected as a part of a randomized controlled trial.[156,161,162] At study enrollment, participants were exposed to a study coordinator who explained that participants have access to community primary care providers. When the participant had additional questions, study coordinators answered their question or directed them to relevant information. Further, the purpose of the larger randomized controlled trial was to incentivize participants to visit their primary care

doctor through a cash incentive. All participants were exposed to the experiment, and it is possible that the experiment, itself, increased health insurance literacy. To the extent that this is true, results would likely be biased downward, meaning that the magnitude of the influence of HIL on unmet need and utilization outcomes may be larger in other populations. We did include a control variable for incentive group assignment to control for the impact of incentive group assignment.

Further, this study was conducted in a safety net health program, and it is possible that individuals enrolled in this program sought care outside of this health system. However, given that care received in the health system was free, it is likely that participants elected to obtain MH care within the health system.

The population enrolled in the current study was a low-income population with complex health needs. These findings may not be generalizable to healthier populations with higher levels of income.[154] However, low-income is associated with low HIL in prior literature, so limiting the sample to a low-income population limits bias associated with income level.

We also must address issues of potential bias resulting from endogeneity. Prior research has found that locus of control and numeracy, unmeasured variables in the current study, are correlated with HIL.[146,164] Locus of control or numeracy could be omitted variables that are associated with both outcomes of interest and HIL, making the measure of HIL endogenous. Further, we have a measure of prior experience with health insurance, but our measure does not allow us to account for the length of experience with health insurance and level of prior interaction with the health care system. It is possible that a continuous measure of insurance history would unveil that it is the intensity of prior interaction, rather than HIL, that predicts unmet needs and mental health utilization. We addressed this limitation in the model by

controlling for the number of chronic conditions and prior experience with private health insurance. Sensitivity analyses suggest the HIL variable in the model the specialty utilization may be endogenous and biasing estimates upward. Future research could explore this further by incorporating methods designed to address endogeneity, such as instrumental variables or two-stage residual inclusion.[165,166]

Conclusions

These findings provide evidence that HIL may help individuals gain access to needed care. Inversely, low HIL may be a barrier to the receipt of needed BH treatment. Particular attention should be paid to barriers that may be modifiable, such as HIL. Policy makers should consider ways to increase HIL or reduce the complexity of health insurance to aid consumer understanding. Interventions focused on increasing HIL in individuals reported mostly positive results, but at least one reported null findings.[167–170] For example, Kneippi[168] conducted an intervention to increase Medicaid knowledge and skills among women with chronic conditions. Those assigned to the intervention group increased in Medicaid knowledge and skills and were more likely to have a new MH visit. Another intervention, using targeted mailing materials to Medicare enrollees, observed utilization of mammography services.[167] Further, many programs have utilized care coordinators or navigators through hospitals, outpatient clinics, or community health centers to help individuals navigate health systems, including health insurance landscapes.[171] However, the efficacy of those individuals may be limited by the HIL of the navigator providing the service, as they may have low HIL, themselves.[172]

Evidence suggests that access to BH treatment services can improve health outcomes and sometimes reduce the risk of mortality.[8,161,173] Given the prevalence of MH conditions (20%) and SUD (10%), the low rates of treatment (45% and 7%, respectively), and the shocking increase in

suicide rates (35% increase from 1999 to 2018)[1,5] researchers and policy makers should focus on reducing any barriers to BH services. Two potential paths to increasing HIL include (1) insurer-level efforts to increase the clarity and accessibility of health insurance terms/processes and (2) interventions to increase health insurance literacy at the individual level. Addressing these barriers could increase access to care, reduce unmet needs, and improve health outcomes.

Chapter V: Conclusions

Despite increased coverage of BH services through the Affordable Care Act,[9] national trends show little overall change in reported access to BH services. Untreated BH symptoms can result in more severe symptoms, additional diagnoses, or increased mortality risk.[2–5] Low treatment rates and slow growth in treatment trends suggest that other barriers remain.

Workforce supply barriers may limit the full potential of reforms, like Medicaid expansion and CARA, to improve access to behavioral health services. State-level legislation limiting the practice authority of mid-level practitioners may exacerbate workforce shortage problems. Even when workforce supply is adequate and insurance provides behavioral health services coverage individual factors may mitigate demand. Limited understanding of insurance jargon can increase confusion about covered services and providers, resulting in limited-service utilization, particularly for those with little experience accessing healthcare services using insurance. This dissertation used data from three sources and quasi-experimental research methods to explore potential barriers to behavioral health services.

Using nationally representative data, we conducted a quasi-experimental study to examine the impact of Medicaid expansion and MH workforce on MH utilization and self-reported outcomes. We find evidence that the number of MH OP and MH ED visits (conditional on any visit) increase in Medicaid expansion states after expansion. However, similar to other literature, we do not find evidence of greater increases in the number of individuals who access MH services in Medicaid expansion states.[28] Estimates suggest that the current MH workforce can only meet 28% of MH needs.[12] To examine the influence of workforce shortage on access to BH services, we stratified our models by HPSA. We found little difference between counties with MH workforce shortage and areas with adequate supply, except that MH ED visits appear to

be higher in areas with adequate supply. These findings may be limited by the HPSA measure, which relies heavily on psychiatry supply. Further, supply measures do not account for the share of providers that accept Medicaid patients. Researchers and policymakers should explore the mechanisms that may prevent increases in the number of individuals who access MH services in MH expansion states.

The interaction between federal and state policies may impact access to care for those seeking medications for opioid use disorder. We used DEA buprenorphine dispensing data and buprenorphine waivered provider counts merged with multiple other national data sources to determine the impact of buprenorphine dispensing following CARA. Further, we examined whether buprenorphine dispensing increases more in states where NPs have more practice autonomy. We find evidence that buprenorphine dispensing increases after CARA, and that increase is greater in states where NPs are granted more practice autonomy. Policymakers working to address the opioid epidemic in their state should consider whether increasing NP practice autonomy may lead to increased access to medication for OUD, particularly among underserved populations.

Finally, we used data from members enrolled in a safety-net coverage program to examine whether health insurance literacy at baseline hinders subsequent access to BH services and increases reports of unmet MH need 12 months later. We find evidence that low health insurance literacy is associated with an increased probability of reported unmet MH need 12 months later in individuals with mental health symptoms. Further, individuals with low HIL at baseline are less likely to access specialist BH services, but additional testing suggests that the naïve utilization estimates may be biased upwards. Two potential paths to increasing HIL include

(1) insurer-level efforts to increase the clarity and accessibility of health insurance terms/processes and (2) interventions to increase health insurance literacy at the individual level.

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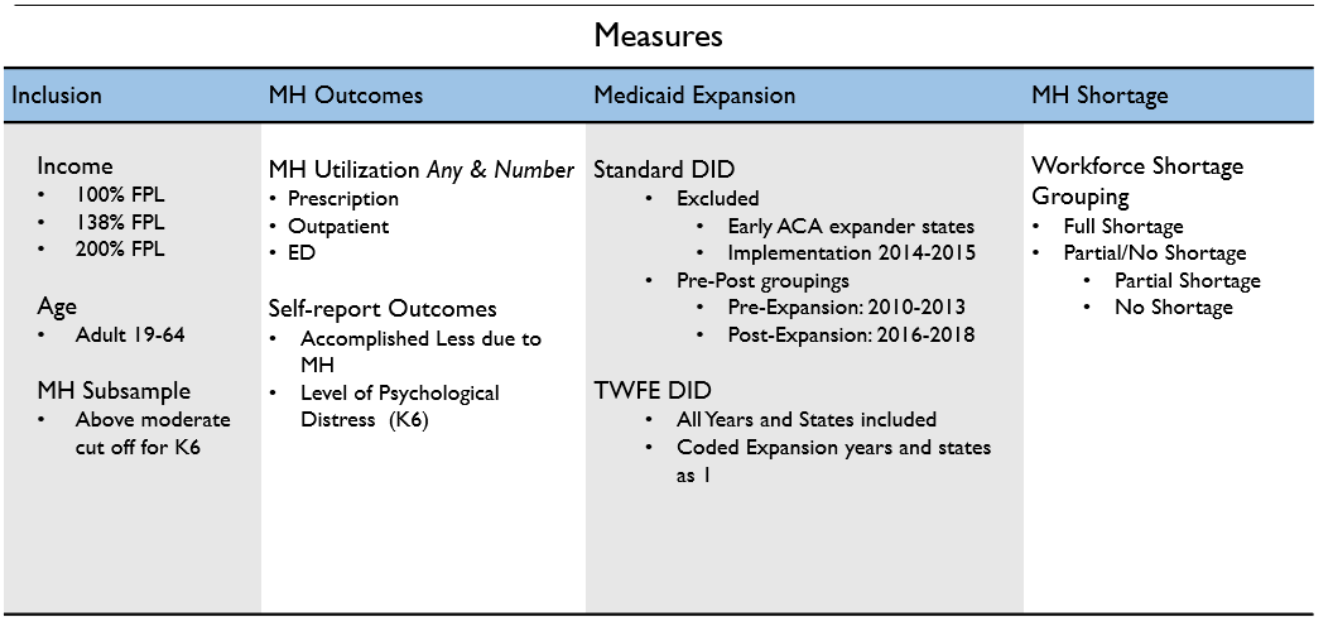
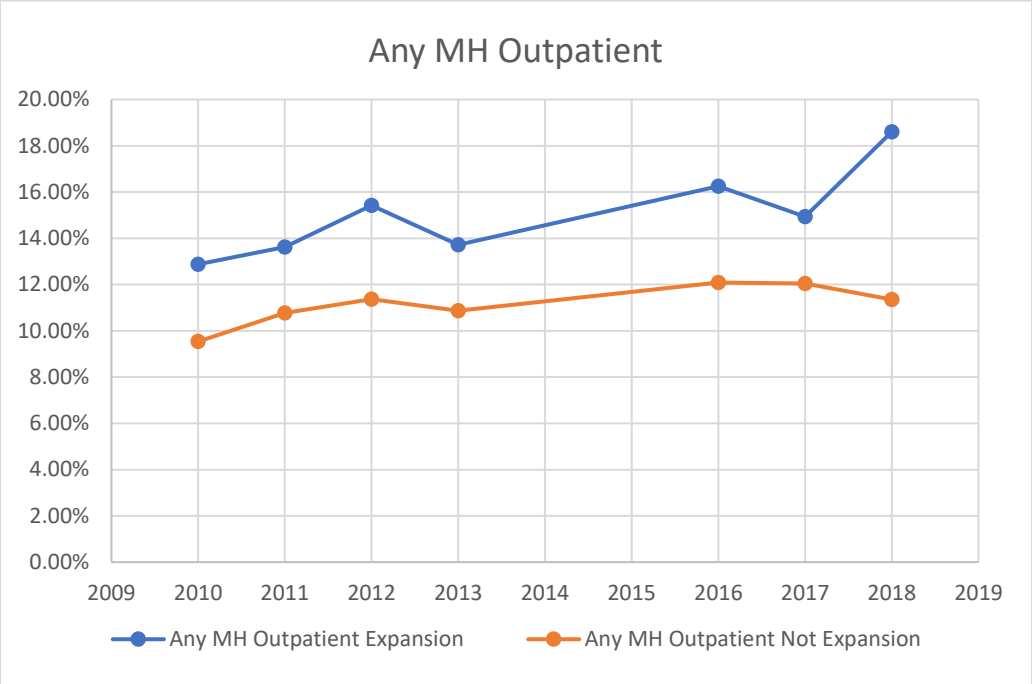
APPENDIX A

Appendix A, Table 1. Summary of Measures, Chapter II

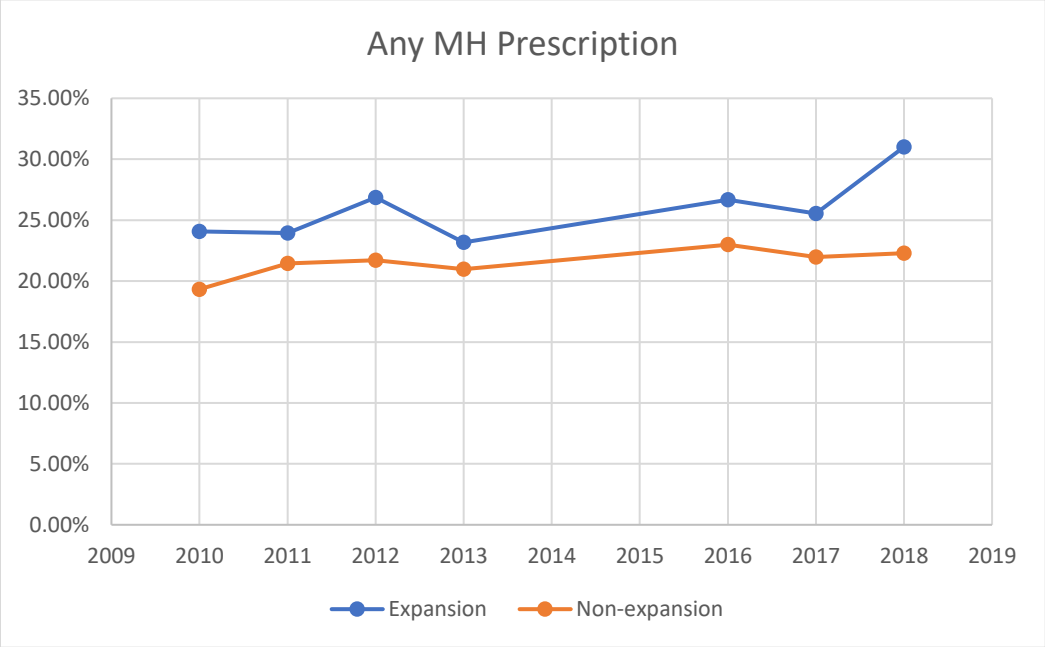
Mental Health (MH) Outcomes (MEPS)	Mental Disorder	Medicaid Expansion	Behavioral Health Workforce	Covariates and Other Measures
Probability of a MH-related office visits # of MH-related office visits Probability of receiving any MH pharmacotherapy Accomplished Less due to emotional problems Level of Psychological Distress	Above cut-off for moderate psychological distress on K-6	Expansion state * Post expansion	HRSA MH shortage area	Race Age Sex Income Educational attainment County-level factors



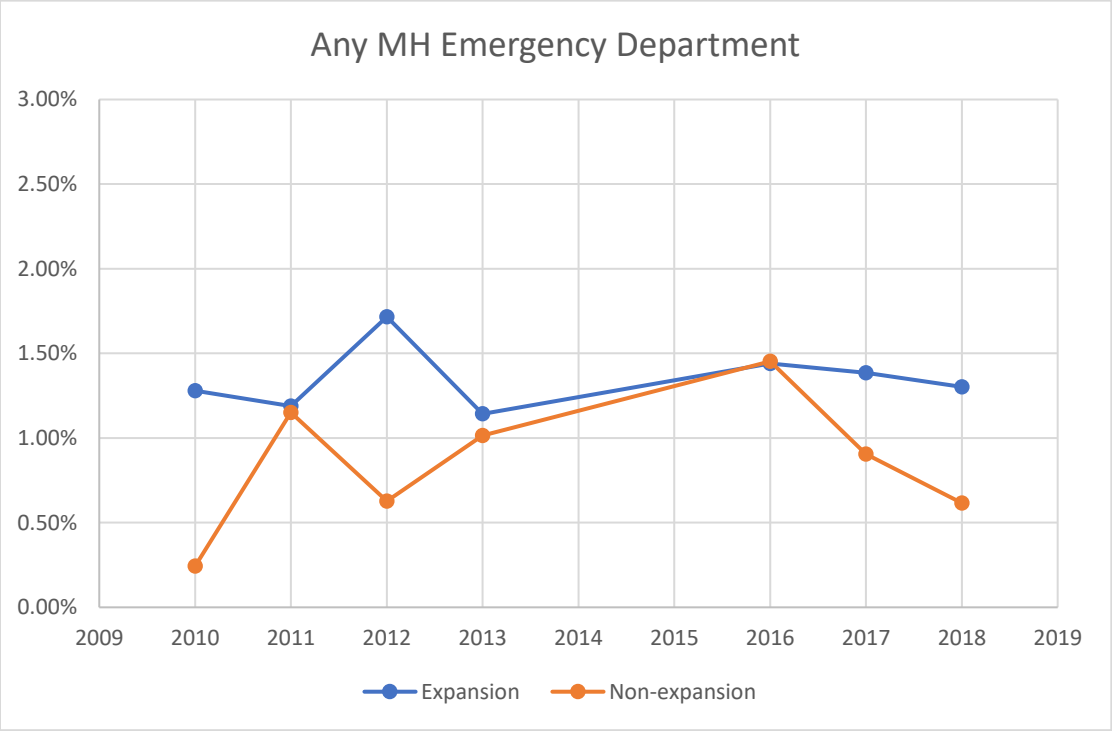
Appendix A. Figure 1. Parallel Trends Assumption, Any MH Outpatient



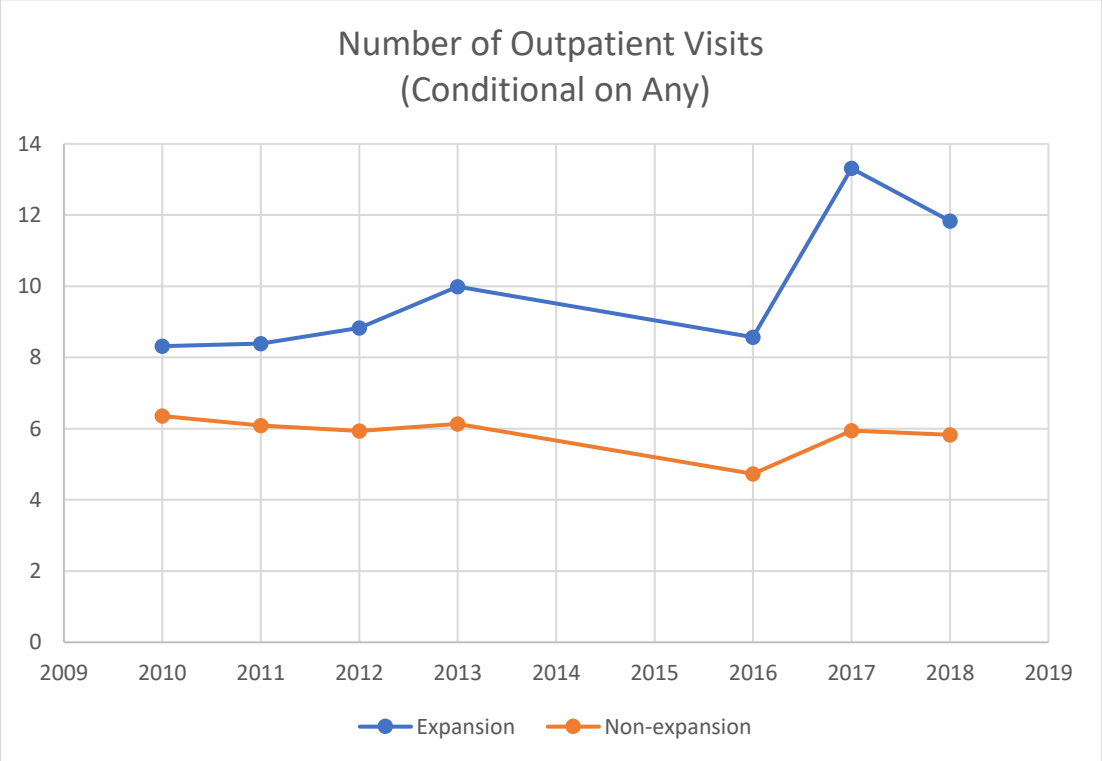
Appendix A. Figure 2. Parallel Trends Assumption, Any MH Prescription



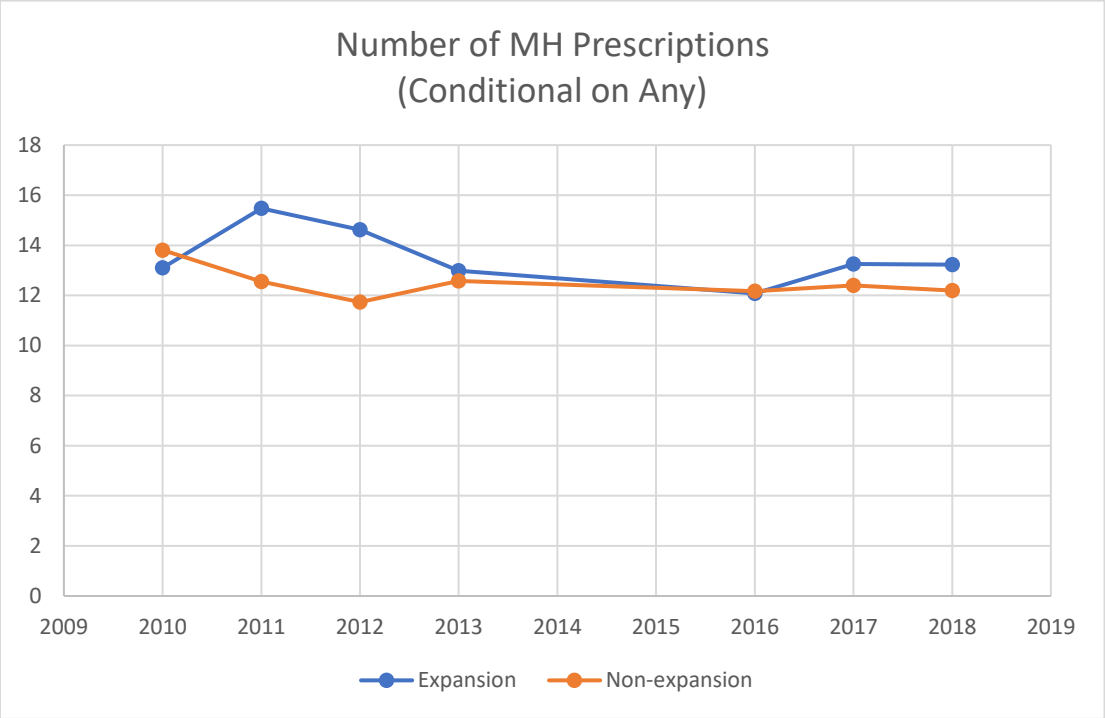
Appendix A. Figure 3. Parallel Trends Assumption, Any MH ED Visit



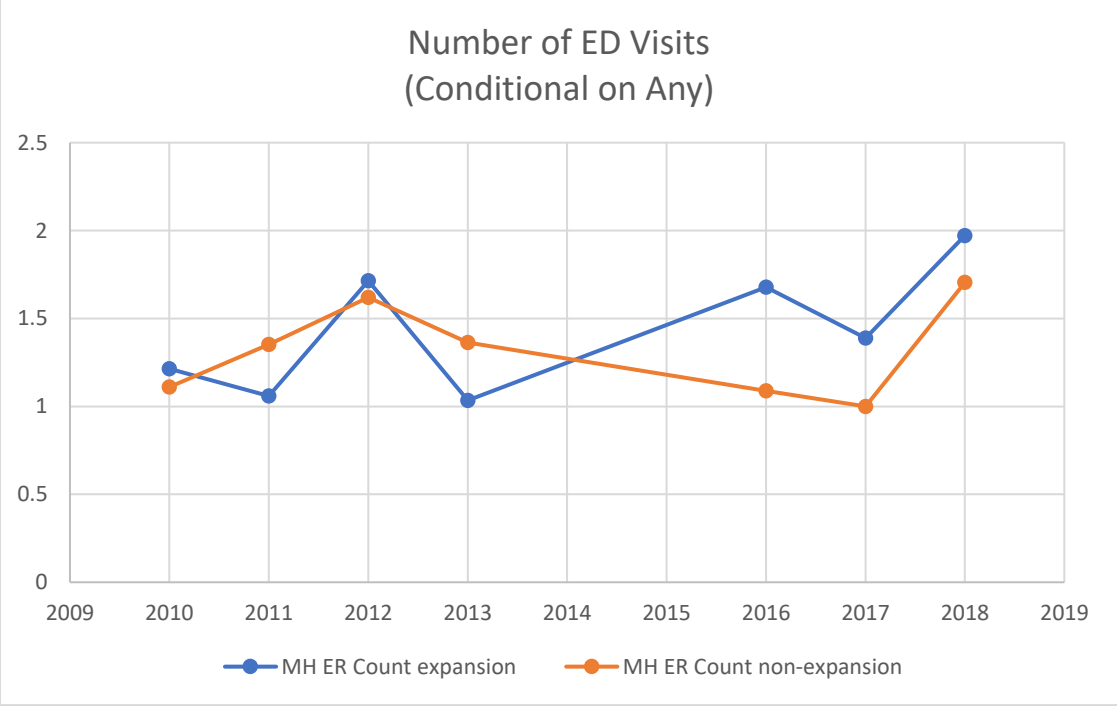
Appendix A. Figure 4. Parallel Trends Assumption, Number of OP MH Visits



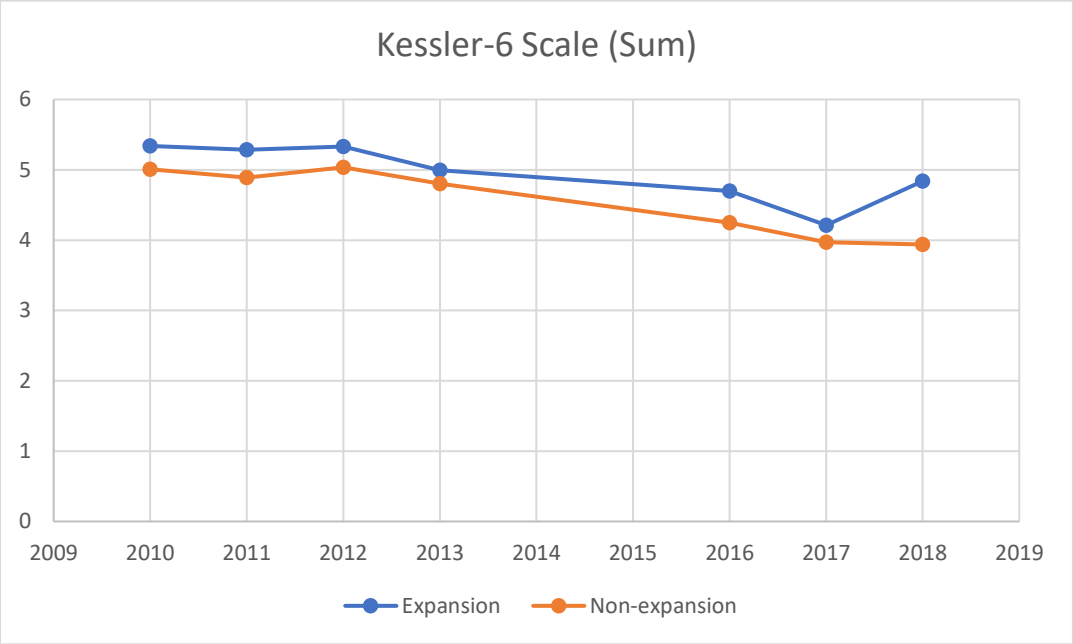
Appendix A. Figure 5. Parallel Trends Assumption, Number of MH Prescriptions



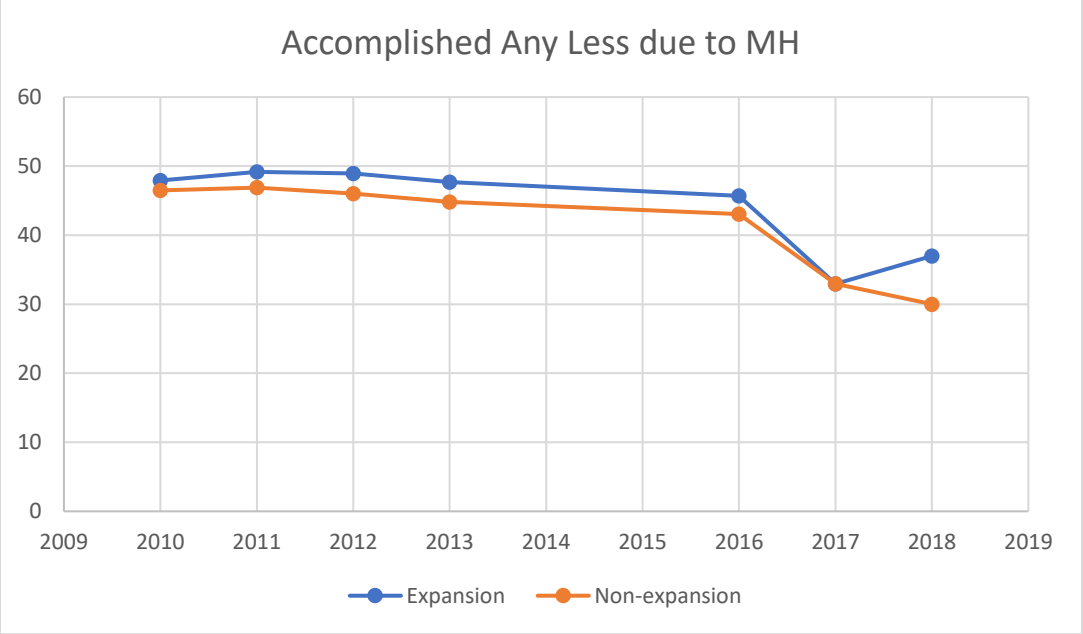
Appendix A. Figure 6. Parallel Trends Assumption, Number of MH ED Visits



Appendix A. Figure 7. Parallel Trends Assumption, Kessler-6 Scale (continuous)



Appendix A. Figure 8. Parallel Trends Assumption, Accomplished less due to MH



Appendix A, Table 2. 2x2 DID estimates for Medicaid Expansion, Full Sample at 100% FPL

	Any Utilization (LPM)			Self-Reported Outcome (LPM)		Number of Visits, Conditional on Any (Poisson, IRR)		
	Any MH related ED	Any MH Outpatient	Any MH Rx	Kessler 6 Scale	Accomplished ANY less due to MH	Rx count	ED count	MH Outpatient count
Expansion						1.734**	0.612*	0.514**
Medicaid expansion State	0.0147	0.00978	-0.0750*	0.450	0.0359	[1.13,2.66]	[0.36,1.05]	[0.30,0.89]
	[-0.02,0.05]	[-0.07,0.09]	[-0.15,0.00]	[-0.38,1.28]	[-0.06,0.13]	0.991	0.788	0.874
Post-ME	0.00538	0.00776	0.0330*	-1.134***	-0.159***	[0.85,1.16]	[0.49,1.26]	[0.64,1.20]
	[-0.00,0.01]	[-0.02,0.04]	[-0.00,0.07]	[-1.66,-0.61]	[-0.20,-0.12]	0.898	1.838***	1.594***
Medicaid expansion State * Post ME	-0.00562	0.00563	0.0113	0.230	0.00370	[0.75,1.08]	[1.30,2.59]	[1.16,2.20]
	[-0.01,0.00]	[-0.02,0.03]	[-0.02,0.05]	[-0.27,0.73]	[-0.04,0.05]			
Age						1.142	0.826	1.137
25-35	0.000922	0.0204**	0.0596***	0.988***	0.0584***	[0.96,1.35]	[0.61,1.11]	[0.81,1.59]
	[-0.00,0.01]	[0.00,0.04]	[0.04,0.08]	[0.67,1.31]	[0.03,0.09]	1.595***	0.933	1.368*
36-50	0.00936***	0.0528***	0.105***	1.558***	0.113***	[1.33,1.91]	[0.69,1.25]	[0.99,1.90]
	[0.00,0.02]	[0.03,0.07]	[0.08,0.13]	[1.23,1.88]	[0.08,0.14]	1.343***	0.930	1.162
51-64	0.000515	0.000558	0.111***	0.723***	0.129***	[1.12,1.61]	[0.63,1.38]	[0.80,1.69]
	[-0.01,0.01]	[-0.02,0.03]	[0.08,0.14]	[0.33,1.11]	[0.09,0.17]			
Gender						1.041	0.857	0.761***
Female	0.00482**	0.0278***	0.0527***	0.396***	0.0458***	[0.95,1.14]	[0.71,1.04]	[0.64,0.91]
	[0.00,0.01]	[0.01,0.04]	[0.04,0.07]	[0.16,0.63]	[0.03,0.06]			
Education (ref=less than HS)						0.981	0.736**	1.174
High School	-0.00298	0.0122	0.00403	-0.234	-0.0404***	[0.89,1.08]	[0.58,0.94]	[0.93,1.49]
	[-0.01,0.00]	[-0.01,0.03]	[-0.02,0.03]	[-0.56,0.09]	[-0.06,-0.02]	0.982	0.802*	1.303**
More than HS	-0.00279	0.0138	0.0233*	-0.547***	-0.0454***	[0.87,1.10]	[0.64,1.01]	[1.01,1.67]
	[-0.01,0.00]	[-0.01,0.03]	[-0.00,0.05]	[-0.90,-0.20]	[-0.07,-0.02]	0.997	1.428*	1.481
Other/unknown	-0.00174	0.00987	-0.00803	-0.517*	-0.0621**	[0.85,1.17]	[0.99,2.07]	[0.88,2.48]
	[-0.01,0.01]	[-0.02,0.04]	[-0.05,0.03]	[-1.09,0.05]	[-0.11,-0.01]			
Chronic Conditions						1.242***	1.192	1.222
1-2	0.00508**	0.0778***	0.131***	1.777***	0.164***	[1.09,1.42]	[0.95,1.50]	[0.96,1.56]
	[0.00,0.01]	[0.06,0.10]	[0.11,0.15]	[1.53,2.03]	[0.14,0.19]	1.536***	1.144	1.257
3+	0.00893**	0.181***	0.351***	4.370***	0.342***	[1.34,1.76]	[0.91,1.44]	[0.93,1.70]
	[0.00,0.02]	[0.15,0.21]	[0.32,0.38]	[3.93,4.81]	[0.31,0.37]			
Race/Ethnicity						0.769***	1.310	0.687***

Hispanic	-0.00447*	-0.0816***	-0.119***	-1.203***	-0.0393***	[0.67,0.88]	[0.85,2.01]	[0.54,0.88]
	[-0.01,0.00]	[-0.10,-0.06]	[-0.14,-0.10]	[-1.57,-0.83]	[-0.07,-0.01]	0.713***	0.825	1.166
Black/African American	-0.00398*	-0.100***	-0.143***	-1.133***	-0.0632***	[0.65,0.79]	[0.63,1.09]	[0.91,1.49]
	[-0.01,0.00]	[-0.12,-0.08]	[-0.17,-0.12]	[-1.43,-0.83]	[-0.09,-0.04]	1	1	1
Alaskan/Native American	0.00120	-0.00649	-0.0298	-0.129	-0.0577	[1.00,1.00]	[1.00,1.00]	[1.00,1.00]
	[-0.01,0.02]	[-0.06,0.05]	[-0.09,0.03]	[-1.51,1.26]	[-0.16,0.04]	1.208	0.841	0.689**
Asian	-0.00192	-0.0761***	-0.123***	-0.869***	-0.0329	[0.94,1.55]	[0.39,1.83]	[0.50,0.96]
	[-0.01,0.01]	[-0.11,-0.04]	[-0.17,-0.07]	[-1.50,-0.24]	[-0.09,0.03]	0.552***	1.892**	1.683
Multiple/Other	0.00818	0.0284	0.0251	0.993**	0.0759**	[0.37,0.82]	[1.09,3.28]	[0.84,3.36]
	[-0.01,0.03]	[-0.02,0.08]	[-0.03,0.08]	[0.20,1.79]	[0.01,0.14]	0.841	0.652***	1.503**
Married	-0.0108***	-0.0700***	-0.0796***	-1.481***	-0.108***	[0.68,1.04]	[0.48,0.89]	[1.04,2.16]
	[-0.01,-0.01]	[-0.09,-0.05]	[-0.10,-0.06]	[-1.76,-1.20]	[-0.13,-0.08]	0.799***	0.772	0.759***
Percent of FPL	0.0000867	0.000447	0.000314	0.0176	0.00234**	[0.72,0.88]	[0.51,1.16]	[0.63,0.92]
	[-0.00,0.00]	[-0.00,0.00]	[-0.00,0.00]	[-0.01,0.04]	[0.00,0.00]	1.003	0.969***	0.994
Psychiatrists/100k	-0.000179**	0.000485	0.000252	-0.00526	-0.000152	[1.00,1.01]	[0.95,0.99]	[0.97,1.02]
	[-0.00,-0.00]	[-0.00,0.00]	[-0.00,0.00]	[-0.01,0.00]	[-0.00,0.00]			
Year						0.997	0.864	0.820
2011	0.00497	0.00418	-0.000451	-0.142	-0.00776	[0.90,1.11]	[0.58,1.29]	[0.64,1.05]
	[-0.00,0.01]	[-0.02,0.03]	[-0.03,0.02]	[-0.46,0.17]	[-0.04,0.02]	0.929	1.547**	0.842
2012	0.00447	0.0169	0.0223	-0.119	-0.00572	[0.82,1.05]	[1.04,2.30]	[0.64,1.11]
	[-0.00,0.01]	[-0.01,0.04]	[-0.00,0.05]	[-0.48,0.24]	[-0.04,0.03]	0.850**	1.073	1.077
2013	0.00263	0.00314	-0.00362	-0.439**	-0.0214	[0.73,0.99]	[0.81,1.42]	[0.79,1.46]
	[-0.00,0.01]	[-0.02,0.03]	[-0.03,0.02]	[-0.84,-0.04]	[-0.05,0.01]	-	-	-
2014	0.00456	0.00157	-0.0288*	0.0192	0.101***			
	[-0.00,0.01]	[-0.02,0.03]	[-0.06,0.00]	[-0.48,0.52]	[0.06,0.14]	0.927	1.106	0.832
2015	-0.000538	-0.00614	-0.0477***	-0.399*	-0.0108	[0.82,1.05]	[0.77,1.58]	[0.66,1.05]
	[-0.01,0.01]	[-0.03,0.02]	[-0.07,-0.02]	[-0.83,0.04]	[-0.05,0.02]	1.028	0.915	1.155
2016	0	0	0	0	0	[0.92,1.15]	[0.65,1.29]	[0.80,1.67]
	[0.00,0.00]	[0.00,0.00]	[0.00,0.00]	[0.00,0.00]	[0.00,0.00]	1.028	0.915	1.155
2017	0.00445	0.0768**	0.129***	4.880***	0.344***	[0.92,1.15]	[0.65,1.29]	[0.80,1.67]
	[-0.01,0.02]	[0.00,0.15]	[0.06,0.20]	[3.93,5.83]	[0.25,0.43]	1	1	1
2018	0.00497	0.00418	-0.000451	-0.142	-0.00776	[1.00,1.00]	[1.00,1.00]	[1.00,1.00]
	[-0.00,0.01]	[-0.02,0.03]	[-0.03,0.02]	[-0.46,0.17]	[-0.04,0.02]	-	-	-
Constant	0.00447	0.0169	0.0223	-0.119	-0.00572			
	[-0.00,0.01]	[-0.01,0.04]	[-0.00,0.05]	[-0.48,0.24]	[-0.04,0.03]			
Observations	304873	304873	304873	301761	302743	283117	157885	273626

95% confidence intervals in brackets* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix A. Table 3. 2x2 DID estimates for Medicaid Expansion, Full Sample at 138% FPL

	Any Utilization (LPM)			Self-Reported Outcome (LPM)		Number of Visits, Conditional on Any (Poisson, IRR)		
	Any MH related ED	Any MH Outpatient	Any MH Rx	Kessler 6 Scale	Accomplished ANY less due to MH	Rx count	ED count	MH Outpatient count
Expansion								
Medicaid expansion State	0.00527	0.0298	-0.0231	0.774	0.0377	1.659***	0.914	0.612***
	[-0.03,0.04]	[-0.04,0.10]	[-0.11,0.07]	[-0.30,1.85]	[-0.09,0.17]	[1.19,2.30]	[0.69,1.22]	[0.44,0.85]
Post-ME	0.00174	0.0262**	0.0350***	-0.991***	-0.154***	0.979	0.969	0.903
	[-0.00,0.01]	[0.00,0.05]	[0.01,0.06]	[-1.41,-0.58]	[-0.19,-0.12]	[0.85,1.13]	[0.66,1.42]	[0.68,1.19]
Medicaid expansion State * Post ME	-0.00183	0.0102	0.00953	0.124	0.00412	0.947	1.552***	1.410**
	[-0.01,0.00]	[-0.01,0.03]	[-0.02,0.04]	[-0.26,0.51]	[-0.03,0.04]	[0.81,1.11]	[1.18,2.04]	[1.04,1.92]
Age								
25-35	0.000513	0.0174**	0.0532***	0.806***	0.0544***	1.188**	0.894	1.097
	[-0.00,0.00]	[0.00,0.03]	[0.03,0.07]	[0.55,1.07]	[0.03,0.08]	[1.02,1.38]	[0.70,1.14]	[0.82,1.46]
36-50	0.00707***	0.0393***	0.0908***	1.184***	0.100***	1.532***	0.985	1.296*
	[0.00,0.01]	[0.02,0.06]	[0.07,0.11]	[0.91,1.45]	[0.08,0.12]	[1.32,1.78]	[0.75,1.30]	[0.99,1.70]
51-64	0.0000555	-0.00641	0.0941***	0.458***	0.121***	1.318***	0.994	1.127
	[-0.01,0.01]	[-0.03,0.01]	[0.07,0.12]	[0.14,0.78]	[0.09,0.15]	[1.13,1.54]	[0.68,1.46]	[0.81,1.57]
Gender								
Female	0.00476***	0.0296***	0.0588***	0.470***	0.0544***	1.033	0.852*	0.727***
	[0.00,0.01]	[0.02,0.04]	[0.05,0.07]	[0.28,0.66]	[0.04,0.07]	[0.96,1.12]	[0.71,1.02]	[0.61,0.86]
Education (ref=less than HS)								
High School	-0.00150	0.00708	-0.000531	-0.248*	-0.0383***	1.001	0.758**	1.087
	[-0.01,0.00]	[-0.01,0.02]	[-0.02,0.02]	[-0.53,0.03]	[-0.06,-0.02]	[0.91,1.10]	[0.60,0.96]	[0.87,1.36]
More than HS	-0.00256	0.0131	0.0143	-0.559***	-0.0518***	0.984	0.815*	1.169
	[-0.01,0.00]	[-0.01,0.03]	[-0.01,0.04]	[-0.86,-0.26]	[-0.08,-0.03]	[0.89,1.09]	[0.66,1.01]	[0.92,1.49]
Other/unknown	-0.00116	0.0123	0.00921	-0.598***	-0.0577***	0.986	1.180	1.263
	[-0.01,0.01]	[-0.02,0.04]	[-0.02,0.04]	[-1.05,-0.15]	[-0.10,-0.02]	[0.86,1.13]	[0.83,1.68]	[0.78,2.05]
Chronic Conditions								
1-2	0.00462**	0.0718***	0.122***	1.714***	0.153***	1.245***	1.080	1.220*
	[0.00,0.01]	[0.06,0.09]	[0.10,0.14]	[1.51,1.91]	[0.13,0.17]	[1.11,1.40]	[0.89,1.31]	[0.98,1.53]
3+	0.00942***	0.180***	0.349***	4.460***	0.347***	1.561***	1.050	1.309**
	[0.00,0.02]	[0.16,0.20]	[0.32,0.37]	[4.09,4.83]	[0.32,0.37]	[1.39,1.75]	[0.87,1.27]	[1.01,1.70]
Race/Ethnicity								
Hispanic	-0.00231	-0.0701***	-0.118***	-1.126***	-0.0370***	0.846***	1.181	0.715***
	[-0.01,0.00]	[-0.09,-0.05]	[-0.14,-0.10]	[-1.44,-0.81]	[-0.06,-0.01]	[0.75,0.96]	[0.80,1.75]	[0.57,0.89]

Black/African American	-0.00331*	-0.0967***	-0.140***	-1.146***	-0.0678***	0.715***	0.801**	1.180
	[-0.01,0.00]	[-0.11,-0.08]	[-0.16,-0.12]	[-1.40,-0.89]	[-0.09,-0.05]	[0.66,0.78]	[0.66,0.97]	[0.96,1.46]
Alaskan/Native American	-0.0000406	-0.000441	-0.0300	-0.230	-0.0420	1.104	0.872	0.809
	[-0.01,0.01]	[-0.03,0.03]	[-0.08,0.02]	[-1.25,0.79]	[-0.12,0.04]	[0.88,1.39]	[0.42,1.82]	[0.57,1.14]
Asian	-0.00263	-0.0759***	-0.126***	-0.915***	-0.0529**	0.566***	1.759***	1.541
	[-0.01,0.00]	[-0.10,-0.05]	[-0.16,-0.09]	[-1.45,-0.38]	[-0.10,-0.01]	[0.39,0.82]	[1.15,2.69]	[0.83,2.86]
Multiple/Other	0.00769	0.0209	0.0132	1.119***	0.0973***	0.907	0.686***	1.458**
	[-0.01,0.02]	[-0.02,0.07]	[-0.04,0.06]	[0.36,1.88]	[0.04,0.15]	[0.75,1.09]	[0.55,0.85]	[1.03,2.07]
Married	0	0	0	0	0	1	1	1
	[0.00,0.00]	[0.00,0.00]	[0.00,0.00]	[0.00,0.00]	[0.00,0.00]	[1.00,1.00]	[1.00,1.00]	[1.00,1.00]
Percent FPL	-0.00887***	-0.0672***	-0.0763***	-1.376***	-0.0951***	0.782***	0.706**	0.784***
	[-0.01,-0.01]	[-0.08,-0.05]	[-0.09,-0.06]	[-1.61,-1.14]	[-0.11,-0.08]	[0.72,0.85]	[0.52,0.96]	[0.66,0.93]
Psychiatry 100k	-0.00000680	0.000184	0.0000238	0.0178	0.00174**	1.004	0.977***	0.991
	[-0.00,0.00]	[-0.00,0.00]	[-0.00,0.00]	[-0.00,0.04]	[0.00,0.00]	[1.00,1.01]	[0.96,0.99]	[0.97,1.01]
Year								
2011	0.00444	0.0107	0.0126	-0.0528	0.00945	1.019	0.863	0.888
	[-0.00,0.01]	[-0.01,0.03]	[-0.01,0.03]	[-0.33,0.22]	[-0.02,0.04]	[0.92,1.13]	[0.63,1.18]	[0.70,1.13]
2012	0.00386	0.0227**	0.0279**	0.0778	0.00530	0.963	1.578***	0.917
	[-0.00,0.01]	[0.00,0.04]	[0.01,0.05]	[-0.25,0.40]	[-0.02,0.03]	[0.87,1.07]	[1.12,2.22]	[0.70,1.20]
2013	0.00317	0.0102	0.00424	-0.278	-0.0153	0.932	1.072	1.121
	[-0.00,0.01]	[-0.01,0.03]	[-0.02,0.03]	[-0.62,0.06]	[-0.04,0.01]	[0.82,1.06]	[0.86,1.34]	[0.87,1.44]
2016	0.00542*	-0.00639	-0.0190	0.0545	0.108***	0.938	0.966	0.849
	[-0.00,0.01]	[-0.03,0.01]	[-0.04,0.00]	[-0.33,0.44]	[0.07,0.14]	[0.84,1.04]	[0.72,1.29]	[0.69,1.05]
2017	0.00275	-0.0130	-0.0276**	-0.247	-0.00281	1.021	0.833	1.090
	[-0.00,0.01]	[-0.03,0.01]	[-0.05,-0.01]	[-0.59,0.10]	[-0.03,0.03]	[0.93,1.12]	[0.63,1.10]	[0.82,1.45]
2018	0	0	0	0	0	1	1	1
	[0.00,0.00]	[0.00,0.00]	[0.00,0.00]	[0.00,0.00]	[0.00,0.00]	[1.00,1.00]	[1.00,1.00]	[1.00,1.00]
Constant	0.0131	0.0708**	0.117***	4.387***	0.325***	-	-	-
	[-0.01,0.03]	[0.01,0.13]	[0.06,0.17]	[3.45,5.32]	[0.23,0.42]			
Observations	307704	307704	307704	303366	304153	278266	169916	271557

95% confidence intervals in brackets

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix Table 4. 2x2 DID estimates for Medicaid Expansion, Full Sample at 200% FPL

	Any Utilization (LPM)			Self-Reported Outcome (LPM)		Number of Visits, Conditional on Any (Poisson, IRR)		
	Any MH related ED	Any MH Outpatient	Any MH Rx	Kessler 6 Scale	Accomplished ANY less due to MH	Rx count	ED count	MH Outpatient count
Expansion								
Medicaid expansion	0.00681	0.0269	-0.0221	0.795	0.0634	1.392*	0.924	0.607***
	[-0.02,0.04]	[-0.03,0.09]	[-0.10,0.06]	[-0.31,1.90]	[-0.02,0.15]	[0.96,2.03]	[0.71,1.21]	[0.45,0.81]
Post-ME	0.000722	0.00833	0.0291**	-1.031***	-0.149***	0.985	0.914	0.880
	[-0.00,0.01]	[-0.01,0.03]	[0.01,0.05]	[-1.36,-0.70]	[-0.18,-0.12]	[0.85,1.13]	[0.68,1.24]	[0.69,1.13]
Medicaid expansion	-0.00109	0.0133	-0.00469	0.0941	0.00138	0.979	1.599***	1.470***
	[-0.01,0.00]	[-0.01,0.03]	[-0.03,0.02]	[-0.23,0.42]	[-0.03,0.03]	[0.85,1.13]	[1.27,2.01]	[1.11,1.95]
Age								
25-35	0.00175	0.0212***	0.0594***	0.636***	0.0450***	1.233***	0.936	1.160
	[-0.00,0.01]	[0.01,0.03]	[0.04,0.08]	[0.42,0.85]	[0.02,0.07]	[1.08,1.41]	[0.76,1.14]	[0.91,1.49]
36-50	0.00451**	0.0304***	0.0902***	0.798***	0.0745***	1.506***	1.037	1.324**
	[0.00,0.01]	[0.02,0.04]	[0.07,0.11]	[0.57,1.03]	[0.05,0.10]	[1.31,1.73]	[0.82,1.31]	[1.04,1.68]
51-64	-0.00108	-0.00202	0.0913***	0.250*	0.0948***	1.333***	1.014	1.169
	[-0.01,0.00]	[-0.02,0.01]	[0.07,0.11]	[-0.02,0.52]	[0.07,0.12]	[1.16,1.54]	[0.75,1.38]	[0.87,1.58]
Female	0.00439***	0.0340***	0.0714***	0.542***	0.0636***	1.004	0.868*	0.791***
	[0.00,0.01]	[0.02,0.04]	[0.06,0.08]	[0.39,0.69]	[0.05,0.08]	[0.94,1.07]	[0.74,1.01]	[0.67,0.93]
Education (ref=less than HS)								
High School	-0.00151	-0.000669	-0.00381	-0.258**	-0.0428***	1.012	0.740**	1.126
	[-0.00,0.00]	[-0.01,0.01]	[-0.02,0.01]	[-0.48,-0.03]	[-0.06,-0.03]	[0.93,1.10]	[0.59,0.93]	[0.91,1.39]
More than HS	-0.00260	0.0112	0.00950	-0.608***	-0.0554***	0.992	0.796**	1.213*
	[-0.01,0.00]	[-0.00,0.03]	[-0.01,0.03]	[-0.86,-0.35]	[-0.08,-0.03]	[0.91,1.08]	[0.66,0.97]	[0.98,1.50]
Other/unknown	-0.000311	0.0139	0.00913	-0.619***	-0.0519***	0.990	1.174	1.246
	[-0.01,0.01]	[-0.01,0.04]	[-0.02,0.04]	[-0.96,-0.28]	[-0.08,-0.02]	[0.88,1.12]	[0.89,1.55]	[0.84,1.86]
Chronic Conditions								

1-2	0.00482***	0.0615***	0.113***	1.569***	0.138***	1.271***	1.013	1.205*
	[0.00,0.01]	[0.05,0.07]	[0.10,0.13]	[1.42,1.72]	[0.12,0.15]	[1.16,1.39]	[0.85,1.21]	[0.99,1.46]
3+	0.0101***	0.166***	0.334***	4.409***	0.339***	1.625***	1.065	1.383***
	[0.01,0.02]	[0.15,0.19]	[0.31,0.36]	[4.12,4.70]	[0.32,0.36]	[1.47,1.79]	[0.90,1.26]	[1.10,1.74]
Race/Ethnicity								
Hispanic	-0.000837	-0.0683***	-0.116***	-1.097***	-0.0433***	0.866**	1.077	0.822*
	[-0.00,0.00]	[-0.08,-0.06]	[-0.13,-0.10]	[-1.33,-0.86]	[-0.06,-0.02]	[0.78,0.97]	[0.78,1.49]	[0.67,1.01]
Black/African American	-0.00145	-0.0890***	-0.138***	-1.059***	-0.0672***	0.740***	0.869*	1.196*
	[-0.00,0.00]	[-0.10,-0.08]	[-0.15,-0.12]	[-1.27,-0.85]	[-0.08,-0.05]	[0.69,0.80]	[0.75,1.00]	[0.98,1.46]
Alaskan/Native	-0.00199	-0.00481	-0.0355*	-0.164	-0.0242	1.151	0.904	0.900
	[-0.01,0.01]	[-0.04,0.03]	[-0.07,0.00]	[-0.92,0.59]	[-0.09,0.04]	[0.92,1.44]	[0.47,1.76]	[0.67,1.22]
Asian	-0.00270	-0.0735***	-0.134***	-0.846***	-0.0399**	0.599***	1.778**	1.456
	[-0.01,0.00]	[-0.09,-0.05]	[-0.16,-0.11]	[-1.25,-0.44]	[-0.08,-0.00]	[0.44,0.81]	[1.08,2.92]	[0.79,2.69]
Multiple/Other	0.00984	0.0215	0.00235	0.839***	0.0667***	0.989	0.757***	1.385**
	[-0.00,0.02]	[-0.01,0.06]	[-0.04,0.04]	[0.27,1.41]	[0.02,0.11]	[0.84,1.16]	[0.64,0.90]	[1.05,1.83]
Married	-0.00717***	-0.0656***	-0.0668***	-1.188***	-0.0917***	0.743***	0.852	0.766***
	[-0.01,-0.00]	[-0.08,-0.05]	[-0.08,-0.05]	[-1.39,-0.99]	[-0.11,-0.08]	[0.69,0.80]	[0.68,1.07]	[0.66,0.89]
Percent FPL	0.0000379	0.000168	-0.000226	0.0194**	0.00173***	1.007**	0.980***	0.994
	[-0.00,0.00]	[-0.00,0.00]	[-0.00,0.00]	[0.00,0.04]	[0.00,0.00]	[1.00,1.01]	[0.97,0.99]	[0.98,1.01]
Psychiatrists/100,000	-0.0000554	0.000437*	0.000142	0.00239	0.000478	1.000	0.998	1.008***
	[-0.00,0.00]	[-0.00,0.00]	[-0.00,0.00]	[-0.00,0.01]	[-0.00,0.00]	[1.00,1.00]	[0.99,1.01]	[1.00,1.01]
Year								
2011	0.00126	-0.00411	0.0110	-0.0855	-0.00445	1.010	0.808	0.914
	[-0.00,0.01]	[-0.02,0.01]	[-0.01,0.03]	[-0.32,0.15]	[-0.03,0.02]	[0.93,1.10]	[0.59,1.12]	[0.74,1.12]
2012	0.00210	0.00507	0.00867	-0.102	-0.0118	0.970	1.283**	0.913
	[-0.00,0.01]	[-0.01,0.02]	[-0.01,0.03]	[-0.39,0.19]	[-0.04,0.01]	[0.88,1.07]	[1.01,1.63]	[0.73,1.15]
2013	0.00146	-0.00329	-0.00152	-0.364**	-0.0302**	0.952	0.998	1.073
	[-0.00,0.01]	[-0.02,0.01]	[-0.02,0.02]	[-0.65,-0.08]	[-0.06,-0.00]	[0.85,1.07]	[0.84,1.19]	[0.86,1.34]
2016	0.00428*	-0.00629	-0.0233**	0.0759	0.0859***	0.945	0.928	0.885
	[-0.00,0.01]	[-0.02,0.01]	[-0.04,-0.00]	[-0.23,0.38]	[0.06,0.11]	[0.86,1.04]	[0.72,1.19]	[0.74,1.06]

2017	0.00360	-0.00829	-0.0225**	-0.211	-0.00808	1.000	0.796*	1.086
	[-0.00,0.01]	[-0.02,0.01]	[-0.04,-0.00]	[-0.47,0.04]	[-0.03,0.02]	[0.92,1.09]	[0.62,1.03]	[0.86,1.36]
2018	0	0	0	0	0	1	1	1
	[0.00,0.00]	[0.00,0.00]	[0.00,0.00]	[0.00,0.00]	[0.00,0.00]	[1.00,1.00]	[1.00,1.00]	[1.00,1.00]
Constant	0.00770	0.0823***	0.110***	3.860***	0.297***			
	[-0.01,0.02]	[0.03,0.14]	[0.05,0.17]	[2.99,4.73]	[0.23,0.36]			
Observations	309142	309142	309142	303803	304876	271873	177492	263433

95% confidence intervals in brackets
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix A. Table 5. Mental Health Subsample, 2x2 DID estimates for Medicaid Expansion, Full Sample at 100% FPL

	Any Utilization (LPM)			Self-Reported Outcome (LPM)		Number of Visits, Conditional on Any (Poisson, IRR)		
	Any MH related ED	Any MH Outpatient	Any MH Rx	Kessler 6 Scale	Accomplished ANY less due to MH	Rx count	ED count	MH Outpatient count
Expansion								
Medicaid expansion State	0.0263	0.0573	-0.00712	0.667	0.0370	1.710**	0.348**	0.577*
	[-0.04,0.09]	[-0.09,0.21]	[-0.11,0.10]	[-0.68,2.01]	[-0.01,0.09]	[1.13,2.59]	[0.15,0.78]	[0.31,1.06]
Post-ME	0.0213**	0.0397	0.0975***	-0.734**	-0.104***	1.061	0.874	0.855
	[0.00,0.04]	[-0.02,0.10]	[0.04,0.16]	[-1.38,-0.08]	[-0.16,-0.05]	[0.88,1.28]	[0.52,1.47]	[0.61,1.20]
Medicaid expansion State * Post ME	-0.00721	0.0171	0.00632	0.583*	0.0195	0.888	2.139***	1.667***
	[-0.03,0.02]	[-0.04,0.08]	[-0.06,0.07]	[-0.09,1.26]	[-0.04,0.08]	[0.73,1.09]	[1.31,3.50]	[1.22,2.27]
Age								
25-35	-0.00661	0.00925	0.0827***	1.088***	0.0496**	1.056	0.819	1.121
	[-0.02,0.01]	[-0.04,0.06]	[0.03,0.14]	[0.61,1.56]	[0.01,0.09]	[0.83,1.34]	[0.57,1.17]	[0.80,1.57]
36-50	0.0117	0.0727***	0.148***	1.667***	0.108***	1.511***	0.797	1.159
	[-0.01,0.03]	[0.03,0.12]	[0.10,0.20]	[1.22,2.12]	[0.06,0.15]	[1.21,1.89]	[0.55,1.15]	[0.83,1.61]
51-64	0.00107	-0.00763	0.179***	1.207***	0.150***	1.349**	0.952	0.965
	[-0.02,0.02]	[-0.06,0.05]	[0.13,0.23]	[0.72,1.69]	[0.10,0.20]	[1.07,1.71]	[0.62,1.47]	[0.70,1.33]
Female	0.00872*	0.0356**	0.0645***	0.286	0.0516***	1.031	0.920	0.803**
	[-0.00,0.02]	[0.01,0.07]	[0.03,0.10]	[-0.07,0.64]	[0.03,0.08]	[0.93,1.14]	[0.78,1.09]	[0.68,0.95]
Education (ref=less than HS)								
High School	-0.00557	0.0457***	0.0354*	-0.174	-0.0193	0.994	0.662**	1.321***
	[-0.02,0.01]	[0.01,0.08]	[-0.00,0.07]	[-0.51,0.16]	[-0.05,0.01]	[0.90,1.10]	[0.44,0.99]	[1.08,1.62]
More than HS	-0.00162	0.0333	0.0580**	-0.742***	-0.00666	1.038	0.691**	1.470***
	[-0.02,0.01]	[-0.01,0.07]	[0.01,0.10]	[-1.17,-0.31]	[-0.04,0.03]	[0.89,1.20]	[0.52,0.93]	[1.16,1.86]
Other/unknown	0.00434	0.0422	0.00142	-0.681	-0.0309	1.068	1.554**	1.424*
	[-0.02,0.03]	[-0.03,0.11]	[-0.07,0.07]	[-1.50,0.14]	[-0.10,0.03]	[0.90,1.27]	[1.08,2.23]	[0.97,2.09]
Chronic Conditions								
1-2	-0.00118	0.106***	0.171***	0.846***	0.0831***	1.172	1.324	1.183
	[-0.01,0.01]	[0.07,0.15]	[0.13,0.22]	[0.47,1.22]	[0.04,0.12]	[0.97,1.42]	[0.94,1.86]	[0.94,1.49]
3+	-0.00238	0.187***	0.335***	2.097***	0.145***	1.413***	1.143	1.362**
	[-0.02,0.01]	[0.14,0.23]	[0.29,0.38]	[1.61,2.58]	[0.11,0.19]	[1.18,1.69]	[0.84,1.55]	[1.05,1.77]
Race/Ethnicity								
Hispanic	-0.00821	-0.107***	-0.126***	-0.700***	-0.0150	0.810***	1.279	0.747**

	[-0.02,0.00]	[-0.15,-0.07]	[-0.17,-0.08]	[-1.19,-0.21]	[-0.05,0.02]	[0.70,0.94]	[0.83,1.97]	[0.57,0.97]
Black/African American	-0.0112**	-0.137***	-0.188***	-0.783***	-0.0518***	0.731***	0.805	1.205
	[-0.02,-0.00]	[-0.17,-0.10]	[-0.23,-0.15]	[-1.18,-0.39]	[-0.08,-0.02]	[0.65,0.82]	[0.57,1.14]	[0.96,1.51]
Alaskan/Native American	-0.00457	-0.0913	-0.0251	0.708	0.00148	1.309**	1.535	0.775
	[-0.04,0.03]	[-0.20,0.02]	[-0.14,0.09]	[-1.01,2.42]	[-0.09,0.10]	[1.03,1.66]	[0.88,2.69]	[0.49,1.23]
Asian	-0.0246***	-0.120**	-0.179***	-0.637	0.0133	0.429***		1.768**
	[-0.03,-0.01]	[-0.22,-0.02]	[-0.29,-0.07]	[-1.73,0.46]	[-0.09,0.12]	[0.29,0.63]		[1.10,2.83]
Multiple/Other	0.00876	0.00803	0.0147	0.245	0.0366	0.812	0.633**	1.811***
	[-0.03,0.04]	[-0.07,0.09]	[-0.08,0.11]	[-0.56,1.05]	[-0.02,0.09]	[0.63,1.05]	[0.43,0.94]	[1.35,2.43]
Married	-0.0159***	-0.0856***	-0.0710***	-0.931***	-0.0397**	0.858**	0.848	0.711***
	[-0.02,-0.01]	[-0.12,-0.05]	[-0.11,-0.03]	[-1.33,-0.53]	[-0.07,-0.01]	[0.76,0.97]	[0.60,1.19]	[0.59,0.86]
Percent FPL	-0.0000587	-0.000405	-0.00291*	-0.00490	0.000752	1.001	0.960***	0.990
	[-0.00,0.00]	[-0.00,0.00]	[-0.01,0.00]	[-0.03,0.02]	[-0.00,0.00]	[0.99,1.01]	[0.94,0.98]	[0.98,1.00]
Psychiatrists/100,000	-0.000213	0.000685	-0.000173	-0.0145**	-0.000625	0.999	1.008	1.007***
	[-0.00,0.00]	[-0.00,0.00]	[-0.00,0.00]	[-0.03,-0.00]	[-0.00,0.00]	[1.00,1.00]	[0.99,1.03]	[1.00,1.01]
Year								
2011	0.0100	0.0154	0.0214	-0.0311	0.00117	1.037	0.966	0.789**
	[-0.01,0.03]	[-0.03,0.06]	[-0.03,0.07]	[-0.56,0.50]	[-0.04,0.04]	[0.92,1.17]	[0.60,1.55]	[0.62,1.00]
2012	0.0116	0.0406*	0.0580**	0.224	-0.0167	0.915	1.717**	0.867
	[-0.00,0.03]	[-0.01,0.09]	[0.01,0.11]	[-0.33,0.78]	[-0.06,0.02]	[0.80,1.05]	[1.03,2.85]	[0.65,1.16]
2013	0.00945	0.0222	0.0294	-0.154	0.00599	0.877	1.546**	1.160
	[-0.01,0.03]	[-0.03,0.08]	[-0.02,0.08]	[-0.68,0.37]	[-0.03,0.04]	[0.73,1.05]	[1.07,2.23]	[0.87,1.55]
2016	0.00108	-0.0132	-0.0770***	0.117	0.0939***	0.907	1.090	0.811
	[-0.02,0.02]	[-0.07,0.04]	[-0.13,-0.02]	[-0.55,0.79]	[0.04,0.15]	[0.78,1.06]	[0.75,1.58]	[0.61,1.07]
2017	-0.00661	-0.0129	-0.0800***	-0.180	-0.0193	0.986	0.841	1.058
	[-0.03,0.02]	[-0.07,0.04]	[-0.13,-0.03]	[-0.82,0.46]	[-0.08,0.04]	[0.87,1.12]	[0.57,1.23]	[0.77,1.45]
2018	0	0	0	0	0	1	1	1
	[0.00,0.00]	[0.00,0.00]	[0.00,0.00]	[0.00,0.00]	[0.00,0.00]	[1.00,1.00]	[1.00,1.00]	[1.00,1.00]
Constant	0.0221	0.143***	0.204***	9.922***	0.671***	-	-	-
	[-0.01,0.06]	[0.04,0.25]	[0.09,0.32]	[8.88,10.97]	[0.59,0.75]	-	-	-
Observations	298392	298392	298392	298392	298324	287742	127156	272284

95% confidence intervals in brackets * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix A. Table 6. Mental Health Subsample, 2x2 DID estimates for Medicaid Expansion, Full Sample at 138% FPL

	Any Utilization (LPM)			Self-Reported Outcome (LPM)		Number of Visits, Conditional on Any (Poisson, IRR)		
	Any MH related ED	Any MH Outpatient	Any MH Rx	Kessler 6 Scale	Accomplished ANY less due to MH	Rx count	ED count	MH Outpatient count
Expansion								
Medicaid expansion State	0.0190	0.0592	0.0279	0.189	0.00716	1.472*	0.496**	0.633**
	[-0.05,0.09]	[-0.07,0.18]	[-0.06,0.12]	[-0.63,1.01]	[-0.08,0.10]	[1.00,2.18]	[0.29,0.86]	[0.41,0.98]
Post-ME	0.0146*	0.0550*	0.0829***	-0.762***	-0.121***	1.029	1.086	0.861
	[-0.00,0.03]	[-0.00,0.11]	[0.03,0.14]	[-1.34,-0.19]	[-0.17,-0.07]	[0.86,1.23]	[0.73,1.61]	[0.64,1.16]
Medicaid expansion State * Post ME	-0.00644	0.0225	0.0128	0.519*	0.0209	0.954	1.655***	1.660***
	[-0.02,0.01]	[-0.03,0.08]	[-0.05,0.07]	[-0.07,1.11]	[-0.03,0.07]	[0.80,1.14]	[1.17,2.34]	[1.23,2.24]
Age								
25-35	-0.00688	0.00954	0.0756***	0.813***	0.0566**	1.149	0.903	1.073
	[-0.02,0.01]	[-0.03,0.05]	[0.03,0.12]	[0.39,1.24]	[0.01,0.10]	[0.93,1.43]	[0.65,1.26]	[0.80,1.45]
36-50	0.00970	0.0637***	0.131***	1.331***	0.105***	1.582***	0.895	1.067
	[-0.01,0.02]	[0.02,0.10]	[0.09,0.18]	[0.91,1.76]	[0.06,0.15]	[1.30,1.92]	[0.61,1.30]	[0.79,1.43]
51-64	0.000315	-0.00611	0.167***	0.820***	0.143***	1.394***	0.957	0.905
	[-0.02,0.02]	[-0.05,0.04]	[0.12,0.21]	[0.35,1.29]	[0.10,0.19]	[1.13,1.72]	[0.59,1.55]	[0.67,1.22]
Female	0.00833**	0.0459***	0.0771***	0.228	0.0513***	1.044	0.965	0.786***
	[0.00,0.02]	[0.02,0.07]	[0.05,0.10]	[-0.10,0.55]	[0.03,0.07]	[0.96,1.14]	[0.83,1.13]	[0.67,0.92]
Education (ref=less than HS)	-0.00382	0.0400**	0.0264	-0.275*	-0.0158	1.014	0.761*	1.133
High School	[-0.01,0.01]	[0.01,0.07]	[-0.01,0.06]	[-0.57,0.02]	[-0.04,0.01]	[0.92,1.12]	[0.55,1.05]	[0.93,1.38]
	-0.00115	0.0380**	0.0475**	-0.702***	-0.0114	1.040	0.760**	1.223*
More than HS	[-0.01,0.01]	[0.00,0.07]	[0.01,0.09]	[-1.12,-0.28]	[-0.04,0.02]	[0.92,1.18]	[0.60,0.97]	[0.98,1.53]
	0.000502	0.0388	0.0188	-0.906***	-0.0166	1.074	1.391*	1.158
Other/unknown	[-0.02,0.02]	[-0.02,0.10]	[-0.04,0.08]	[-1.59,-0.23]	[-0.07,0.04]	[0.92,1.26]	[0.97,2.00]	[0.81,1.66]
Chronic Conditions	0.00116	0.0941***	0.161***	0.845***	0.0779***	1.176*	1.297*	1.192
1-2	[-0.01,0.01]	[0.06,0.13]	[0.12,0.20]	[0.54,1.15]	[0.04,0.11]	[0.99,1.40]	[0.96,1.76]	[0.96,1.48]
	0.000976	0.178***	0.341***	2.326***	0.153***	1.409***	1.162	1.422***
3+	[-0.01,0.01]	[0.14,0.21]	[0.30,0.38]	[1.93,2.72]	[0.12,0.19]	[1.19,1.67]	[0.91,1.49]	[1.10,1.84]
Race/Ethnicity	-0.00185	-0.0951***	-0.148***	-0.582***	-0.0118	0.887	1.127	0.768**

Hispanic	[-0.01,0.01]	[-0.13,-0.06]	[-0.18,-0.11]	[-1.01,-0.15]	[-0.04,0.02]	[0.76,1.03]	[0.74,1.71]	[0.61,0.96]
	-0.00568	-0.135***	-0.196***	-0.726***	-0.0506***	0.722***	0.759**	1.195
Black/African American	[-0.02,0.00]	[-0.17,-0.11]	[-0.23,-0.16]	[-1.06,-0.40]	[-0.08,-0.02]	[0.65,0.80]	[0.59,0.97]	[0.96,1.49]
	-0.00311	-0.0421	0.00182	0.799	0.00105	1.213	1.762**	1.003
Alaskan/Native American	[-0.03,0.02]	[-0.14,0.06]	[-0.10,0.11]	[-0.66,2.25]	[-0.08,0.08]	[0.96,1.53]	[1.07,2.91]	[0.56,1.80]
	-0.0179***	-0.123***	-0.158***	-0.499	-0.0409	0.462***	0.595***	1.821**
Asian	[-0.03,-0.01]	[-0.21,-0.04]	[-0.25,-0.06]	[-1.48,0.48]	[-0.13,0.05]	[0.32,0.66]	[0.43,0.82]	[1.15,2.88]
	0.00954	0.00900	0.0157	0.490	0.0569**	0.881	0.610***	1.649***
Multiple/Other	[-0.02,0.04]	[-0.07,0.09]	[-0.06,0.10]	[-0.23,1.21]	[0.01,0.10]	[0.71,1.09]	[0.45,0.83]	[1.22,2.24]
	-0.0116***	-0.0775***	-0.0715***	-0.864***	-0.0304**	0.848***	0.741**	0.786**
Married	[-0.02,-0.00]	[-0.11,-0.05]	[-0.10,-0.04]	[-1.22,-0.51]	[-0.05,-0.01]	[0.76,0.94]	[0.55,1.00]	[0.65,0.94]
	-0.000344	-0.000185	-0.00211	-0.000642	0.000506	1.002	0.972***	0.992
Percent FPL	[-0.00,0.00]	[-0.00,0.00]	[-0.00,0.00]	[-0.03,0.03]	[-0.00,0.00]	[1.00,1.01]	[0.95,0.99]	[0.98,1.01]
	-0.000172	0.000703	-0.000123	-0.00905*	-0.000404	0.999	1.007	1.008***
Psychiatrists/100,000	[-0.00,0.00]	[-0.00,0.00]	[-0.00,0.00]	[-0.02,0.00]	[-0.00,0.00]	[1.00,1.00]	[0.99,1.02]	[1.00,1.01]
Year	0.00686	0.00844	0.0359*	-0.159	0.00449	1.035	0.921	0.803**
2011	[-0.01,0.02]	[-0.03,0.05]	[-0.00,0.08]	[-0.61,0.29]	[-0.03,0.04]	[0.92,1.17]	[0.61,1.38]	[0.65,0.99]
	0.00694	0.0317	0.0560***	0.129	-0.0132	0.951	1.806***	0.939
2012	[-0.01,0.02]	[-0.01,0.07]	[0.01,0.10]	[-0.29,0.55]	[-0.04,0.02]	[0.84,1.07]	[1.20,2.71]	[0.72,1.22]
	0.0107	0.0242	0.0390	-0.0349	0.000505	0.941	1.440***	1.259*
2013	[-0.00,0.02]	[-0.02,0.07]	[-0.01,0.09]	[-0.49,0.42]	[-0.03,0.04]	[0.81,1.09]	[1.09,1.90]	[0.98,1.61]
	0.00207	-0.0255	-0.0517**	0.149	0.104***	0.902	1.022	0.816
2016	[-0.01,0.02]	[-0.08,0.03]	[-0.10,-0.00]	[-0.41,0.71]	[0.05,0.15]	[0.79,1.03]	[0.76,1.37]	[0.63,1.05]
	-0.00167	-0.0248	-0.0364	-0.124	0.0107	0.997	0.780*	1.045
2017	[-0.02,0.02]	[-0.07,0.02]	[-0.09,0.01]	[-0.64,0.39]	[-0.04,0.06]	[0.89,1.11]	[0.58,1.05]	[0.79,1.38]
	0	0	0	0	0	1	1	1
2018	[0.00,0.00]	[0.00,0.00]	[0.00,0.00]	[0.00,0.00]	[0.00,0.00]	[1.00,1.00]	[1.00,1.00]	[1.00,1.00]
	[-0.07,-0.01]	[-0.35,-0.03]	[-0.03,0.16]	[-2.84,-1.27]	[-0.17,-0.03]	[0.69,1.22]		[0.40,1.36]
Constant	0.0312*	0.127**	0.184***	10.12***	0.665***	-	-	-
	[-0.01,0.07]	[0.03,0.23]	[0.09,0.28]	[9.18,11.07]	[0.58,0.75]	-	-	-
Observations	298861	298861	298861	298861	298772	288303	142848	278597

95% confidence intervals in brackets

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix A. Table 7. Mental Health Subsample, 2x2 DID estimates for Medicaid Expansion, 200% FPL

	Any Utilization (LPM)			Self-Reported Outcome (LPM)		Number of Visits, Conditional on Any (Poisson, IRR)		
	Any MH related ED	Any MH Outpatient	Any MH Rx	Kessler 6 Scale	Accomplished ANY less due to MH	Rx count	ED count	MH Outpatient count
Expansion								
Medicaid expansion State	0.0210	0.0670	0.00411	0.571	0.0478	1.354	0.610**	0.664*
	[-0.05,0.09]	[-0.09,0.22]	[-0.12,0.13]	[-0.14,1.29]	[-0.01,0.11]	[0.92,1.99]	[0.37,0.99]	[0.44,1.00]
Post-ME	0.0119*	0.0373	0.0652**	-0.652***	-0.113***	1.074	0.925	0.828
	[-0.00,0.03]	[-0.01,0.09]	[0.01,0.12]	[-1.14,-0.16]	[-0.16,-0.07]	[0.91,1.27]	[0.66,1.30]	[0.64,1.07]
Medicaid expansion State * Post ME	-0.00555	0.0270	0.00635	0.338	0.0131	0.953	1.656***	1.676***
	[-0.02,0.01]	[-0.02,0.08]	[-0.05,0.06]	[-0.14,0.82]	[-0.03,0.05]	[0.82,1.11]	[1.25,2.19]	[1.28,2.19]
Age								
25-35	-0.00356	0.0184	0.104***	0.570***	0.0450**	1.196**	0.911	1.090
	[-0.01,0.01]	[-0.02,0.06]	[0.06,0.15]	[0.22,0.92]	[0.01,0.08]	[1.00,1.42]	[0.68,1.23]	[0.84,1.41]
36-50	0.00553	0.0440**	0.144***	0.979***	0.0801***	1.521***	0.956	1.128
	[-0.01,0.02]	[0.01,0.08]	[0.11,0.18]	[0.62,1.34]	[0.04,0.12]	[1.29,1.80]	[0.70,1.31]	[0.89,1.43]
51-64	-0.00325	-0.00781	0.166***	0.509**	0.116***	1.367***	1.014	1.000
	[-0.02,0.01]	[-0.05,0.03]	[0.13,0.21]	[0.07,0.95]	[0.08,0.16]	[1.14,1.64]	[0.68,1.52]	[0.77,1.29]
Female	0.00950***	0.0489***	0.0927***	0.238*	0.0562***	1.021	0.942	0.864**
	[0.00,0.02]	[0.03,0.07]	[0.07,0.12]	[-0.02,0.50]	[0.03,0.08]	[0.94,1.10]	[0.83,1.07]	[0.75,0.99]
Education (ref=less than HS)								
High School	-0.00238	0.0208	0.0176	-0.352**	-0.0288**	1.019	0.754**	1.177*
	[-0.01,0.01]	[-0.01,0.05]	[-0.01,0.05]	[-0.63,-0.07]	[-0.05,-0.01]	[0.93,1.12]	[0.57,1.00]	[0.98,1.42]
More than HS	-0.000310	0.0428***	0.0390**	-0.662***	-0.0113	1.051	0.750**	1.276**
	[-0.01,0.01]	[0.01,0.07]	[0.00,0.08]	[-1.02,-0.30]	[-0.04,0.02]	[0.95,1.17]	[0.60,0.94]	[1.04,1.56]
Other/unknown	0.00276	0.0372	0.0214	-0.883***	-0.0108	1.073	1.352*	1.220
	[-0.01,0.02]	[-0.02,0.09]	[-0.03,0.07]	[-1.43,-0.34]	[-0.05,0.03]	[0.94,1.23]	[0.98,1.86]	[0.89,1.67]
Chronic Conditions								
1-2	0.00576	0.0752***	0.144***	0.850***	0.0757***	1.225***	1.157	1.197*
	[-0.00,0.01]	[0.05,0.11]	[0.11,0.18]	[0.58,1.12]	[0.05,0.10]	[1.07,1.40]	[0.88,1.52]	[0.98,1.46]
3+	0.00668	0.166***	0.327***	2.460***	0.152***	1.484***	1.118	1.418***
	[-0.00,0.02]	[0.13,0.20]	[0.29,0.36]	[2.14,2.78]	[0.12,0.18]	[1.28,1.72]	[0.89,1.40]	[1.14,1.77]

Race/Ethnicity								
Hispanic	0.00411	-0.0905***	-0.147***	-0.468***	-0.0200	0.884*	1.018	0.868
	[-0.01,0.01]	[-0.12,-0.06]	[-0.18,-0.11]	[-0.80,-0.13]	[-0.05,0.01]	[0.78,1.01]	[0.75,1.39]	[0.69,1.09]
Black/African American	-0.00200	-0.130***	-0.191***	-0.595***	-0.0586***	0.738***	0.854	1.211*
	[-0.01,0.01]	[-0.16,-0.10]	[-0.22,-0.16]	[-0.89,-0.30]	[-0.08,-0.04]	[0.67,0.81]	[0.70,1.03]	[0.98,1.50]
Alaskan/Native American	-0.00544	-0.0191	-0.0117	0.772	-0.00222	1.275**	1.866***	1.086
	[-0.03,0.02]	[-0.11,0.07]	[-0.10,0.07]	[-0.40,1.94]	[-0.09,0.08]	[1.02,1.59]	[1.21,2.89]	[0.71,1.66]
Asian	-0.0167***	-0.133***	-0.175***	-0.397	-0.0188	0.485***	0.554***	1.789**
	[-0.02,-0.01]	[-0.20,-0.06]	[-0.25,-0.10]	[-1.16,0.36]	[-0.09,0.06]	[0.34,0.69]	[0.43,0.71]	[1.14,2.81]
Multiple/Other	0.0126	0.0242	0.0134	0.609*	0.0480*	0.956	0.642***	1.468***
	[-0.01,0.04]	[-0.05,0.09]	[-0.06,0.09]	[-0.10,1.32]	[-0.00,0.10]	[0.79,1.16]	[0.48,0.86]	[1.13,1.90]
Married	-0.00964***	-0.0922***	-0.0693***	-0.777***	-0.0467***	0.803***	0.923	0.818**
	[-0.02,-0.00]	[-0.12,-0.07]	[-0.10,-0.04]	[-1.06,-0.50]	[-0.07,-0.02]	[0.73,0.88]	[0.73,1.17]	[0.69,0.96]
Percent FPL	-0.000214	0.00000976	-0.00206*	0.00807	0.00134*	1.003	0.979**	0.991
	[-0.00,0.00]	[-0.00,0.00]	[-0.00,0.00]	[-0.01,0.03]	[-0.00,0.00]	[1.00,1.01]	[0.96,1.00]	[0.98,1.00]
Psychiatrists/100,000	-0.0000346	0.000718	-0.0000872	-0.00908**	-0.000420	1.000	1.000	1.008***
	[-0.00,0.00]	[-0.00,0.00]	[-0.00,0.00]	[-0.02,-0.00]	[-0.00,0.00]	[1.00,1.00]	[0.99,1.01]	[1.00,1.01]
Year								
2011	0.000952	-0.0151	0.0310*	-0.153	-0.0160	1.025	0.771	0.843*
	[-0.01,0.01]	[-0.05,0.02]	[-0.01,0.07]	[-0.48,0.18]	[-0.05,0.01]	[0.93,1.13]	[0.50,1.19]	[0.71,1.01]
2012	0.00428	0.0135	0.0339	0.0452	-0.0267*	0.972	1.296*	0.938
	[-0.01,0.01]	[-0.02,0.05]	[-0.01,0.08]	[-0.36,0.45]	[-0.06,0.00]	[0.87,1.08]	[0.97,1.73]	[0.77,1.14]
2013	0.00682	0.00481	0.0248	-0.138	-0.0242	0.974	1.138	1.215*
	[-0.00,0.02]	[-0.03,0.04]	[-0.02,0.07]	[-0.53,0.25]	[-0.06,0.01]	[0.86,1.11]	[0.88,1.46]	[0.99,1.49]
2016	0.00180	-0.0207	-0.0402	0.0347	0.0691***	0.892*	0.991	0.893
	[-0.01,0.02]	[-0.07,0.03]	[-0.09,0.01]	[-0.42,0.48]	[0.03,0.11]	[0.79,1.01]	[0.76,1.29]	[0.71,1.12]
2017	-0.000166	-0.0215	-0.0177	-0.226	-0.00922	0.952	0.776*	1.092
	[-0.02,0.02]	[-0.06,0.02]	[-0.06,0.03]	[-0.64,0.19]	[-0.06,0.04]	[0.85,1.06]	[0.60,1.01]	[0.87,1.36]
2018	0	0	0	0	0	1	1	1
	[0.00,0.00]	[0.00,0.00]	[0.00,0.00]	[0.00,0.00]	[0.00,0.00]	[1.00,1.00]	[1.00,1.00]	[1.00,1.00]
Constant	0.0220	0.159**	0.188***	9.909***	0.671***	-	-	-
	[-0.01,0.05]	[0.03,0.28]	[0.07,0.30]	[9.07,10.75]	[0.61,0.74]	-	-	-
Observations	303269	303269	303269	303269	303141	290070	162111	285221

95% confidence intervals in brackets

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix A. Table 8. TWFE, DID Medicaid Expansion, 100% FPL, Full Sample

	Any Utilization (LPM)			Self-Reported Outcome (LPM)		Number of Visits, Conditional on Any (Poisson, IRR)		
	Any MH related ED	Any MH Outpatient	Any MH Rx	Kessler 6 Scale	Accomplished ANY less due to MH	Rx count	ED count	MH Outpatient count
Expansion	-0.00648	0.0132	0.00617	-0.0415	0.00857	0.936	1.447***	1.386*
	[-0.01,0.00]	[-0.01,0.03]	[-0.02,0.03]	[-0.41,0.33]	[-0.02,0.04]	[0.81,1.07]	[1.17,1.79]	[1.06,1.81]
Age								
25-35	-0.000755	0.0280***	0.0479***	0.868***	0.0634***	1.285***	0.991	1.257
	[-0.01,0.00]	[0.01,0.04]	[0.03,0.06]	[0.62,1.12]	[0.04,0.09]	[1.12,1.47]	[0.80,1.22]	[1.00,1.58]
36-50	0.00637*	0.0576***	0.0995***	1.388***	0.125***	1.751***	1.038	1.502***
	[0.00,0.01]	[0.04,0.08]	[0.08,0.12]	[1.12,1.66]	[0.10,0.15]	[1.52,2.02]	[0.86,1.25]	[1.18,1.91]
51-64	-0.00158	0.0207	0.119***	0.740***	0.142***	1.520***	0.883	1.410*
	[-0.01,0.01]	[-0.00,0.04]	[0.10,0.14]	[0.41,1.07]	[0.12,0.17]	[1.33,1.74]	[0.66,1.19]	[1.04,1.91]
Female	0.00343	0.0327***	0.0625***	0.465***	0.0480***	1.000	0.877	0.754***
	[-0.00,0.01]	[0.02,0.04]	[0.05,0.08]	[0.29,0.64]	[0.03,0.06]	[0.93,1.07]	[0.75,1.03]	[0.66,0.86]
Education (ref=less than HS)								
High School	-0.000505	0.00725	0.00970	-0.249*	-0.0375***	0.987	0.849	1.153
	[-0.00,0.00]	[-0.01,0.02]	[-0.01,0.03]	[-0.48,-0.02]	[-0.06,-0.02]	[0.90,1.08]	[0.67,1.07]	[0.96,1.39]
More than HS	0.00224	0.0167*	0.0236*	-0.437**	-0.0435***	1.016	0.897	1.367***
	[-0.00,0.01]	[0.00,0.03]	[0.00,0.04]	[-0.70,-0.18]	[-0.06,-0.02]	[0.92,1.12]	[0.74,1.09]	[1.16,1.61]
Other/unknown	0.00179	0.0144	0.0173	-0.418	-0.0609**	0.943	1.278	1.390
	[-0.01,0.01]	[-0.01,0.04]	[-0.01,0.05]	[-0.89,0.05]	[-0.10,-0.02]	[0.82,1.08]	[0.85,1.92]	[0.88,2.19]
Chronic Conditions								
1-2	0.00571**	0.0823***	0.135***	1.814***	0.153***	1.266***	1.078	1.056
	[0.00,0.01]	[0.07,0.10]	[0.12,0.15]	[1.61,2.02]	[0.13,0.17]	[1.13,1.42]	[0.96,1.21]	[0.82,1.36]
3+	0.00973**	0.179***	0.350***	4.454***	0.336***	1.480***	1.109	1.077
	[0.00,0.02]	[0.16,0.20]	[0.33,0.37]	[4.10,4.81]	[0.31,0.36]	[1.34,1.64]	[0.95,1.29]	[0.83,1.39]
Race/Ethnicity								
Hispanic	-0.00369	-0.0798***	-0.115***	-1.156***	-0.0500***	0.798***	1.076	0.796*
	[-0.01,0.00]	[-0.10,-0.06]	[-0.13,-0.10]	[-1.42,-0.89]	[-0.07,-0.03]	[0.71,0.90]	[0.78,1.49]	[0.67,0.95]
Black/African American	-0.00469*	-0.0908***	-0.135***	-1.039***	-0.0640***	0.707***	0.834*	0.998
	[-0.01,-0.00]	[-0.11,-0.07]	[-0.15,-0.12]	[-1.27,-0.81]	[-0.08,-0.05]	[0.65,0.77]	[0.72,0.96]	[0.82,1.21]
Alaskan/Native American	-0.00777	-0.0668**	-0.0647*	-0.235	-0.0540	1.042	0.838	0.640***
	[-0.02,0.00]	[-0.11,-0.02]	[-0.12,-0.01]	[-1.66,1.19]	[-0.16,0.05]	[0.81,1.34]	[0.41,1.69]	[0.49,0.83]

Asian	-0.00753*	-0.0952***	-0.129***	-0.666**	-0.0529**	0.535***	1.276	1.417
	[-0.01,-0.00]	[-0.12,-0.07]	[-0.16,-0.10]	[-1.11,-0.22]	[-0.09,-0.01]	[0.41,0.70]	[0.81,2.00]	[0.71,2.81]
Multiple/Other	0.0140	0.0198	-0.00691	0.687*	0.0763***	0.916	0.826	1.406*
	[-0.00,0.03]	[-0.02,0.06]	[-0.05,0.03]	[0.12,1.25]	[0.03,0.12]	[0.79,1.06]	[0.63,1.08]	[1.06,1.86]
Married	-0.0104***	-0.0649***	-0.0618***	-1.457***	-0.0960***	0.766***	0.896	0.780**
	[-0.01,-0.01]	[-0.08,-0.05]	[-0.08,-0.05]	[-1.68,-1.24]	[-0.12,-0.08]	[0.71,0.83]	[0.72,1.12]	[0.66,0.92]
Percent FPL	-0.000109	-0.0000281	0.0000932	0.0218*	0.00233**	1.002	0.982*	1.000
	[-0.00,0.00]	[-0.00,0.00]	[-0.00,0.00]	[0.00,0.04]	[0.00,0.00]	[1.00,1.01]	[0.97,1.00]	[0.98,1.02]
Psychiatrists/100k	-0.0000901	0.000432	0.000343	-0.00260	0.0000610	0.999	0.997	1.007**
	[-0.00,0.00]	[-0.00,0.00]	[-0.00,0.00]	[-0.01,0.01]	[-0.00,0.00]	[1.00,1.00]	[0.99,1.01]	[1.00,1.01]
Year								
2010	0	0	0	0	0	1	1	1
	[0.00,0.00]	[0.00,0.00]	[0.00,0.00]	[0.00,0.00]	[0.00,0.00]	[1.00,1.00]	[1.00,1.00]	[1.00,1.00]
2011	0.00383	0.00672	0.00571	-0.143	0.00175	0.984	1.006	0.794
	[-0.00,0.01]	[-0.01,0.03]	[-0.02,0.03]	[-0.44,0.15]	[-0.03,0.03]	[0.88,1.10]	[0.73,1.39]	[0.61,1.04]
2012	0.00295	0.0101	0.0147	-0.126	0.000985	0.908	1.516*	0.849
	[-0.00,0.01]	[-0.01,0.03]	[-0.01,0.04]	[-0.46,0.21]	[-0.03,0.03]	[0.80,1.03]	[1.04,2.21]	[0.68,1.06]
2013	0.00253	-0.000721	-0.00292	-0.489**	-0.0223	0.869	1.108	0.920
	[-0.00,0.01]	[-0.02,0.02]	[-0.03,0.02]	[-0.82,-0.16]	[-0.05,0.01]	[0.75,1.00]	[0.87,1.41]	[0.69,1.23]
2014	0.00642	0.00856	0.00898	-0.761***	-0.0540**	1.052	0.965	0.927
	[-0.00,0.01]	[-0.01,0.03]	[-0.02,0.04]	[-1.17,-0.35]	[-0.09,-0.02]	[0.91,1.22]	[0.72,1.30]	[0.65,1.32]
2015	0.00740*	0.0169	0.0308*	-0.835***	-0.0665***	0.979	0.880	0.701*
	[0.00,0.01]	[-0.01,0.04]	[0.00,0.06]	[-1.22,-0.45]	[-0.10,-0.03]	[0.83,1.15]	[0.66,1.18]	[0.50,0.98]
2016	0.0111**	0.0119	0.0110	-0.798***	-0.0475*	0.937	0.975	0.790
	[0.00,0.02]	[-0.01,0.04]	[-0.02,0.04]	[-1.22,-0.37]	[-0.08,-0.01]	[0.80,1.09]	[0.75,1.27]	[0.57,1.09]
2017	0.00482	0.00117	-0.00996	-1.205***	-0.159***	1.036	0.890	1.276
	[-0.00,0.01]	[-0.02,0.03]	[-0.04,0.02]	[-1.62,-0.79]	[-0.20,-0.12]	[0.88,1.22]	[0.62,1.28]	[0.92,1.77]
2018	0.00613	0.00678	0.0331*	-0.958***	-0.158***	0.995	1.045	0.982
	[-0.00,0.01]	[-0.02,0.03]	[0.00,0.06]	[-1.40,-0.51]	[-0.20,-0.12]	[0.86,1.15]	[0.73,1.49]	[0.72,1.34]
Constant	0.00845	0.0624	0.119**	4.391***	0.309***	-	-	-
	[-0.01,0.02]	[-0.01,0.14]	[0.05,0.19]	[3.44,5.34]	[0.23,0.39]	-	-	-
Observations	311324	311324	311324	307895	308915	284926	204670	279819

95% confidence intervals in brackets

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Appendix A. Table 9. TWFE, DID Medicaid Expansion, 138% FPL, Full Sample

	Any Utilization (LPM)			Self-Reported Outcome (LPM)		Number of Visits, Conditional on Any (Poisson, IRR)		
	Any MH related ED	Any MH Outpatient	Any MH Rx	Kessler 6 Scale	Accomplished ANY less due to MH	Rx count	ED count	MH Outpatient count
Expansion	-0.00293	0.00950	0.00584	-0.0121	0.00941	0.981	1.330***	1.337**
	[-0.01,0.00]	[-0.01,0.03]	[-0.02,0.03]	[-0.31,0.29]	[-0.02,0.03]	[0.87,1.10]	[1.12,1.57]	[1.02,1.75]
Age								
25-35	-0.000783	0.0207***	0.0489***	0.693***	0.0586***	1.297***	1.004	1.293**
	[-0.00,0.00]	[0.01,0.03]	[0.03,0.06]	[0.50,0.89]	[0.04,0.08]	[1.15,1.46]	[0.86,1.17]	[1.06,1.58]
36-50	0.00401*	0.0428***	0.0886***	1.085***	0.110***	1.700***	1.048	1.478***
	[-0.00,0.01]	[0.03,0.06]	[0.07,0.10]	[0.87,1.30]	[0.09,0.13]	[1.50,1.92]	[0.88,1.25]	[1.21,1.81]
51-64	-0.00245	0.00932	0.106***	0.481***	0.127***	1.492***	0.977	1.399**
	[-0.01,0.00]	[-0.01,0.03]	[0.09,0.13]	[0.22,0.74]	[0.11,0.15]	[1.33,1.68]	[0.75,1.27]	[1.06,1.84]
Female	0.00356**	0.0315***	0.0650***	0.505***	0.0523***	1.006	0.861**	0.765***
	[0.00,0.01]	[0.02,0.04]	[0.05,0.08]	[0.37,0.64]	[0.04,0.06]	[0.94,1.07]	[0.75,0.99]	[0.67,0.87]
Education (ref=less than HS)								
High School	-0.000510	0.00122	0.00514	-0.210**	-0.0337***	0.993	0.902	1.118
	[-0.00,0.00]	[-0.01,0.01]	[-0.01,0.02]	[-0.42,-0.00]	[-0.05,-0.02]	[0.91,1.08]	[0.74,1.10]	[0.94,1.33]
More than HS	0.000162	0.0175**	0.0172**	-0.455***	-0.0445***	1.001	0.908	1.249***
	[-0.00,0.00]	[0.00,0.03]	[0.00,0.03]	[-0.68,-0.23]	[-0.06,-0.03]	[0.92,1.09]	[0.77,1.08]	[1.07,1.46]
Other/unknown	0.000454	0.0127	0.0277**	-0.461**	-0.0535***	0.940	1.230	1.235
	[-0.00,0.01]	[-0.01,0.03]	[0.00,0.05]	[-0.83,-0.09]	[-0.08,-0.02]	[0.83,1.07]	[0.87,1.74]	[0.81,1.87]
Chronic Conditions								
1-2	0.00574***	0.0753***	0.123***	1.764***	0.149***	1.257***	1.061	1.086
	[0.00,0.01]	[0.06,0.09]	[0.11,0.14]	[1.61,1.92]	[0.13,0.16]	[1.14,1.39]	[0.94,1.20]	[0.87,1.36]
3+	0.0103***	0.177***	0.346***	4.467***	0.338***	1.487***	1.089	1.134
	[0.01,0.02]	[0.16,0.19]	[0.33,0.37]	[4.17,4.76]	[0.32,0.36]	[1.36,1.63]	[0.96,1.23]	[0.89,1.44]
Race/Ethnicity								
Hispanic	-0.00161	-0.0721***	-0.117***	-1.140***	-0.0556***	0.842***	1.013	0.796***
	[-0.01,0.00]	[-0.08,-0.06]	[-0.13,-0.10]	[-1.37,-0.92]	[-0.07,-0.04]	[0.76,0.93]	[0.79,1.30]	[0.68,0.93]
Black/African American	-0.00355*	-0.0898***	-0.134***	-1.102***	-0.0715***	0.718***	0.856**	1.054
	[-0.01,0.00]	[-0.10,-0.08]	[-0.15,-0.12]	[-1.30,-0.90]	[-0.09,-0.05]	[0.67,0.77]	[0.76,0.96]	[0.88,1.26]
Alaskan/Native American	-0.00580	-0.0448**	-0.0505**	-0.107	-0.0242	0.954	1.000	0.696**
	[-0.01,0.00]	[-0.08,-0.01]	[-0.09,-0.01]	[-1.15,0.94]	[-0.10,0.05]	[0.79,1.16]	[0.57,1.75]	[0.52,0.93]

Asian	-0.00571***	-0.0920***	-0.136***	-0.671***	-0.0699***	0.564***	1.209	1.347
	[-0.01,-0.00]	[-0.11,-0.07]	[-0.16,-0.11]	[-1.02,-0.32]	[-0.10,-0.04]	[0.44,0.72]	[0.84,1.75]	[0.76,2.38]
Multiple/Other	0.0125*	0.0134	-0.00978	0.734***	0.0767***	0.938	0.878	1.409***
	[-0.00,0.03]	[-0.02,0.04]	[-0.04,0.02]	[0.20,1.27]	[0.04,0.12]	[0.82,1.07]	[0.72,1.08]	[1.10,1.81]
Married	-0.00883***	-0.0627***	-0.0615***	-1.313***	-0.0861***	0.771***	0.886	0.795***
	[-0.01,-0.01]	[-0.07,-0.05]	[-0.07,-0.05]	[-1.50,-1.13]	[-0.10,-0.07]	[0.72,0.83]	[0.74,1.07]	[0.69,0.92]
Percent FPL	-0.000135	-0.000112	0.0000924	0.0193**	0.00171***	1.003	0.986**	0.996
	[-0.00,0.00]	[-0.00,0.00]	[-0.00,0.00]	[0.00,0.04]	[0.00,0.00]	[1.00,1.01]	[0.97,1.00]	[0.98,1.01]
Psychiatrists/100k	-0.0000971*	0.000340	0.000235	-0.00222	0.000235	0.999	0.997	1.008***
	[-0.00,0.00]	[-0.00,0.00]	[-0.00,0.00]	[-0.01,0.01]	[-0.00,0.00]	[1.00,1.00]	[0.99,1.01]	[1.00,1.01]
Year								
2011	0.00363	0.00992	0.0163*	-0.0762	0.0108	1.009	0.988	0.863
	[-0.00,0.01]	[-0.01,0.02]	[-0.00,0.03]	[-0.34,0.19]	[-0.01,0.04]	[0.91,1.11]	[0.76,1.29]	[0.67,1.11]
2012	0.00222	0.0135	0.0238**	0.0323	0.00950	0.956	1.366*	0.921
	[-0.00,0.01]	[-0.00,0.03]	[0.00,0.04]	[-0.26,0.32]	[-0.02,0.04]	[0.86,1.06]	[0.99,1.89]	[0.74,1.15]
2013	0.00261	0.00607	0.00847	-0.311**	-0.0231*	0.951	1.030	0.994
	[-0.00,0.01]	[-0.01,0.02]	[-0.01,0.03]	[-0.60,-0.02]	[-0.05,0.00]	[0.85,1.07]	[0.84,1.26]	[0.78,1.26]
2014	0.00415	0.0169*	0.0204*	-0.584***	-0.0412***	1.043	0.885	0.910
	[-0.00,0.01]	[-0.00,0.04]	[-0.00,0.04]	[-0.93,-0.24]	[-0.07,-0.01]	[0.92,1.19]	[0.70,1.13]	[0.68,1.23]
2015	0.00646**	0.0206**	0.0302***	-0.689***	-0.0465***	0.935	0.852	0.735**
	[0.00,0.01]	[0.00,0.04]	[0.01,0.05]	[-1.01,-0.37]	[-0.07,-0.02]	[0.82,1.07]	[0.68,1.07]	[0.55,0.99]
2016	0.00728**	0.0174*	0.0188	-0.792***	-0.0497***	0.940	0.937	0.829
	[0.00,0.01]	[-0.00,0.04]	[-0.00,0.04]	[-1.15,-0.43]	[-0.08,-0.02]	[0.82,1.07]	[0.73,1.20]	[0.63,1.09]
2017	0.00414	0.0125	0.00502	-1.073***	-0.153***	1.015	0.877	1.189
	[-0.00,0.01]	[-0.01,0.03]	[-0.02,0.03]	[-1.42,-0.73]	[-0.18,-0.12]	[0.88,1.17]	[0.66,1.17]	[0.88,1.61]
2018	0.00258	0.0221**	0.0349***	-0.915***	-0.160***	0.984	1.134	0.949
	[-0.00,0.01]	[0.00,0.04]	[0.01,0.06]	[-1.28,-0.55]	[-0.19,-0.13]	[0.87,1.12]	[0.84,1.53]	[0.72,1.25]
Constant	[-0.04,-0.00]	[-0.26,0.05]	[-0.00,0.19]	[-2.02,-0.18]	[0.01,0.19]	[0.80,2.05]	-	[0.48,1.80]
	0.0150	0.0716*	0.103***	4.198***	0.315***	-	-	-
Observations	[-0.01,0.04]	[-0.00,0.15]	[0.04,0.16]	[3.38,5.02]	[0.24,0.39]	-	-	-
	311305	311305	311305	306295	307754	273221	210184	268124

95% confidence intervals in brackets

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix A. Table 10. TWFE, DID Medicaid Expansion, 200% FPL, Full Sample

	Any Utilization (LPM)			Self-Reported Outcome (LPM)		Number of Visits, Conditional on Any (Poisson, IRR)		
	Any MH related ED	Any MH Outpatient	Any MH Rx	Kessler 6 Scale	Accomplished ANY less due to MH	Rx count	ED count	MH Outpatient count
Expansion	-0.00127	0.0161**	-0.00197	-0.0282	-0.000409	1.025	1.260***	1.318**
	[-0.00,0.00]	[0.00,0.03]	[-0.02,0.02]	[-0.27,0.21]	[-0.02,0.02]	[0.93,1.13]	[1.08,1.47]	[1.04,1.66]
Age								
25-35	-0.000511	0.0202***	0.0513***	0.532***	0.0468***	1.327***	0.992	1.234**
	[-0.00,0.00]	[0.01,0.03]	[0.04,0.06]	[0.36,0.70]	[0.03,0.06]	[1.19,1.48]	[0.87,1.12]	[1.04,1.46]
36-50	0.00158	0.0301***	0.0829***	0.725***	0.0807***	1.643***	1.050	1.442***
	[-0.00,0.00]	[0.02,0.04]	[0.07,0.10]	[0.54,0.91]	[0.06,0.10]	[1.47,1.83]	[0.90,1.22]	[1.21,1.72]
51-64	-0.00318	0.00467	0.0946***	0.257**	0.0991***	1.476***	0.999	1.374**
	[-0.01,0.00]	[-0.01,0.02]	[0.08,0.11]	[0.04,0.47]	[0.08,0.12]	[1.32,1.64]	[0.82,1.22]	[1.07,1.76]
Female	0.00346***	0.0342***	0.0723***	0.568***	0.0601***	1.007	0.874**	0.838***
	[0.00,0.01]	[0.03,0.04]	[0.06,0.08]	[0.45,0.68]	[0.05,0.07]	[0.95,1.06]	[0.78,0.98]	[0.74,0.94]
Education (ref=less than HS)								
High School	-0.000171	-0.00422	0.000907	-0.213**	-0.0384***	1.003	0.876	1.135
	[-0.00,0.00]	[-0.01,0.01]	[-0.01,0.01]	[-0.38,-0.05]	[-0.05,-0.02]	[0.93,1.08]	[0.75,1.03]	[0.96,1.34]
More than HS	-0.00137	0.0136**	0.0124*	-0.516***	-0.0497***	0.993	0.873*	1.239***
	[-0.00,0.00]	[0.00,0.02]	[-0.00,0.03]	[-0.69,-0.34]	[-0.06,-0.04]	[0.92,1.07]	[0.76,1.01]	[1.06,1.45]
Other/unknown	-0.000467	0.0145	0.0261**	-0.437***	-0.0435***	0.974	1.240	1.264
	[-0.00,0.00]	[-0.00,0.03]	[0.01,0.05]	[-0.70,-0.18]	[-0.07,-0.02]	[0.88,1.08]	[0.93,1.65]	[0.89,1.79]
Chronic Conditions								
1-2	0.00519***	0.0649***	0.113***	1.616***	0.138***	1.254***	1.012	1.062
	[0.00,0.01]	[0.06,0.07]	[0.10,0.12]	[1.50,1.73]	[0.13,0.15]	[1.16,1.36]	[0.90,1.13]	[0.88,1.29]
3+	0.0102***	0.164***	0.336***	4.355***	0.333***	1.520***	1.083	1.157
	[0.01,0.01]	[0.15,0.18]	[0.32,0.35]	[4.13,4.58]	[0.32,0.35]	[1.40,1.65]	[0.96,1.22]	[0.93,1.44]
Race/Ethnicity								
Hispanic	-0.00154	-0.0653***	-0.112***	-1.061***	-0.0538***	0.845***	1.060	0.823***
	[-0.00,0.00]	[-0.08,-0.05]	[-0.12,-0.10]	[-1.24,-0.89]	[-0.07,-0.04]	[0.77,0.93]	[0.88,1.28]	[0.71,0.95]
Black/African American	-0.00235	-0.0815***	-0.131***	-1.015***	-0.0683***	0.738***	0.894**	1.053

	[-0.01,0.00]	[-0.09,-0.07]	[-0.14,-0.12]	[-1.19,-0.84]	[-0.08,-0.05]	[0.69,0.79]	[0.81,0.99]	[0.90,1.23]
Alaskan/Native American	-0.00507*	-0.0294**	-0.0439**	0.0416	-0.0143	0.984	0.806	0.730**
	[-0.01,0.00]	[-0.06,-0.00]	[-0.08,-0.01]	[-0.74,0.82]	[-0.07,0.04]	[0.83,1.17]	[0.52,1.25]	[0.54,0.98]
Asian	-0.00531***	-0.0840***	-0.135***	-0.583***	-0.0507***	0.612***	1.331	1.316
	[-0.01,-0.00]	[-0.10,-0.07]	[-0.15,-0.12]	[-0.87,-0.30]	[-0.08,-0.03]	[0.50,0.75]	[0.89,1.98]	[0.73,2.38]
Multiple/Other	0.00933*	0.0126	-0.0145	0.529**	0.0475***	0.998	0.841*	1.349***
	[-0.00,0.02]	[-0.01,0.04]	[-0.04,0.01]	[0.12,0.94]	[0.01,0.08]	[0.89,1.12]	[0.71,1.00]	[1.09,1.67]
Married	-0.00720***	-0.0603***	-0.0607***	-1.159***	-0.0866***	0.746***	0.897*	0.771***
	[-0.01,-0.01]	[-0.07,-0.05]	[-0.07,-0.05]	[-1.31,-1.00]	[-0.10,-0.07]	[0.70,0.79]	[0.79,1.02]	[0.68,0.87]
Percent FPL	-0.000133	-0.000144	-0.000248	0.0201***	0.00167***	1.005**	0.989**	0.999
	[-0.00,0.00]	[-0.00,0.00]	[-0.00,0.00]	[0.01,0.03]	[0.00,0.00]	[1.00,1.01]	[0.98,1.00]	[0.98,1.01]
Psychiatrists/100k	-0.0000309	0.000252	0.0000685	0.00103	0.000493	0.999	0.997	1.009***
	[-0.00,0.00]	[-0.00,0.00]	[-0.00,0.00]	[-0.01,0.01]	[-0.00,0.00]	[1.00,1.00]	[0.99,1.00]	[1.01,1.01]
Year								
2011	0.00105	-0.00275	0.0125*	-0.0191	-0.000475	1.020	0.935	0.879
	[-0.00,0.00]	[-0.01,0.01]	[-0.00,0.03]	[-0.23,0.19]	[-0.02,0.02]	[0.94,1.11]	[0.74,1.18]	[0.71,1.08]
2012	0.00125	0.00117	0.0102	-0.0239	-0.00428	0.990	1.205	0.912
	[-0.00,0.00]	[-0.01,0.02]	[-0.01,0.03]	[-0.27,0.22]	[-0.03,0.02]	[0.90,1.09]	[0.94,1.54]	[0.74,1.12]
2013	0.00162	-0.00378	0.00162	-0.311**	-0.0351***	0.990	0.989	0.992
	[-0.00,0.01]	[-0.02,0.01]	[-0.02,0.02]	[-0.56,-0.06]	[-0.06,-0.01]	[0.89,1.10]	[0.85,1.16]	[0.80,1.24]
2014	0.00333	0.00271	0.0121	-0.543***	-0.0461***	1.032	0.910	0.903
	[-0.00,0.01]	[-0.01,0.02]	[-0.01,0.03]	[-0.83,-0.26]	[-0.07,-0.02]	[0.92,1.16]	[0.76,1.09]	[0.67,1.21]
2015	0.00424*	0.0123*	0.0268**	-0.638***	-0.0493***	0.954	0.864	0.802*
	[-0.00,0.01]	[-0.00,0.03]	[0.01,0.05]	[-0.93,-0.34]	[-0.08,-0.02]	[0.84,1.08]	[0.70,1.06]	[0.63,1.02]
2016	0.00418*	0.00414	0.00879	-0.746***	-0.0584***	0.954	0.952	0.868
	[-0.00,0.01]	[-0.01,0.02]	[-0.01,0.03]	[-1.03,-0.46]	[-0.08,-0.03]	[0.85,1.07]	[0.80,1.13]	[0.67,1.12]
2017	0.00453**	0.00335	0.00466	-1.001***	-0.150***	1.013	0.879	1.138
	[0.00,0.01]	[-0.01,0.02]	[-0.02,0.02]	[-1.27,-0.73]	[-0.17,-0.13]	[0.89,1.15]	[0.73,1.07]	[0.87,1.49]
2018	0.000750	0.00921	0.0275**	-0.880***	-0.149***	1.015	1.141	0.938
	[-0.00,0.00]	[-0.01,0.03]	[0.01,0.05]	[-1.17,-0.59]	[-0.18,-0.12]	[0.90,1.14]	[0.90,1.45]	[0.73,1.20]
Constant	0.0117*	0.0810***	0.103***	3.737***	0.295***			
	[-0.00,0.03]	[0.02,0.14]	[0.04,0.16]	[2.99,4.49]	[0.25,0.34]			
Observations	311252	311252	311252	303681	305694	254533	202948	248336

95% confidence intervals in brackets

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix A. Table 11. TWFE, DID Medicaid Expansion, 100% FPL, MH Sub-sample

	Any Utilization (LPM)			Self-Reported Outcome (LPM)		Number of Visits, Conditional on Any (Poisson, IRR)		
	Any MH related ED	Any MH Outpatient	Any MH Rx	Kessler 6 Scale	Accomplished ANY less due to MH	Rx count	ED count	MH Outpatient count
Expansion	-0.0114	0.0121	-0.00818	0.0822	0.0107	0.899	1.631***	1.338**
	[-0.03,0.01]	[-0.03,0.06]	[-0.05,0.04]	[-0.39,0.56]	[-0.03,0.05]	[0.78,1.04]	[1.25,2.12]	[1.05,1.70]
Age								
25-35	-0.00895	0.0348*	0.0786***	0.976***	0.0588***	1.304***	0.987	1.135
	[-0.03,0.01]	[-0.00,0.07]	[0.04,0.12]	[0.62,1.33]	[0.02,0.10]	[1.08,1.57]	[0.77,1.26]	[0.87,1.48]
36-50	0.00643	0.0790***	0.147***	1.364***	0.126***	1.762***	1.003	1.248
	[-0.01,0.02]	[0.04,0.12]	[0.11,0.19]	[1.01,1.71]	[0.09,0.16]	[1.48,2.09]	[0.78,1.29]	[0.93,1.67]
51-64	-0.00550	0.0250	0.204***	1.071***	0.159***	1.580***	0.912	1.134
	[-0.02,0.01]	[-0.02,0.07]	[0.16,0.25]	[0.65,1.49]	[0.12,0.20]	[1.33,1.88]	[0.66,1.26]	[0.81,1.60]
Female	0.00572	0.0441***	0.0757***	0.223*	0.0457***	0.993	0.833**	0.809***
	[-0.00,0.01]	[0.02,0.07]	[0.05,0.10]	[-0.03,0.48]	[0.03,0.07]	[0.92,1.07]	[0.71,0.98]	[0.70,0.93]
Education (ref=less than HS)								
High School	-0.000346	0.0384***	0.0352**	-0.128	-0.0171	1.024	0.806	1.344***
	[-0.01,0.01]	[0.01,0.07]	[0.01,0.06]	[-0.38,0.13]	[-0.04,0.01]	[0.93,1.13]	[0.59,1.10]	[1.15,1.58]
More than HS	0.00819	0.0423**	0.0601***	-0.643***	-0.0127	1.068	0.800**	1.528***
	[-0.00,0.02]	[0.01,0.08]	[0.03,0.09]	[-0.94,-0.34]	[-0.04,0.01]	[0.95,1.20]	[0.65,0.99]	[1.28,1.82]
Other/unknown	0.0115	0.0444	0.0387	-0.488	-0.0446	0.996	1.307	1.505**
	[-0.01,0.03]	[-0.01,0.10]	[-0.02,0.10]	[-1.15,0.17]	[-0.10,0.01]	[0.86,1.15]	[0.91,1.87]	[1.07,2.11]
Chronic Conditions								
1-2	0.00567	0.118***	0.175***	0.952***	0.0630***	1.206**	1.118	1.012
	[-0.00,0.02]	[0.09,0.15]	[0.14,0.21]	[0.66,1.24]	[0.03,0.09]	[1.03,1.41]	[0.93,1.35]	[0.76,1.34]
3+	0.00233	0.187***	0.323***	2.226***	0.128***	1.371***	1.120	1.059
	[-0.01,0.01]	[0.15,0.22]	[0.29,0.36]	[1.85,2.60]	[0.10,0.16]	[1.19,1.58]	[0.94,1.34]	[0.79,1.43]
Race/Ethnicity								
Hispanic	-0.00336	-0.0912***	-0.113***	-0.421**	-0.0310**	0.839***	1.055	0.784**
	[-0.01,0.01]	[-0.12,-0.06]	[-0.15,-0.08]	[-0.78,-0.06]	[-0.06,-0.00]	[0.74,0.95]	[0.74,1.51]	[0.64,0.95]
Black/African American	-0.00831*	-0.115***	-0.165***	-0.560***	-0.0540***	0.714***	0.833*	1.005
	[-0.02,0.00]	[-0.14,-0.09]	[-0.20,-0.13]	[-0.86,-0.26]	[-0.08,-0.03]	[0.65,0.78]	[0.68,1.02]	[0.83,1.22]
Alaskan/Native	-0.0163*	-0.147***	-0.121**	0.341	0.0267	1.186	1.503**	0.741*

American								
	[-0.03,0.00]	[-0.23,-0.06]	[-0.22,-0.02]	[-0.93,1.62]	[-0.05,0.10]	[0.92,1.54]	[1.07,2.11]	[0.53,1.03]
Asian	-0.0230***	-0.168***	-0.203***	-0.696**	-0.0373	0.489***		1.530
	[-0.03,-0.02]	[-0.22,-0.12]	[-0.26,-0.14]	[-1.30,-0.09]	[-0.10,0.02]	[0.36,0.67]		[0.92,2.56]
Multiple/Other	0.0244	-0.0200	-0.0504	-0.0275	0.0337	0.898	0.917	1.515***
	[-0.01,0.06]	[-0.08,0.04]	[-0.12,0.01]	[-0.67,0.61]	[-0.01,0.08]	[0.75,1.07]	[0.72,1.18]	[1.16,1.97]
Married	-0.0163***	-0.0725***	-0.0370**	-0.837***	-0.0256**	0.815***	0.836	0.772***
	[-0.02,-0.01]	[-0.10,-0.04]	[-0.07,-0.01]	[-1.13,-0.54]	[-0.05,-0.00]	[0.74,0.89]	[0.66,1.06]	[0.66,0.91]
Percent FPL	-0.000343	-0.000223	-0.00189	0.00746	0.00171*	0.999	0.980**	0.997
	[-0.00,0.00]	[-0.00,0.00]	[-0.00,0.00]	[-0.01,0.03]	[-0.00,0.00]	[0.99,1.01]	[0.96,1.00]	[0.98,1.01]
Psychiatrists/100k	-0.0000949	0.000647	-0.000441	-0.0105*	0.0000943	0.999	1.000	1.008***
	[-0.00,0.00]	[-0.00,0.00]	[-0.00,0.00]	[-0.02,0.00]	[-0.00,0.00]	[1.00,1.00]	[0.99,1.01]	[1.00,1.01]
Year								
2011	0.00718	0.00978	0.0193	-0.163	0.00318	1.041	1.089	0.865
	[-0.01,0.02]	[-0.03,0.05]	[-0.02,0.06]	[-0.62,0.29]	[-0.03,0.04]	[0.92,1.18]	[0.74,1.61]	[0.67,1.11]
2012	0.00534	0.0167	0.0248	0.143	-0.0174	0.908	1.738**	0.893
	[-0.01,0.02]	[-0.02,0.06]	[-0.02,0.07]	[-0.34,0.62]	[-0.05,0.02]	[0.80,1.04]	[1.10,2.75]	[0.73,1.10]
2013	0.00680	0.00219	0.0101	-0.232	0.00186	0.887	1.242	1.095
	[-0.01,0.02]	[-0.04,0.05]	[-0.04,0.06]	[-0.69,0.23]	[-0.03,0.04]	[0.75,1.05]	[0.90,1.71]	[0.83,1.44]
2014	0.0127	0.0418*	0.0488*	-0.339	-0.00653	1.092	1.035	1.039
	[-0.00,0.03]	[-0.01,0.09]	[-0.01,0.10]	[-0.94,0.27]	[-0.05,0.04]	[0.93,1.28]	[0.72,1.49]	[0.76,1.41]
2015	0.0211**	0.0585**	0.0818***	-0.380	-0.0647***	1.096	0.852	0.785
	[0.00,0.04]	[0.01,0.11]	[0.03,0.13]	[-0.92,0.16]	[-0.11,-0.02]	[0.92,1.31]	[0.58,1.25]	[0.57,1.08]
2016	0.0232**	0.0397	0.0342	-0.247	-0.0107	0.997	1.055	0.827
	[0.00,0.04]	[-0.01,0.09]	[-0.02,0.09]	[-0.86,0.36]	[-0.05,0.03]	[0.83,1.20]	[0.74,1.50]	[0.60,1.15]
2017	0.0113	0.0362	0.0357	-0.487	-0.122***	1.074	0.838	1.221
	[-0.01,0.03]	[-0.02,0.09]	[-0.02,0.09]	[-1.08,0.11]	[-0.17,-0.07]	[0.89,1.29]	[0.55,1.27]	[0.87,1.72]
2018	0.0195*	0.0317	0.0821***	-0.456	-0.110***	1.079	1.148	1.012
	[-0.00,0.04]	[-0.02,0.09]	[0.03,0.14]	[-1.04,0.13]	[-0.16,-0.06]	[0.91,1.28]	[0.74,1.79]	[0.74,1.38]
Constant	0.0238	0.118**	0.171***	9.665***	0.651***	-	-	-
	[-0.01,0.06]	[0.01,0.23]	[0.07,0.27]	[8.79,10.54]	[0.59,0.72]	-	-	-
Observations	310928	310928	310928	310928	310799	301770	179558	295465

95% confidence intervals in brackets

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix A. Table 11. TWFE, DID Medicaid Expansion, 138% FPL, MH Sub-sample

	Any Utilization (LPM)			Self-Reported Outcome (LPM)		Number of Visits, Conditional on Any (Poisson, IRR)		
	Any MH related ED	Any MH Outpatient	Any MH Rx	Kessler 6 Scale	Accomplished ANY less due to MH	Rx count	ED count	MH Outpatient count
Expansion	-0.00773	0.0119	-0.00201	0.133	0.0129	0.968	1.512***	1.438***
	[-0.02,0.01]	[-0.03,0.05]	[-0.04,0.04]	[-0.27,0.54]	[-0.02,0.04]	[0.85,1.10]	[1.24,1.85]	[1.14,1.81]
Age								
25-35	-0.00568	0.0242	0.0834***	0.714***	0.0625***	1.358***	1.011	1.242
	[-0.02,0.01]	[-0.01,0.06]	[0.05,0.12]	[0.39,1.03]	[0.03,0.10]	[1.15,1.60]	[0.82,1.25]	[0.95,1.62]
36-50	0.00687	0.0660***	0.139***	1.161***	0.123***	1.790***	0.997	1.299*
	[-0.01,0.02]	[0.03,0.10]	[0.10,0.17]	[0.87,1.46]	[0.09,0.16]	[1.53,2.09]	[0.79,1.26]	[0.96,1.75]
51-64	-0.00451	0.0179	0.199***	0.761***	0.149***	1.581***	0.935	1.166
	[-0.02,0.01]	[-0.02,0.05]	[0.16,0.24]	[0.41,1.12]	[0.11,0.18]	[1.35,1.85]	[0.69,1.27]	[0.82,1.65]
Female	0.00513	0.0426***	0.0785***	0.154	0.0397***	1.012	0.869**	0.839***
	[-0.00,0.01]	[0.02,0.06]	[0.06,0.10]	[-0.07,0.38]	[0.02,0.06]	[0.94,1.09]	[0.76,1.00]	[0.74,0.96]
Education (ref=less than HS)								
High School	0.000422	0.0267**	0.0255*	-0.190*	-0.0104	1.022	0.879	1.235**
	[-0.01,0.01]	[0.00,0.05]	[-0.00,0.05]	[-0.41,0.04]	[-0.03,0.01]	[0.93,1.12]	[0.69,1.12]	[1.05,1.46]
More than HS	0.00599	0.0495***	0.0530***	-0.599***	-0.00709	1.048	0.842*	1.332***
	[-0.00,0.01]	[0.02,0.08]	[0.02,0.08]	[-0.88,-0.32]	[-0.03,0.02]	[0.95,1.15]	[0.70,1.01]	[1.13,1.58]
Other/unknown	0.00611	0.0335	0.0488*	-0.671**	-0.0222	0.996	1.321*	1.267
	[-0.01,0.02]	[-0.02,0.08]	[-0.00,0.10]	[-1.23,-0.12]	[-0.06,0.02]	[0.86,1.16]	[0.95,1.83]	[0.93,1.73]
Chronic Conditions								
1-2	0.00753*	0.107***	0.163***	1.012***	0.0667***	1.189**	1.122	1.057
	[-0.00,0.02]	[0.08,0.13]	[0.14,0.19]	[0.78,1.24]	[0.04,0.09]	[1.03,1.37]	[0.94,1.34]	[0.81,1.37]
3+	0.00541	0.182***	0.325***	2.390***	0.137***	1.359***	1.145*	1.144
	[-0.00,0.01]	[0.15,0.21]	[0.30,0.35]	[2.09,2.69]	[0.11,0.16]	[1.19,1.55]	[0.99,1.32]	[0.86,1.52]
Race/Ethnicity								
Hispanic	0.00142	-0.0921***	-0.138***	-0.377**	-0.0302**	0.888**	0.993	0.798**
	[-0.01,0.01]	[-0.12,-0.07]	[-0.17,-0.11]	[-0.69,-0.06]	[-0.05,-0.01]	[0.79,1.00]	[0.74,1.33]	[0.67,0.96]
Black/African	-0.00314	-0.116***	-0.171***	-0.523***	-0.0537***	0.715***	0.823**	1.023

American								
	[-0.01,0.00]	[-0.14,-0.09]	[-0.20,-0.14]	[-0.77,-0.27]	[-0.07,-0.03]	[0.66,0.78]	[0.70,0.96]	[0.85,1.23]
Alaskan/Native	-0.0117	-0.0869*	-0.0819	0.395	0.0342	1.033	1.489	0.769
American								
	[-0.03,0.00]	[-0.19,0.02]	[-0.19,0.02]	[-0.80,1.59]	[-0.03,0.09]	[0.82,1.30]	[0.80,2.77]	[0.49,1.21]
Asian	-0.0159***	-0.168***	-0.208***	-0.547**	-0.0574**	0.526***	0.717	1.483
	[-0.02,-0.01]	[-0.21,-0.12]	[-0.26,-0.16]	[-1.05,-0.05]	[-0.11,-0.01]	[0.40,0.69]	[0.36,1.44]	[0.89,2.46]
Multiple/Other	0.0197	-0.0123	-0.0305	0.179	0.0410**	0.922	0.914	1.466***
	[-0.01,0.05]	[-0.07,0.04]	[-0.09,0.03]	[-0.45,0.81]	[0.00,0.08]	[0.79,1.07]	[0.74,1.13]	[1.14,1.88]
Married	-0.0125***	-0.0690***	-0.0416***	-0.728***	-0.0179*	0.824***	0.855*	0.803***
	[-0.02,-0.01]	[-0.09,-0.04]	[-0.07,-0.02]	[-0.99,-0.47]	[-0.04,0.00]	[0.76,0.89]	[0.71,1.03]	[0.69,0.93]
Percent FPL	-0.000451	-0.000245	-0.00129	0.00663	0.00123	0.999	0.984**	0.998
	[-0.00,0.00]	[-0.00,0.00]	[-0.00,0.00]	[-0.01,0.03]	[-0.00,0.00]	[0.99,1.01]	[0.97,1.00]	[0.98,1.02]
Psychiatrist/100k	-0.000105	0.000405	-0.000535	-0.0115**	0.0000365	0.999	0.999	1.009***
	[-0.00,0.00]	[-0.00,0.00]	[-0.00,0.00]	[-0.02,-0.00]	[-0.00,0.00]	[1.00,1.00]	[0.99,1.01]	[1.01,1.01]
Year								
2011	0.00545	0.00304	0.0332*	-0.199	0.00300	1.046	1.025	0.851
	[-0.01,0.02]	[-0.03,0.04]	[-0.00,0.07]	[-0.58,0.18]	[-0.03,0.03]	[0.93,1.17]	[0.73,1.45]	[0.69,1.05]
2012	0.00236	0.00919	0.0382**	0.0315	-0.0133	0.951	1.584**	0.951
	[-0.01,0.01]	[-0.03,0.04]	[0.00,0.08]	[-0.35,0.41]	[-0.04,0.02]	[0.85,1.07]	[1.07,2.35]	[0.78,1.16]
2013	0.00851	0.0125	0.0314	-0.0993	-0.00908	0.956	1.153	1.138
	[-0.00,0.02]	[-0.03,0.05]	[-0.01,0.07]	[-0.48,0.28]	[-0.04,0.02]	[0.83,1.10]	[0.89,1.49]	[0.90,1.43]
2014	0.00691	0.0395*	0.0512**	-0.333	-0.00271	1.087	1.012	0.967
	[-0.01,0.02]	[-0.00,0.08]	[0.01,0.10]	[-0.84,0.17]	[-0.04,0.03]	[0.94,1.26]	[0.74,1.39]	[0.74,1.25]
2015	0.0167**	0.0518**	0.0874***	-0.412*	-0.0507**	1.008	0.820	0.766**
	[0.00,0.03]	[0.01,0.09]	[0.04,0.13]	[-0.87,0.05]	[-0.09,-0.01]	[0.86,1.19]	[0.60,1.12]	[0.59,1.00]
2016	0.0158*	0.0328	0.0443*	-0.377	-0.0284	0.972	1.043	0.827
	[-0.00,0.03]	[-0.01,0.08]	[-0.00,0.09]	[-0.91,0.15]	[-0.07,0.01]	[0.82,1.15]	[0.76,1.43]	[0.62,1.10]
2017	0.00929	0.0391*	0.0554**	-0.496*	-0.108***	1.047	0.790	1.133
	[-0.01,0.02]	[-0.01,0.08]	[0.00,0.11]	[-1.04,0.05]	[-0.15,-0.06]	[0.89,1.24]	[0.58,1.08]	[0.83,1.55]
2018	0.0140*	0.0453*	0.0763***	-0.580**	-0.136***	1.049	1.174	0.942
	[-0.00,0.03]	[-0.01,0.10]	[0.03,0.13]	[-1.09,-0.07]	[-0.18,-0.09]	[0.90,1.23]	[0.83,1.66]	[0.72,1.24]
Constant	0.0260	0.131**	0.144***	9.814***	0.651***	-	-	-
	[-0.01,0.06]	[0.01,0.25]	[0.04,0.24]	[9.05,10.58]	[0.58,0.72]	-	-	-
Observations	310925	310925	310925	310925	310761	300202	197300	295297

95% confidence intervals in brackets

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix A. Table 12 TWFE, DID Medicaid Expansion, 200% FPL, MH Sub-sample

	Any Utilization (LPM)			Self-Reported Outcome (LPM)		Number of Visits, Conditional on Any (Poisson, IRR)		
	Any MH related ED	Any MH Outpatient	Any MH Rx	Kessler 6 Scale	Accomplished ANY less due to MH	Rx count	ED count	MH Outpatient count
Expansion	-0.00562	0.0226	-0.00424	0.112	0.00428	1.001	1.393***	1.411***
	[-0.02,0.00]	[-0.01,0.05]	[-0.04,0.03]	[-0.23,0.46]	[-0.02,0.03]	[0.89,1.12]	[1.16,1.67]	[1.13,1.75]
Age								
25-35	-0.00497	0.0233*	0.0936***	0.519***	0.0485***	1.371***	0.972	1.158
	[-0.02,0.01]	[-0.00,0.05]	[0.06,0.13]	[0.25,0.79]	[0.02,0.08]	[1.19,1.57]	[0.81,1.17]	[0.95,1.42]
36-50	0.00145	0.0414***	0.132***	0.853***	0.0903***	1.703***	1.018	1.271**
	[-0.01,0.01]	[0.01,0.07]	[0.10,0.16]	[0.59,1.12]	[0.06,0.12]	[1.49,1.95]	[0.83,1.25]	[1.01,1.60]
51-64	-0.00696	0.000978	0.173***	0.472***	0.118***	1.536***	0.934	1.174
	[-0.02,0.00]	[-0.03,0.03]	[0.14,0.21]	[0.14,0.80]	[0.09,0.15]	[1.33,1.77]	[0.73,1.19]	[0.88,1.57]
Female	0.00657**	0.0461***	0.0895***	0.197**	0.0414***	1.010	0.885**	0.904*
	[0.00,0.01]	[0.03,0.06]	[0.07,0.11]	[0.01,0.38]	[0.03,0.06]	[0.94,1.08]	[0.79,0.99]	[0.80,1.02]
Education (ref=less than HS)								
High School	0.00245	0.0109	0.0188	-0.205*	-0.0200**	1.029	0.857	1.279***
	[-0.00,0.01]	[-0.01,0.03]	[-0.01,0.04]	[-0.41,0.00]	[-0.04,-0.00]	[0.95,1.12]	[0.70,1.05]	[1.10,1.48]
More than HS	0.00336	0.0439***	0.0430***	-0.619***	-0.0118	1.037	0.805***	1.371***
	[-0.00,0.01]	[0.02,0.07]	[0.01,0.07]	[-0.87,-0.37]	[-0.03,0.01]	[0.95,1.13]	[0.69,0.94]	[1.19,1.58]
Other/unknown	0.00461	0.0378*	0.0510**	-0.634***	-0.00613	1.060	1.333*	1.378**
	[-0.01,0.02]	[-0.01,0.08]	[0.01,0.09]	[-1.05,-0.21]	[-0.04,0.03]	[0.94,1.20]	[0.98,1.81]	[1.07,1.78]
Chronic Conditions								
1-2	0.00831***	0.0859***	0.146***	0.994***	0.0689***	1.211***	1.026	1.081
	[0.00,0.01]	[0.06,0.11]	[0.12,0.17]	[0.80,1.19]	[0.05,0.09]	[1.08,1.36]	[0.86,1.22]	[0.87,1.35]
3+	0.00849**	0.170***	0.322***	2.463***	0.144***	1.411***	1.117	1.173
	[0.00,0.02]	[0.14,0.20]	[0.29,0.35]	[2.21,2.72]	[0.12,0.17]	[1.26,1.58]	[0.95,1.31]	[0.91,1.52]
Race/Ethnicity								
Hispanic	0.00404	-0.0940***	-0.142***	-0.398***	-0.0419***	0.880**	1.014	0.841**
	[-0.00,0.01]	[-0.12,-0.07]	[-0.17,-0.12]	[-0.67,-0.13]	[-0.06,-0.02]	[0.79,0.98]	[0.83,1.24]	[0.71,0.99]
Black/African American	-0.00173	-0.114***	-0.175***	-0.493***	-0.0614***	0.740***	0.872**	1.047
	[-0.01,0.01]	[-0.14,-0.09]	[-0.20,-0.15]	[-0.72,-0.27]	[-0.08,-0.04]	[0.68,0.80]	[0.76,1.00]	[0.88,1.24]
Alaskan/Native American	-0.0111*	-0.0613	-0.0733	0.512	0.0108	1.068	0.746	0.776

	[-0.02,0.00]	[-0.15,0.03]	[-0.16,0.01]	[-0.44,1.47]	[-0.06,0.08]	[0.87,1.32]	[0.44,1.26]	[0.54,1.11]
Asian	-0.0137***	-0.169***	-0.216***	-0.537**	-0.0545**	0.570***	0.697	1.454
	[-0.02,-0.01]	[-0.21,-0.13]	[-0.26,-0.17]	[-0.97,-0.10]	[-0.10,-0.01]	[0.44,0.74]	[0.36,1.36]	[0.85,2.49]
Multiple/Other	0.0150	-0.00551	-0.0345	0.190	0.0313	0.997	0.843	1.403***
	[-0.01,0.04]	[-0.06,0.04]	[-0.08,0.02]	[-0.35,0.73]	[-0.01,0.07]	[0.86,1.15]	[0.67,1.06]	[1.13,1.75]
Married	-0.0108***	-0.0802***	-0.0526***	-0.650***	-0.0316***	0.803***	0.897	0.821***
	[-0.02,-0.01]	[-0.10,-0.06]	[-0.07,-0.03]	[-0.86,-0.44]	[-0.05,-0.02]	[0.75,0.86]	[0.77,1.04]	[0.72,0.93]
Percent FPL	-0.000468*	-0.000284	-0.00155	0.0122	0.00144**	1.001	0.987*	0.998
	[-0.00,0.00]	[-0.00,0.00]	[-0.00,0.00]	[-0.01,0.03]	[0.00,0.00]	[1.00,1.01]	[0.97,1.00]	[0.98,1.01]
Psychiatrists 100k	-0.00000130	0.000400	-0.000561	-0.0102**	-0.00000244	1.000	0.999	1.009***
	[-0.00,0.00]	[-0.00,0.00]	[-0.00,0.00]	[-0.02,-0.00]	[-0.00,0.00]	[1.00,1.00]	[0.99,1.01]	[1.01,1.01]
Year								
2011	0.00180	-0.0133	0.0250	-0.0659	-0.0169	1.052	0.892	0.847*
	[-0.01,0.01]	[-0.04,0.01]	[-0.01,0.06]	[-0.37,0.24]	[-0.04,0.01]	[0.95,1.16]	[0.66,1.21]	[0.71,1.01]
2012	0.00238	-0.00403	0.0186	-0.00553	-0.0305**	0.989	1.270	0.927
	[-0.01,0.01]	[-0.03,0.03]	[-0.02,0.05]	[-0.36,0.34]	[-0.06,-0.00]	[0.89,1.10]	[0.94,1.72]	[0.77,1.11]
2013	0.00677	0.00265	0.0195	-0.0840	-0.0308**	0.999	1.041	1.115
	[-0.00,0.02]	[-0.03,0.04]	[-0.02,0.06]	[-0.43,0.26]	[-0.06,-0.00]	[0.88,1.13]	[0.86,1.26]	[0.91,1.36]
2014	0.00725	0.0211	0.0499**	-0.203	-0.0253	1.083	0.991	0.953
	[-0.00,0.02]	[-0.02,0.06]	[0.01,0.09]	[-0.65,0.25]	[-0.06,0.01]	[0.95,1.24]	[0.78,1.26]	[0.74,1.23]
2015	0.0151**	0.0461***	0.0788***	-0.271	-0.0555***	1.024	0.790	0.778**
	[0.00,0.03]	[0.01,0.08]	[0.04,0.12]	[-0.72,0.18]	[-0.09,-0.02]	[0.88,1.19]	[0.60,1.05]	[0.62,0.98]
2016	0.0116*	0.0258	0.0344	-0.450**	-0.0527***	0.974	0.972	0.859
	[-0.00,0.02]	[-0.01,0.06]	[-0.01,0.08]	[-0.90,-0.00]	[-0.09,-0.02]	[0.84,1.14]	[0.76,1.24]	[0.65,1.13]
2017	0.00931	0.0260	0.0490**	-0.509**	-0.125***	1.041	0.776*	1.105
	[-0.00,0.02]	[-0.01,0.06]	[0.01,0.09]	[-0.98,-0.04]	[-0.16,-0.09]	[0.90,1.20]	[0.60,1.00]	[0.84,1.45]
2018	0.0106*	0.0398*	0.0629***	-0.522**	-0.125***	1.092	1.121	0.911
	[-0.00,0.02]	[-0.00,0.08]	[0.02,0.11]	[-0.96,-0.08]	[-0.17,-0.08]	[0.95,1.26]	[0.84,1.49]	[0.71,1.16]
Constant	0.0231*	0.163**	0.173***	9.584***	0.680***	-	-	-
	[-0.00,0.05]	[0.03,0.30]	[0.06,0.29]	[8.82,10.35]	[0.62,0.74]	-	-	-
Observations	311341	311341	311341	311341	311112	298574	214101	294036

95% confidence intervals in brackets

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix A. Table 13. Medicaid Expansion by MH HPSA Shortage Area, Full Sample at 138% FPL

	Any Utilization (LPM)			Self-Reported Outcome (LPM)		Any Utilization (LPM)			Self-Reported Outcome (LPM)	
	Any MH related ED	Any MH Outpatient	Any MH Rx	Kessler 6 Scale	Accomplished ANY less due to MH	Any MH related ED	Any MH Outpatient	Any MH Rx	Kessler 6 Scale	Accomplished ANY less due to MH
	Shortage					No or Partial Shortage				
Expansion										
Medicaid expansion State	-0.0350**	0.0304	0.0672	2.158***	0.224***	0.0264**	0.0353	-0.0689**	-0.0619	-0.0669
	[-0.06,-0.01]	[-0.07,0.13]	[-0.02,0.15]	[0.68,3.64]	[0.16,0.29]	[0.00,0.05]	[-0.02,0.09]	[-0.13,-0.01]	[-1.36,1.24]	[-0.18,0.04]
Post-ME	0.000357	0.0325	0.0330	-0.520	-0.129***	0.000956	0.0119	0.0325**	-1.196***	-0.165***
	[-0.01,0.01]	[-0.01,0.07]	[-0.02,0.08]	[-1.32,0.28]	[-0.19,-0.06]	[-0.01,0.01]	[-0.02,0.04]	[0.00,0.06]	[-1.69,-0.70]	[-0.21,-0.12]
Medicaid expansion State * Post ME	-0.00992	0.0182	-0.00524	-0.316	-0.0340	0.00219	0.0135	0.0205	0.304	0.0150
	[-0.02,0.00]	[-0.03,0.07]	[-0.07,0.06]	[-1.11,0.48]	[-0.11,0.04]	[-0.00,0.01]	[-0.02,0.04]	[-0.01,0.05]	[-0.13,0.74]	[-0.03,0.06]
Age										
25-35	0.00648	0.0229	0.0759***	0.931***	0.0791***	-0.00208	0.0164	0.0446***	0.768***	0.0425***
	[-0.00,0.02]	[-0.01,0.05]	[0.04,0.11]	[0.49,1.38]	[0.04,0.12]	[-0.01,0.00]	[-0.00,0.04]	[0.02,0.07]	[0.47,1.06]	[0.01,0.07]
36-50	0.00751**	0.0314**	0.102***	1.330***	0.130***	0.00692**	0.0460***	0.0889***	1.137***	0.0870***
	[0.00,0.01]	[0.00,0.06]	[0.07,0.14]	[0.82,1.84]	[0.09,0.17]	[0.00,0.01]	[0.02,0.07]	[0.06,0.11]	[0.82,1.45]	[0.06,0.12]
51-64	0.00591	-0.0209	0.0912***	0.534	0.145***	-0.00259	0.00333	0.0988***	0.421**	0.107***
	[-0.01,0.02]	[-0.06,0.01]	[0.05,0.13]	[-0.13,1.20]	[0.10,0.19]	[-0.01,0.00]	[-0.02,0.03]	[0.07,0.13]	[0.07,0.77]	[0.07,0.14]
Female	0.00648	0.0229	0.0759***	0.931***	0.0791***	-0.00208	0.0164	0.0446***	0.768***	0.0425***
	[-0.00,0.02]	[-0.01,0.05]	[0.04,0.11]	[0.49,1.38]	[0.04,0.12]	[-0.01,0.00]	[-0.00,0.04]	[0.02,0.07]	[0.47,1.06]	[0.01,0.07]
Education (ref=less than HS)										
High School	-0.00287	0.00458	0.00692	-0.151	-0.0457**	-0.000719	0.00936	-0.00335	-0.306*	-0.0348***
	[-0.01,0.01]	[-0.02,0.03]	[-0.03,0.04]	[-0.62,0.32]	[-0.08,-0.01]	[-0.01,0.00]	[-0.01,0.03]	[-0.03,0.02]	[-0.63,0.02]	[-0.06,-0.01]
More than HS	-0.000801	0.00566	0.0151	-0.542*	-0.0485**	-0.00334	0.0201**	0.0175	-0.586***	-0.0548***
	[-0.01,0.01]	[-0.03,0.04]	[-0.03,0.06]	[-1.11,0.03]	[-0.09,-0.00]	[-0.01,0.00]	[0.00,0.04]	[-0.01,0.04]	[-0.91,-0.26]	[-0.08,-0.03]
Other/unknown	-0.00285	-0.0303	-0.00959	-0.765*	-0.0503	-0.000000336	0.0331*	0.0187	-0.510*	-0.0606**
	[-0.02,0.01]	[-0.08,0.01]	[-0.07,0.05]	[-1.54,0.01]	[-0.12,0.02]	[-0.01,0.01]	[-0.00,0.07]	[-0.02,0.06]	[-1.04,0.02]	[-0.11,-0.01]

Chronic Conditions										
1-2	0.000455	0.0566***	0.104***	1.545***	0.133***	0.00653***	0.0790***	0.129***	1.789***	0.161***
	[-0.01,0.01]	[0.03,0.08]	[0.07,0.13]	[1.19,1.90]	[0.10,0.17]	[0.00,0.01]	[0.06,0.10]	[0.11,0.15]	[1.54,2.04]	[0.14,0.18]
3+	0.00398	0.185***	0.366***	4.685***	0.348***	0.0119***	0.177***	0.336***	4.336***	0.346***
	[-0.01,0.02]	[0.14,0.23]	[0.32,0.41]	[4.05,5.32]	[0.31,0.39]	[0.00,0.02]	[0.15,0.20]	[0.31,0.37]	[3.91,4.76]	[0.31,0.38]
Race/Ethnicity										
Hispanic	-0.00268	-0.0707***	-0.128***	-0.996***	-0.0199	-0.00267	-0.0676***	-0.110***	-1.167***	-0.0448***
	[-0.01,0.00]	[-0.10,-0.04]	[-0.17,-0.09]	[-1.48,-0.51]	[-0.06,0.02]	[-0.01,0.00]	[-0.09,-0.05]	[-0.13,-0.09]	[-1.54,-0.79]	[-0.07,-0.02]
Black/African American	-0.00913**	-0.102***	-0.161***	-0.809***	-0.0470**	-0.000687	-0.0866***	-0.124***	-1.236***	-0.0765***
	[-0.02,-0.00]	[-0.13,-0.07]	[-0.19,-0.13]	[-1.23,-0.38]	[-0.09,-0.01]	[-0.01,0.00]	[-0.10,-0.07]	[-0.14,-0.10]	[-1.52,-0.95]	[-0.10,-0.05]
Alaskan/Native American	-0.00517	0.0405	-0.0398	-1.370	-0.127*	0.00105	-0.0216	-0.0255	0.389	0.00815
	[-0.02,0.01]	[-0.04,0.12]	[-0.14,0.06]	[-3.36,0.62]	[-0.26,0.01]	[-0.01,0.01]	[-0.07,0.03]	[-0.08,0.03]	[-0.56,1.33]	[-0.07,0.09]
Asian	0.00528	-0.0566**	-0.0862*	-1.091**	-0.0850*	-0.00400	-0.0778***	-0.128***	-0.899***	-0.0477*
	[-0.03,0.04]	[-0.11,-0.00]	[-0.17,0.00]	[-2.13,-0.05]	[-0.18,0.01]	[-0.01,0.00]	[-0.11,-0.05]	[-0.17,-0.09]	[-1.53,-0.27]	[-0.10,0.01]
Multiple/Other	-0.00297	-0.0345	-0.0342	2.135***	0.161***	0.0113	0.0435*	0.0330	0.762*	0.0724**
	[-0.02,0.02]	[-0.10,0.03]	[-0.15,0.08]	[0.90,3.36]	[0.08,0.25]	[-0.01,0.03]	[-0.01,0.09]	[-0.02,0.08]	[-0.03,1.55]	[0.01,0.14]
Married	-0.0139***	-0.0455***	-0.0555***	-1.138***	-0.0744***	-0.00622***	-0.0801***	-0.0890***	-1.479***	-0.105***
	[-0.02,-0.01]	[-0.07,-0.02]	[-0.09,-0.02]	[-1.52,-0.75]	[-0.10,-0.05]	[-0.01,-0.00]	[-0.10,-0.06]	[-0.11,-0.07]	[-1.78,-1.18]	[-0.13,-0.08]
Percent of FPL	0.000419	0.00129*	-0.000675	0.00927	0.00167	-0.000368*	-0.00106	-0.000528	0.0225	0.00221*
	[-0.00,0.00]	[-0.00,0.00]	[-0.00,0.00]	[-0.02,0.04]	[-0.00,0.00]	[-0.00,0.00]	[-0.00,0.00]	[-0.00,0.00]	[-0.01,0.06]	[-0.00,0.00]
Year										
2011	0.00507	0.0238*	-0.000827	-0.205	0.00552	0.00362	0.00339	0.0207	0.0587	0.0128
	[-0.00,0.01]	[-0.00,0.05]	[-0.03,0.03]	[-0.64,0.23]	[-0.04,0.05]	[-0.00,0.01]	[-0.02,0.03]	[-0.01,0.05]	[-0.29,0.41]	[-0.02,0.05]
2012	0.00194	0.0292*	0.0138	0.166	0.0202	0.00459	0.0195	0.0379***	0.0543	-0.00109
	[-0.01,0.01]	[-0.00,0.06]	[-0.02,0.05]	[-0.35,0.68]	[-0.03,0.07]	[-0.00,0.01]	[-0.00,0.04]	[0.01,0.07]	[-0.36,0.47]	[-0.04,0.04]
2013	-0.000688	0.0423*	0.0359	-0.0661	-0.00477	0.00599	-0.00665	-0.00664	-0.361	-0.0193
	[-0.01,0.01]	[-0.00,0.09]	[-0.01,0.08]	[-0.68,0.55]	[-0.05,0.04]	[-0.00,0.01]	[-0.03,0.02]	[-0.03,0.02]	[-0.82,0.10]	[-0.06,0.02]
2016	0.0119*	0.0125	0.0166	-0.169	0.0855**	0.00508	-0.0100	-0.0321**	0.175	0.119***
	[-0.00,0.03]	[-0.03,0.05]	[-0.03,0.07]	[-0.99,0.65]	[0.02,0.16]	[-0.00,0.01]	[-0.04,0.02]	[-0.06,-0.01]	[-0.26,0.61]	[0.08,0.16]
2017	0.00821	-0.00406	0.000665	-0.521	-0.0294	0.00225	-0.0126	-0.0355***	-0.122	0.00811
	[-0.00,0.02]	[-0.04,0.03]	[-0.05,0.05]	[-1.33,0.28]	[-0.10,0.04]	[-0.01,0.01]	[-0.04,0.01]	[-0.06,-	[-0.49,0.24]	[-0.03,0.04]

								0.01]		
2018	0	0	0	0	0	0	0	0	0	0
	[0.00,0.00]	[0.00,0.00]	[0.00,0.00]	[0.00,0.00]	[0.00,0.00]	[0.00,0.00]	[0.00,0.00]	[0.00,0.00]	[0.00,0.00]	[0.00,0.00]
Constant	0.0182	0.0506	0.106**	3.415***	0.236***	-	-	-	-	-
	[-0.01,0.05]	[-0.05,0.15]	[0.02,0.19]	[2.10,4.73]	[0.15,0.32]	-	-	-	-	-
Observations	284004	284004	284004	278804	280286	306262	306262	306262	302144	302721

95% confidence intervals in brackets

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix A. Table 14. Medicaid Expansion by MH HRSA Shortage Area, Full Sample at 138% FPL

	Number of Visits, Conditional on Any (Poisson, IRR)			Number of Visits, Conditional on Any (Poisson, IRR)		
	Rx count	ED count	MH Outpatient count	Rx count	ED count	MH Outpatient count
	Shortage			No/Partial Shortage		
Expansion						
Medicaid expansion State	1.451**	1.033	0.367***	1.931***	0.562**	0.784
	[1.07,1.98]	[0.49,2.17]	[0.21,0.65]	[1.23,3.04]	[0.34,0.93]	[0.53,1.16]
Post-ME	0.925	0.578**	1.209	1.035	1.034	0.941
	[0.74,1.15]	[0.35,0.95]	[0.77,1.91]	[0.86,1.25]	[0.62,1.71]	[0.67,1.33]
Medicaid expansion State * Post ME	1.180*	1.693**	2.120***	0.889	1.683***	1.152
	[0.97,1.43]	[1.12,2.56]	[1.32,3.41]	[0.73,1.08]	[1.18,2.40]	[0.77,1.72]
Age						
25-35	1.095	0.671**	0.883	1.233**	0.849	1.254
	[0.87,1.37]	[0.49,0.93]	[0.62,1.26]	[1.01,1.50]	[0.64,1.13]	[0.88,1.78]
36-50	1.317***	0.950	1.156	1.657***	0.922	1.462**
	[1.08,1.61]	[0.66,1.37]	[0.84,1.60]	[1.37,2.01]	[0.64,1.33]	[1.05,2.04]
51-64	1.145	0.661**	0.949	1.397***	1.046	1.330
	[0.93,1.41]	[0.48,0.91]	[0.63,1.42]	[1.15,1.69]	[0.67,1.63]	[0.88,2.01]
Female	1.185***	0.962	0.820	0.950	0.874	0.690***
	[1.05,1.34]	[0.75,1.23]	[0.63,1.06]	[0.86,1.05]	[0.70,1.09]	[0.56,0.86]
Education (ref=less than HS)						
High School	1.018	0.809*	1.250*	1.003	0.588***	1.026
	[0.89,1.17]	[0.63,1.03]	[1.00,1.57]	[0.88,1.14]	[0.41,0.83]	[0.76,1.39]
More than HS	1.124	1.225	1.331**	0.928	0.645***	1.111
	[0.96,1.31]	[0.96,1.57]	[1.01,1.76]	[0.82,1.04]	[0.48,0.86]	[0.81,1.53]
Other/unknown	1.244*	1.313	1.425	0.853**	1.113	1.210
	[0.98,1.58]	[0.82,2.10]	[0.90,2.24]	[0.73,1.00]	[0.61,2.03]	[0.67,2.19]
Chronic Conditions						
1-2	1.232**	0.998	1.380*	1.265***	1.225	1.196
	[1.04,1.46]	[0.73,1.37]	[0.98,1.94]	[1.10,1.46]	[0.90,1.67]	[0.91,1.57]
3+	1.675***	1.252	1.191	1.501***	1.127	1.278
	[1.37,2.05]	[0.91,1.72]	[0.81,1.75]	[1.33,1.70]	[0.89,1.43]	[0.92,1.77]
Race/Ethnicity						
Hispanic	0.921	0.855	1.118	0.821***	1.076	0.638***
	[0.68,1.25]	[0.61,1.19]	[0.71,1.77]	[0.72,0.94]	[0.79,1.47]	[0.49,0.83]
Black/African American	0.674***	0.762**	1.365*	0.739***	0.811*	1.187
	[0.59,0.77]	[0.60,0.96]	[0.97,1.92]	[0.66,0.83]	[0.65,1.02]	[0.91,1.56]
Alaskan/Native American	0.963	2.831***	0.996	1.242	0.837	0.832

	[0.67,1.38]	[1.53,5.22]	[0.50,1.99]	[0.93,1.66]	[0.33,2.12]	[0.58,1.20]
Asian	0.728	1.415	1.391	0.525***	1.994	1.741
	[0.39,1.34]	[0.80,2.51]	[0.55,3.53]	[0.34,0.81]	[0.85,4.68]	[0.83,3.64]
Multiple/Other	0.798	0.500**	1.231	0.953	0.787	1.478**
	[0.61,1.05]	[0.28,0.90]	[0.74,2.04]	[0.75,1.21]	[0.58,1.06]	[1.01,2.16]
Married	0.802***	0.855	0.694***	0.768***	0.693**	0.823*
	[0.70,0.92]	[0.66,1.10]	[0.53,0.90]	[0.69,0.86]	[0.49,0.97]	[0.65,1.04]
Percent FPL	0.992*	1.010	0.988	1.009**	0.961***	0.996
	[0.98,1.00]	[0.99,1.03]	[0.96,1.01]	[1.00,1.02]	[0.94,0.98]	[0.96,1.03]
Year						
2011	0.975	1.127	0.854	1.054	0.809	0.937
	[0.83,1.15]	[0.80,1.58]	[0.59,1.24]	[0.92,1.21]	[0.46,1.41]	[0.70,1.25]
2012	0.966	1.932***	1.120	0.974	1.663**	0.883
	[0.81,1.15]	[1.34,2.79]	[0.69,1.81]	[0.84,1.13]	[1.11,2.48]	[0.63,1.24]
2013	1.011	1.270	1.508*	0.932	1.267	1.031
	[0.84,1.21]	[0.92,1.76]	[0.98,2.31]	[0.78,1.11]	[0.92,1.75]	[0.75,1.42]
2016	0.856*	2.435***	0.737*	0.973	0.934	0.838
	[0.72,1.02]	[1.70,3.49]	[0.52,1.05]	[0.85,1.11]	[0.67,1.30]	[0.65,1.09]
2017	0.969	1.515*	0.798	1.043	0.684**	1.140
	[0.82,1.15]	[0.95,2.41]	[0.53,1.19]	[0.92,1.18]	[0.50,0.94]	[0.82,1.59]
2018	1	1	1	1	1	1
	[1.00,1.00]	[1.00,1.00]	[1.00,1.00]	[1.00,1.00]	[1.00,1.00]	[1.00,1.00]
Observations	231489	66527	185272	270119	128514	262065

Exponentiated coefficients; 95% confidence intervals in brackets

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix A. Table 15. Medicaid Expansion by MH HRSA Shortage Area, MH Subsample at 138% FPL

	Any Utilization (LPM)			Self-Reported Outcome (LPM)		Any Utilization (LPM)			Self-Reported Outcome (LPM)	
	Any MH related ED	Any MH Outpatient	Any MH Rx	Kessler 6 Scale	Accomplished ANY less due to MH	Any MH related ED	Any MH Outpatient	Any MH Rx	Kessler 6 Scale	Accomplished ANY less due to MH
	Shortage					No or Partial Shortage				
Expansion										
Medicaid expansion State	-0.0569***	-0.0304	0.0596	0.302	0.0580	0.0651**	0.112*	-0.0135	0.235	-0.0389
	[-0.08,-0.03]	[-0.18,0.12]	[-0.10,0.22]	[-0.99,1.60]	[-0.02,0.14]	[0.01,0.12]	[-0.01,0.24]	[-0.12,0.09]	[-0.53,1.00]	[-0.12,0.04]
Post-ME	0.00970	0.0308	0.0393	-0.701	-0.138***	0.0108	0.0391	0.0900***	-0.772**	-0.105***
	[-0.01,0.03]	[-0.05,0.11]	[-0.06,0.14]	[-1.72,0.32]	[-0.23,-0.05]	[-0.01,0.03]	[-0.03,0.11]	[0.02,0.16]	[-1.45,-0.09]	[-0.17,-0.04]
Medicaid expansion State * Post ME	-0.0221	0.0354	0.0174	0.496	0.0569	0.0000939	0.0281	0.0211	0.541	0.00827
	[-0.05,0.01]	[-0.06,0.14]	[-0.10,0.13]	[-0.55,1.54]	[-0.03,0.15]	[-0.02,0.02]	[-0.04,0.10]	[-0.05,0.09]	[-0.15,1.23]	[-0.05,0.07]
Age										
25-35	0.00274	0.00138	0.0662	0.398	0.0492	-0.0141*	0.0193	0.0876***	1.058***	0.0548**
	[-0.02,0.03]	[-0.07,0.08]	[-0.01,0.15]	[-0.26,1.06]	[-0.03,0.13]	[-0.03,0.00]	[-0.03,0.07]	[0.03,0.14]	[0.52,1.60]	[0.00,0.11]
36-50	0.00455	0.0355	0.128***	1.168***	0.138***	0.0105	0.0853***	0.143***	1.405***	0.0846***
	[-0.01,0.02]	[-0.04,0.11]	[0.05,0.21]	[0.50,1.84]	[0.08,0.20]	[-0.01,0.03]	[0.04,0.13]	[0.09,0.20]	[0.83,1.98]	[0.03,0.14]
51-64	0.00645	-0.0400	0.137***	0.308	0.138***	-0.00411	0.0188	0.192***	1.083***	0.139***
	[-0.02,0.03]	[-0.12,0.04]	[0.06,0.22]	[-0.58,1.19]	[0.07,0.20]	[-0.03,0.02]	[-0.04,0.07]	[0.14,0.25]	[0.50,1.66]	[0.08,0.20]
Female	0.00715	0.0727***	0.0942***	0.333	0.0788***	0.00849	0.0275*	0.0657***	0.217	0.0348**
	[-0.00,0.02]	[0.03,0.11]	[0.05,0.14]	[-0.22,0.88]	[0.04,0.11]	[-0.00,0.02]	[-0.00,0.06]	[0.03,0.10]	[-0.16,0.59]	[0.01,0.06]
Education (ref=less than HS)										
High School	-0.00983	0.0485*	0.0594**	-0.118	-0.0119	0.00103	0.0396**	0.0105	-0.349*	-0.0167
	[-0.03,0.01]	[-0.00,0.10]	[0.01,0.11]	[-0.58,0.34]	[-0.06,0.03]	[-0.01,0.01]	[0.00,0.08]	[-0.03,0.05]	[-0.73,0.03]	[-0.05,0.02]
More than HS	0.00457	0.0322	0.0504	-0.530	0.0271	-0.00381	0.0510**	0.0519**	-0.774***	-0.0351*
	[-0.02,0.03]	[-0.03,0.10]	[-0.02,0.12]	[-1.24,0.18]	[-0.02,0.07]	[-0.02,0.01]	[0.01,0.09]	[0.00,0.10]	[-1.28,-0.26]	[-0.07,0.00]
Other/unknown	0.00335	-0.0252	0.00962	-1.229**	0.0136	0.0000357	0.0775*	0.0275	-0.686	-0.0279
	[-0.04,0.04]	[-0.11,0.06]	[-0.07,0.09]	[-2.33,-0.13]	[-0.07,0.09]	[-0.02,0.02]	[-0.00,0.16]	[-0.05,0.10]	[-1.51,0.14]	[-0.10,0.04]
Chronic Conditions										
1-2	-0.0168*	0.0691**	0.102***	0.796***	0.0478*	0.00867	0.106***	0.186***	0.855***	0.0904***
	[-0.04,0.00]	[0.01,0.13]	[0.04,0.16]	[0.27,1.33]	[-0.00,0.10]	[-0.00,0.02]	[0.07,0.14]	[0.14,0.23]	[0.47,1.24]	[0.05,0.13]

3+	-0.0150	0.197***	0.343***	2.710***	0.146***	0.00687	0.166***	0.327***	2.110***	0.150***
	[-0.04,0.01]	[0.13,0.26]	[0.28,0.40]	[2.06,3.36]	[0.10,0.19]	[-0.01,0.02]	[0.12,0.21]	[0.28,0.38]	[1.59,2.63]	[0.10,0.20]
Race/Ethnicity										
Hispanic	-0.00628	-0.105***	-0.126***	-1.133***	-0.0341	-0.00305	-0.0876***	-0.148***	-0.421*	-0.00721
	[-0.03,0.01]	[-0.16,-0.05]	[-0.20,-0.05]	[-1.90,-0.37]	[-0.09,0.02]	[-0.02,0.01]	[-0.12,-0.05]	[-0.19,-0.11]	[-0.92,0.07]	[-0.04,0.03]
Black/African American	-0.0147*	-0.175***	-0.229***	-0.730**	-0.0516**	-0.000731	-0.106***	-0.179***	-0.700***	-0.0506***
	[-0.03,0.00]	[-0.23,-0.12]	[-0.29,-0.17]	[-1.33,-0.13]	[-0.10,-0.00]	[-0.01,0.01]	[-0.14,-0.07]	[-0.22,-0.14]	[-1.08,-0.32]	[-0.08,-0.02]
Alaskan/Native American	-0.0135**	0.0714	0.0609	-0.213	0.0185	0.00116	-0.0928	-0.0363	1.513**	0.00559
	[-0.03,-0.00]	[-0.08,0.23]	[-0.14,0.26]	[-2.87,2.44]	[-0.10,0.14]	[-0.04,0.04]	[-0.21,0.03]	[-0.15,0.08]	[0.12,2.91]	[-0.11,0.12]
Asian	-0.0321***	-0.0604	-0.123	-0.687	-0.121	-0.0133**	-0.130***	-0.168***	-0.500	-0.0254
	[-0.05,-0.01]	[-0.23,0.11]	[-0.28,0.04]	[-2.31,0.94]	[-0.33,0.09]	[-0.02,-0.00]	[-0.23,-0.03]	[-0.28,-0.05]	[-1.68,0.68]	[-0.12,0.07]
Multiple/Other	-0.00841	-0.111**	-0.0961	0.378	0.0928**	0.0141	0.0759	0.0735*	0.600	0.0242
	[-0.04,0.03]	[-0.22,-0.00]	[-0.26,0.06]	[-1.16,1.92]	[0.01,0.17]	[-0.02,0.05]	[-0.02,0.17]	[-0.00,0.15]	[-0.32,1.52]	[-0.04,0.09]
Married	-0.0166**	-0.0579**	-0.0509**	-0.519*	-0.00909	-0.00838	-0.0887***	-0.0820***	-0.997***	-0.0399**
	[-0.03,-0.00]	[-0.10,-0.01]	[-0.10,-0.00]	[-1.06,0.02]	[-0.05,0.03]	[-0.02,0.00]	[-0.13,-0.05]	[-0.12,-0.05]	[-1.48,-0.52]	[-0.07,-0.01]
Percent FLP	0.000800	0.000792	-0.00267	-0.0287	-0.000778	-0.00133**	-0.00133	-0.00142	0.00346	0.000999
	[-0.00,0.00]	[-0.00,0.00]	[-0.01,0.00]	[-0.07,0.02]	[-0.00,0.00]	[-0.00,-0.00]	[-0.00,0.00]	[-0.01,0.00]	[-0.04,0.04]	[-0.00,0.00]
Year										
2011	0.00713	0.0588*	0.0368	-0.400	0.00267	0.00449	-0.0202	0.0311	0.00346	0.00244
	[-0.01,0.03]	[-0.01,0.12]	[-0.03,0.10]	[-0.99,0.20]	[-0.04,0.05]	[-0.01,0.02]	[-0.07,0.03]	[-0.02,0.08]	[-0.61,0.62]	[-0.04,0.05]
2012	0.000793	0.0479	0.0564*	0.611*	0.00690	0.00863	0.0220	0.0543*	-0.181	-0.0241
	[-0.02,0.02]	[-0.02,0.12]	[-0.00,0.11]	[-0.04,1.26]	[-0.05,0.06]	[-0.01,0.02]	[-0.02,0.07]	[-0.00,0.11]	[-0.69,0.33]	[-0.07,0.02]
2013	0.00503	0.0996**	0.0874**	-0.00502	0.00863	0.0154	-0.0122	0.0160	0.0326	0.00638
	[-0.02,0.03]	[0.02,0.18]	[0.00,0.17]	[-0.81,0.80]	[-0.05,0.07]	[-0.00,0.03]	[-0.06,0.04]	[-0.04,0.07]	[-0.49,0.55]	[-0.04,0.05]
2016	0.0279*	0.0347	0.0125	-0.121	0.0864*	-0.00488	-0.0401	-0.0784**	0.321	0.109***
	[-0.01,0.06]	[-0.04,0.11]	[-0.08,0.10]	[-1.06,0.82]	[-0.00,0.17]	[-0.02,0.01]	[-0.10,0.02]	[-0.14,-0.02]	[-0.37,1.01]	[0.05,0.17]
2017	0.0148	0.0173	0.0279	0.0428	0.0273	-0.00391	-0.0310	-0.0552*	-0.186	0.00494
	[-0.02,0.05]	[-0.06,0.09]	[-0.06,0.12]	[-0.81,0.90]	[-0.07,0.12]	[-0.03,0.02]	[-0.09,0.02]	[-0.11,0.00]	[-0.79,0.42]	[-0.06,0.07]
2018	0	0	0	0	0	0	0	0	0	0
	[0.00,0.00]	[0.00,0.00]	[0.00,0.00]	[0.00,0.00]	[0.00,0.00]	[0.00,0.00]	[0.00,0.00]	[0.00,0.00]	[0.00,0.00]	[0.00,0.00]

Constant	0.0412*	0.124	0.178*	10.24***	0.673***	0.0309	0.129***	0.187***	10.18***	0.673***
	[-0.00,0.09]	[-0.04,0.29]	[-0.01,0.37]	[8.58,11.90]	[0.54,0.81]	[-0.01,0.08]	[0.04,0.22]	[0.08,0.30]	[9.16,11.20]	[0.57,0.77]
Observations	251509	251509	251509	251509	251487	293578	293578	293578	293578	293511

95% confidence intervals in brackets

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix A. Table 16. Medicaid Expansion by MH HRSA Shortage Area, MH Sub Sample at 138% FPL

	Number of Visits, Conditional on Any (Poisson, IRR)			Number of Visits, Conditional on Any (Poisson, IRR)		
	Rx count	ED count	MH Outpatient count	Rx count	ED count	MH Outpatient count
	Shortage			No/Partial Shortage		
Expansion						
Medicaid expansion State	1.056	1.441*	0.285***	2.074***	0.262***	0.825
	[0.82,1.36]	[0.98,2.12]	[0.12,0.69]	[1.47,2.92]	[0.15,0.46]	[0.59,1.15]
Post-ME	0.911	0.663	1.146	1.178	0.708	0.877
	[0.71,1.17]	[0.35,1.26]	[0.67,1.95]	[0.94,1.48]	[0.45,1.12]	[0.60,1.29]
Medicaid expansion State * Post ME	1.161	0.606*	2.618***	0.878	1.459**	1.374
	[0.93,1.44]	[0.37,1.00]	[1.49,4.60]	[0.70,1.10]	[1.01,2.11]	[0.92,2.05]
Age						
25-35	1.162	1.075	0.866	1.174	0.654**	1.291
	[0.81,1.67]	[0.72,1.60]	[0.58,1.30]	[0.91,1.51]	[0.44,0.97]	[0.90,1.85]
36-50	1.420**	1.865***	1.019	1.692***	0.569***	1.202
	[1.07,1.89]	[1.22,2.84]	[0.73,1.43]	[1.35,2.12]	[0.38,0.85]	[0.86,1.68]
51-64	1.250	1.111	0.852	1.481***	0.870	1.027
	[0.92,1.71]	[0.62,1.99]	[0.57,1.28]	[1.16,1.89]	[0.56,1.35]	[0.72,1.46]
Female	1.224**	0.662**	0.836	0.953	0.876	0.747***
	[1.04,1.44]	[0.45,0.97]	[0.63,1.10]	[0.86,1.06]	[0.66,1.16]	[0.60,0.92]
Education (ref=less than HS)						
High School	1.066	0.994	1.354*	1.004	0.623***	1.039
	[0.91,1.24]	[0.67,1.47]	[1.00,1.84]	[0.88,1.15]	[0.47,0.82]	[0.81,1.33]
More than HS	1.235**	0.968	1.266	0.960	0.533***	1.158
	[1.03,1.48]	[0.62,1.51]	[0.91,1.77]	[0.82,1.12]	[0.40,0.72]	[0.87,1.54]
Other/unknown	1.284*	0.155***	1.262	0.957	2.179***	1.167
	[0.98,1.68]	[0.05,0.52]	[0.69,2.29]	[0.78,1.17]	[1.25,3.80]	[0.76,1.79]
Chronic Conditions						
1-2	1.334**	0.404***	1.269	1.121	2.025***	1.220
	[1.06,1.67]	[0.28,0.58]	[0.83,1.94]	[0.91,1.38]	[1.34,3.06]	[0.95,1.57]
3+	1.671***	0.735	1.117	1.276***	1.739***	1.569***
	[1.28,2.18]	[0.50,1.08]	[0.73,1.70]	[1.06,1.53]	[1.20,2.51]	[1.15,2.14]
Race/Ethnicity						

Hispanic	0.893	0.347***	1.297	0.871*	1.135	0.660***
	[0.64,1.24]	[0.19,0.65]	[0.81,2.08]	[0.74,1.03]	[0.83,1.55]	[0.52,0.84]
Black/African American	0.678***	0.513**	1.427*	0.746***	0.836	1.183
	[0.56,0.81]	[0.29,0.90]	[1.00,2.04]	[0.65,0.85]	[0.63,1.12]	[0.90,1.55]
Alaskan/Native American	0.979		1.060	1.470***	4.228***	1.218
	[0.65,1.47]		[0.34,3.27]	[1.12,1.93]	[1.86,9.62]	[0.84,1.77]
Asian	0.429**		1.291	0.472***	0.429***	2.195***
	[0.19,0.97]		[0.55,3.01]	[0.31,0.71]	[0.27,0.67]	[1.25,3.84]
Multiple/Other	0.810	1.195	1.018	0.918	0.786	1.697***
	[0.59,1.11]	[0.21,6.88]	[0.57,1.83]	[0.71,1.18]	[0.54,1.16]	[1.21,2.38]
Married	0.927	0.428**	0.698**	0.785***	0.878	0.822*
	[0.77,1.11]	[0.22,0.84]	[0.51,0.95]	[0.69,0.89]	[0.68,1.13]	[0.65,1.04]
Percent FPL	0.985**	1.040**	0.989	1.010*	0.945***	0.989
	[0.97,1.00]	[1.01,1.08]	[0.96,1.02]	[1.00,1.02]	[0.92,0.97]	[0.97,1.01]
Year						
2011	0.976	1.022	0.813	1.085	0.476**	0.863
	[0.79,1.21]	[0.56,1.87]	[0.52,1.27]	[0.93,1.26]	[0.25,0.91]	[0.69,1.08]
2012	0.978	1.339	1.224	0.952	1.303	0.866
	[0.79,1.20]	[0.60,2.99]	[0.68,2.21]	[0.81,1.11]	[0.86,1.98]	[0.67,1.12]
2013	1.031	0.891	1.624**	0.973	1.459*	1.179
	[0.82,1.29]	[0.46,1.74]	[1.03,2.57]	[0.79,1.20]	[0.99,2.16]	[0.89,1.56]
2016	0.869	1.433*	0.716*	0.898	1.559**	0.812
	[0.73,1.03]	[0.96,2.13]	[0.49,1.04]	[0.75,1.07]	[1.06,2.30]	[0.60,1.09]
2017	1.093	1.128	1.050	0.949	1.017	0.991
	[0.92,1.30]	[0.76,1.68]	[0.67,1.64]	[0.83,1.09]	[0.60,1.74]	[0.72,1.37]
2018	1	1	1	1	1	1
	[1.00,1.00]	[1.00,1.00]	[1.00,1.00]	[1.00,1.00]	[1.00,1.00]	[1.00,1.00]
Observations	207602	49709	171014	272920	107741	257656

Exponentiated coefficients; 95% confidence intervals in brackets

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

APPENDIX B

Appendix B. Table 1. Summary of Data and Measures

	Variable	Data Source	Years
Primary analysis			
Outcome	Grams of buprenorphine/100,000 persons	Automated Reports and Consolidated Ordering System (ARCOS)	2014-2019
Primary IV	Nurse Practitioner SOP	Suzanne Phillips Annual Legislative Updates	2014-2019
	CARA	Q2 2017	-
Policy	Medicaid Expansion	Kaiser Family Foundation Policy Tracker	2014-2019
	1115 SUD Waiver	Kaiser Family Foundation Policy Tracker	2014-2019
	Mandatory Prescription Data Monitoring	Lee, Byungkyu (2021)	Supplement table
	Legislation limiting the Use of Prior Authorization for Buprenorphine	Legal Action Center Report published online	2014-2019
Demographics	*Race/Ethnicity *Age *Federal Poverty Level (100%) *Population in fair/poor health *Poor MH 14 of last 30 days, lag	Kaiser Family Foundation State Health Facts	2014-2019
	*Opioid prescribing rate, lagged	CDC opioid prescribing rates available online	2013-2018
	*Rate of APRN/100,000	Suzanne Phillips Annual Legislative Updates	2014-2019
	*Rate of MD waivers/100,000	FOIA requested DEA list of buprenorphine waivered providers	2014-2019
	*Opioid Treatment Programs	National Survey of Substance Abuse Treatment Services (N-SSATS)	2013-2018
Falsification Test	*State and year fixed effects		
Outcome	Prescriptions of Metoprolol/100,000 persons *(Covariates, same as above)*	Medicaid State Utilization data downloaded for each year from here (Extracted prescriptions for Metoprolol that was not suppressed)	2014-2019
Analysis to determine share buprenorphine prescribed for OUD vs analgesic buprenorphine	Share of Analgesic vs OUD. • Analgesic: (Belbuca, Buprenex, Butrans) • OUD: (Suboxone, Zubsolv, Bunavail, Subutex, Sublocade, Cassipa)	Medicaid State Utilization data downloaded from here	2019 for Virginia

Appendix B. Table 2. Buprenorphine Dispensing in Broad vs. Narrow SOP States Before and After CARA (DID), Marginal Effects

	Grams of buprenorphine dispensed/100k		**Number of 90-day buprenorphine prescriptions** (16mg/day)/100k	
	State and Year Fixed Effects and Population	Fully Adjusted	State and Year Fixed Effects and Population	Fully Adjusted
SOP and CARA				
Broad SOP	2.843	5.147	2.234	4.219
(Ref=Narrow SOP)	[-30.84,36.53]	[-22.41,32.70]	[-21.23,25.70]	[-14.88,23.32]
Post-CARA	**17.11*****	**16.00*****	**12.54*****	**11.48*****
(Ref= Narrow SOP)	**[9.03,25.19]**	**[9.05,22.96]**	**[6.92,18.15]**	**[6.82,16.14]**
DID term				
Broad SOP x CARA=1	**23.52****	**22.01****	**15.83***	**15.86****
	[0.32,46.71]	**[3.82,40.20]**	**[-1.11,32.78]**	**[3.12,28.61]**
Policies				
Medicaid Expansion		16.79**		11.63**
		[0.22,33.36]		[0.36,22.90]
Mandatory PDMP		-4.590		-2.166
		[-18.24,9.06]		[-11.90,7.57]
1115 SUD Waiver		-20.27***		-14.08***
		[-33.30,-7.24]		[-23.07,-5.09]
State prior auth law for Bup		-0.994		-1.869
		[-17.13,15.14]		[-12.91,9.17]
OUD risk factors				
Opioid Rx/100k(L)		0.756		0.590*
		[-0.24,1.75]		[-0.01,1.19]
Fair/Poor Health		-1.712		-0.936
		[-6.34,2.91]		[-4.32,2.44]
Poor MH		0.271		0.169
		[-3.89,4.43]		[-2.80,3.13]
Demographics				
Black/African American		-1.803		-1.940
		[-18.66,15.06]		[-14.11,10.23]
Hispanic		-26.73**		-18.29**
		[-49.87,-3.58]		[-34.62,-1.97]
Other Race		-6.455		-5.181
		[-21.24,8.33]		[-15.52,5.16]
Age: 0to18		15.20***		10.21***
		[4.64,25.76]		[2.92,17.50]
Age: 65+		-2.785		-2.055
		[-12.18,6.61]		[-8.98,4.87]
Under 100% FPL		-5.417**		-3.941**
		[-10.27,-0.57]		[-7.16,-0.72]
Supply				
APRN/100k		0.0817		0.0552
		[-0.13,0.29]		[-0.08,0.19]
MD Waivers/100k		1.442**		0.924**
		[0.18,2.70]		[0.08,1.77]
OTP/100k		-18.86		-14.72

		[-57.53,19.80]		[-41.62,12.19]
States				
AK	0	0	0	0
	[0.00,0.00]	[0.00,0.00]	[0.00,0.00]	[0.00,0.00]
AL	249.2***	88.19	177.8***	61.05
	[211.42,286.94]	[-321.29,497.68]	[152.00,203.65]	[-229.06,351.16]
AR	-90.43***	-109.5	-64.20***	-89.09
	[-116.72,-64.14]	[-382.10,163.20]	[-82.18,-46.21]	[-284.50,106.33]
AZ	-169.6***	551.2	-120.8***	330.4
	[-179.79,-159.32]	[-980.18,2082.54]	[-127.82,-113.86]	[-670.64,1331.47]
CA	-206.2***	1199.0	-147.2***	753.4
	[-228.52,-183.93]	[-2217.30,4615.37]	[-162.43,-131.96]	[-1424.16,2930.90]
CO	-169.9***	35.14	-121.2***	0.692
	[-182.37,-157.41]	[-424.88,495.15]	[-129.62,-112.69]	[-322.96,324.34]
CT	135.4***	501.8*	96.27***	334.8*
	[101.52,169.24]	[-59.69,1063.27]	[73.13,119.41]	[-58.41,727.97]
DC	43.23***	299.7	31.98***	245.2
	[40.44,46.02]	[-581.49,1180.93]	[29.99,33.97]	[-456.25,946.58]
DE	67.98***	136.7	48.68***	94.23
	[36.32,99.63]	[-148.86,422.22]	[27.03,70.33]	[-112.25,300.71]
FL	-71.33***	809.8	-51.15***	519.8
	[-98.19,-44.48]	[-552.33,2171.96]	[-69.50,-32.80]	[-395.57,1435.11]
GA	-147.3***	-112.6	-105.2***	-84.55
	[-171.53,-122.97]	[-374.27,148.99]	[-121.84,-88.65]	[-272.42,103.32]
HI	-170.3***	191.7	-121.6***	166.4
	[-180.50,-160.01]	[-720.19,1103.58]	[-128.60,-114.60]	[-545.60,878.47]
IA	-253.7***	-252.5*	-181.0***	-190.9*
	[-268.97,-238.43]	[-516.61,11.68]	[-191.43,-170.58]	[-382.88,1.16]
ID	-98.73***	-78.52	-70.27***	-73.05
	[-104.71,-92.75]	[-412.16,255.12]	[-74.35,-66.20]	[-315.50,169.39]
IL	-191.5***	-49.75	-136.6***	-49.07
	[-214.31,-168.70]	[-325.79,226.29]	[-152.19,-121.01]	[-252.00,153.86]
IN	19.90	-45.33	14.88	-44.27
	[-10.18,49.98]	[-330.91,240.24]	[-5.73,35.48]	[-249.73,161.19]
KS	-215.2***	-186.6	-153.6***	-145.4
	[-237.14,-193.18]	[-451.10,77.88]	[-168.65,-138.62]	[-339.47,48.65]
KY	548.8***	209.8	391.1***	134.2
	[501.03,596.64]	[-181.24,600.90]	[358.40,423.72]	[-138.55,406.97]
LA	114.3***	36.58	81.73***	27.55
	[81.11,147.54]	[-369.11,442.27]	[59.01,104.45]	[-267.00,322.10]
MA	328.4***	547.4**	233.4***	376.1**
	[288.04,368.72]	[118.03,976.69]	[205.87,260.95]	[72.96,679.32]
MD	124.9***	244.6	89.28***	188.3
	[122.17,127.56]	[-207.31,696.46]	[87.29,91.27]	[-157.04,533.56]
ME	461.4***	130.4	330.6***	79.35
	[416.29,506.58]	[-340.27,600.97]	[299.63,361.58]	[-253.27,411.97]
MI	-18.46	-76.69	-13.40	-64.04
	[-47.12,10.19]	[-347.47,194.09]	[-32.98,6.18]	[-256.89,128.81]
MN	-171.7***	-196.8	-122.3***	-150.1

	[-186.59,-156.86]	[-451.54,58.00]	[-132.40,-112.19]	[-335.23,34.94]
MO	-119.3***	-168.3	-84.60***	-129.6
	[-144.65,-93.98]	[-436.46,99.83]	[-101.94,-67.26]	[-322.64,63.35]
MS	48.28***	-65.04	33.94***	-45.93
	[17.39,79.17]	[-451.08,321.01]	[12.84,55.04]	[-326.59,234.73]
MT	-74.90***	-134.2	-52.52***	-106.7
	[-79.70,-70.11]	[-414.00,145.70]	[-55.75,-49.29]	[-309.46,96.09]
NC	45.86***	106.0	33.73***	71.72
	[14.85,76.87]	[-172.82,384.80]	[12.46,54.99]	[-128.11,271.56]
ND	-175.4***	-210.6	-124.9***	-160.4*
	[-186.02,-164.80]	[-469.13,47.94]	[-132.12,-117.67]	[-348.19,27.44]
NE	-240.0***	-221.0	-171.2***	-169.3*
	[-256.66,-223.30]	[-485.87,43.88]	[-182.57,-159.83]	[-362.77,24.23]
NH	290.0***	61.88	206.9***	28.58
	[272.44,307.57]	[-337.48,461.24]	[194.92,218.91]	[-254.02,311.19]
NJ	2.807	569.6	1.469	381.6
	[-26.54,32.15]	[-183.36,1322.48]	[-18.57,21.51]	[-132.79,895.89]
NM	44.23***	9342.5	31.79***	5721.5
	[41.57,46.88]	[-20414.88,39099.80]	[29.97,33.62]	[-12411.51,23854.48]
NV	-193.2***	347.0	-137.9***	206.3
	[-210.81,-175.55]	[-602.16,1296.09]	[-149.85,-125.94]	[-422.59,835.10]
NY	-14.06	533.0	-9.995	361.8
	[-42.90,14.78]	[-104.42,1170.32]	[-29.71,9.73]	[-77.12,800.66]
OH	160.1***	-5.793	113.7***	-13.25
	[125.37,194.75]	[-293.44,281.85]	[90.02,137.40]	[-216.93,190.44]
OR	-53.98***	66.25	-38.02***	26.64
	[-57.35,-50.60]	[-295.20,427.70]	[-40.31,-35.73]	[-235.26,288.55]
PA	224.9***	195.8	160.6***	128.0
	[187.94,261.85]	[-110.09,501.70]	[135.35,185.91]	[-91.33,347.39]
RI	415.7***	1034.9*	295.8***	693.1*
	[390.38,441.06]	[-77.85,2147.68]	[278.53,313.16]	[-66.79,1453.03]
SC	-70.33***	-90.80	-50.00***	-70.34
	[-97.28,-43.39]	[-382.90,201.30]	[-68.43,-31.56]	[-277.21,136.53]
SD	-248.4***	-250.6*	-177.1***	-188.7**
	[-266.41,-230.43]	[-503.28,2.17]	[-189.43,-164.84]	[-372.71,-4.76]
TX	-209.9***	762.5	-150.0***	463.1
	[-232.08,-187.78]	[-1629.12,3154.19]	[-165.09,-134.83]	[-1071.25,1997.47]
UT	15.04	7.002	10.14	-11.32
	[-14.72,44.79]	[-340.88,354.88]	[-10.18,30.46]	[-265.24,242.59]
VA	-48.40***	7.901	-34.78***	-0.495
	[-76.03,-20.77]	[-207.04,222.84]	[-53.66,-15.89]	[-155.67,154.68]
VT	743.6***	309.5	530.6***	210.7
	[689.09,798.13]	[-314.41,933.44]	[493.36,567.89]	[-231.12,652.52]
WA	-34.48***	103.0	-23.90***	60.52
	[-36.81,-32.14]	[-139.69,345.76]	[-25.48,-22.32]	[-119.42,240.46]
WI	-112.2***	-123.7	-80.12***	-100.3
	[-137.72,-86.74]	[-397.79,150.33]	[-97.55,-62.70]	[-299.16,98.63]
WV	608.2***	215.3	433.3***	133.5

	[558.43,658.02]	[-296.21,726.87]	[399.26,467.28]	[-220.78,487.81]
Year				
2015	0	0	0	0
	[0.00,0.00]	[0.00,0.00]	[0.00,0.00]	[0.00,0.00]
2016	24.26***	28.90***	17.36***	20.71***
	[20.80,27.73]	[21.25,36.55]	[14.77,19.94]	[15.40,26.03]
2017	45.26***	60.46***	32.42***	43.26***
	[39.09,51.43]	[43.60,77.33]	[28.00,36.85]	[31.78,54.74]
2018	80.54***	115.7***	57.10***	83.00***
	[71.03,90.05]	[85.56,145.86]	[50.30,63.90]	[62.28,103.72]
2019	139.0***	186.7***	98.13***	133.5***
	[123.27,154.77]	[134.93,238.52]	[87.01,109.25]	[97.95,169.09]
Observations	960	960	960	960

95% confidence intervals in brackets

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix B. Table 3.

Association between NP SOP on NP Waivers/100,000 after CARA legislation

	All Waivers/100k, NP prescribers Incident Rate Ratio
Broad SOP (ref=Narrow SOP)	1.091
	[0.40,3.01]
Interaction: Quarters after CARA x SOP (ref=implementation)	
+1 x Broad SOP	1.050
	[0.87,1.26]
+2 x Broad SOP	1.167
	[0.93,1.47]
+3 x Broad SOP	1.209
	[0.96,1.52]
+4 x Broad SOP	1.237*
	[0.98,1.57]
+5 x Broad SOP	1.278*
	[0.99,1.65]
+6 x Broad SOP	1.344**
	[1.03,1.75]
+7 x Broad SOP	1.372**
	[1.07,1.76]
+8 x Broad SOP	1.377**
	[1.06,1.79]
+9 x Broad SOP	1.350**
	[1.05,1.74]
+10 x Broad SOP	1.339**
	[1.03,1.75]
Quarters after CARA (ref implementation)	
+1	2.175***
	[2.01,2.35]
+2	3.347***
	[3.11,3.60]
+3	4.353***
	[3.76,5.04]
+4	5.341***
	[4.54,6.28]
+5	6.288***
	[5.28,7.48]
+6	7.207***
	[5.98,8.69]
+7	8.386***
	[6.43,10.94]
+8	9.961***
	[7.59,13.07]
+9	11.30***
	[8.63,14.81]
+10	12.74***
	[9.66,16.79]
Policies	
Medicaid Expansion	0.918

	[0.81,1.05]
PDMP	1.093*
	[0.99,1.21]
1115 SUD Waiver	0.998
	[0.92,1.09]
State prior auth law	1.017
	[0.89,1.17]
OUD Risk Factors	
Opioid Rx/100k	0.997
	[0.98,1.01]
Fair/Poor Health (%)	0.997
	[0.96,1.04]
Poor MH (1 yr lag)	1.024
	[0.99,1.07]
Demographics	
Black/AA (%)	0.934
	[0.84,1.04]
Age: 0 to 18 (%)	0.971
	[0.78,1.20]
Age: 65+ (%)	0.970
	[0.84,1.12]
Under FPL(%)	0.970
	[0.89,1.05]
Supply	
OTP/100k	1.163
	[0.82,1.64]
APRN/100k	0.999
States	[1.00,1.00]
AK	0
	[0.00,0.00]
AL	0.285
	[0.01,8.54]
AR	0.202
	[0.01,4.56]
AZ	0.796
	[0.00,467.27]
CA	0.452
	[0.00,910.21]
CO	0.395
	[0.00,58.62]
CT	1.191
	[0.02,58.24]
DC	7.553
	[0.10,571.72]
DE	1.286
	[0.06,27.27]
FL	0.489
	[0.00,120.89]
GA	0.476
	[0.02,11.89]
HI	1.068
	[0.01,201.13]
IA	0.106
	[0.00,3.43]
ID	0.205

	[0.00,10.92]
IL	0.305
	[0.01,13.39]
IN	0.435
	[0.02,10.94]
KS	0.119
	[0.00,3.52]
KY	0.543
	[0.02,16.31]
LA	1.218
	[0.04,39.36]
MA	0.844
	[0.03,20.78]
MD	2.813
	[0.12,66.05]
ME	0.766
	[0.02,30.92]
MI	0.196
	[0.01,3.79]
MN	0.199
	[0.01,3.45]
MO	0.157
	[0.01,3.11]
MS	0.895
	[0.02,44.68]
MT	0.246
	[0.01,4.78]
NC	0.869
	[0.05,16.75]
ND	0.238
	[0.01,4.36]
NE	0.0698
	[0.00,2.34]
NH	0.413
	[0.01,19.75]
NJ	0.707
	[0.01,38.62]
NM	1.467
	[0.00,31243.42]
NV	0.563
	[0.00,139.39]
NY	0.946
	[0.02,41.53]
OH	0.748
	[0.04,15.19]
OR	0.352
	[0.01,12.69]
PA	0.326
	[0.01,7.60]
RI	0.419
	[0.01,31.70]
SC	0.835
	[0.03,22.27]
SD	0.125*
	[0.01,1.36]

TX	0.301
	[0.00,928.00]
UT	0.345
	[0.01,15.23]
VA	0.515
	[0.04,6.83]
VT	0.490
	[0.01,20.98]
WA	0.501
	[0.04,7.04]
WI	0.150
	[0.01,3.44]
WV	0.357
	[0.01,14.01]
Observations	528

95% confidence intervals in brackets

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix B. Table 4.

(1) Increase in total Buprenorphine waivers in Broad SOP states relative to Narrow SOP after CARA

(2) Association of Buprenorphine Waivers/100k and Grams of Buprenorphine Dispensed/100k

	(1) Association of SOP and Waiver Growth Total Buprenorphine Waivers/100k population	(2) Association of Waivers and Buprenorphine Dispensed/100k Grams of Buprenorphine/100k
Broad SOP (ref=Narrow SOP)	0.927	
	[0.81,1.07]	
Post-CARA (ref=Pre-Cara)	1.093***	
	[1.04,1.14]	
Broad SOP x CARA	**1.239*** **	
	[1.12,1.37]	
All Waivers/100k, All prescribers		**1.003*** **
		[1.00,1.01]
Policies		
Medicaid Expansion	0.951	1.044
	[0.88,1.03]	[0.98,1.11]
Mandatory PDMP	0.980	0.978
	[0.92,1.05]	[0.94,1.02]
1115 SUD Waiver	0.963	0.928***
	[0.91,1.01]	[0.89,0.97]
State Prior Auth Law for Buprenorphine	0.991	1.004
	[0.92,1.07]	[0.95,1.06]
OUD Risk		
Opioid Rx/100k	0.997	1.003
	[0.99,1.00]	[1.00,1.01]
Fair/Poor Health(%)	0.994	0.994
	[0.97,1.02]	[0.98,1.01]
Poor MH (%)	1.007	1.004
	[0.99,1.02]	[0.99,1.02]
Demographics		
Black/AA(%)	0.971	1.006
	[0.91,1.03]	[0.95,1.06]
Hispanic (%)	0.931	0.934*
	[0.84,1.03]	[0.87,1.00]
Other Race (%)	0.984	0.991
	[0.92,1.05]	[0.95,1.03]
Age 0to18 (%)	0.978	1.053***
	[0.93,1.02]	[1.02,1.09]
Age 65+	1.031	0.987
	[0.99,1.08]	[0.96,1.01]
Under FPL(%)	1.017	0.985*
	[0.99,1.04]	[0.97,1.00]
OTP		

OTP/100k	0.997	0.938
	[0.82,1.21]	[0.83,1.05]
State		
AK	1	1
	[1.00,1.00]	[1.00,1.00]
AL	0.348	1.278
	[0.05,2.27]	[0.40,4.05]
AR	0.172**	0.651
	[0.03,0.87]	[0.25,1.67]
AZ	1.408	2.652
	[0.08,24.69]	[0.35,20.19]
CA	3.202	3.649
	[0.11,96.18]	[0.33,40.49]
CO	0.793	1.183
	[0.09,7.26]	[0.27,5.19]
CT	1.170	2.846*
	[0.21,6.43]	[0.97,8.35]
DC	1.877	1.598
	[0.23,15.17]	[0.33,7.71]
DE	0.616	1.487
	[0.14,2.68]	[0.63,3.52]
FL	0.931	3.369
	[0.09,9.92]	[0.71,15.93]
GA	0.486	0.509
	[0.09,2.50]	[0.18,1.48]
HI	0.608	1.150
	[0.05,7.32]	[0.25,5.35]
IA	0.0725***	0.171***
	[0.01,0.47]	[0.05,0.54]
ID	0.239	0.886
	[0.03,1.73]	[0.25,3.20]
IL	0.483	0.782
	[0.10,2.39]	[0.28,2.15]
IN	0.272	0.955
	[0.05,1.44]	[0.36,2.53]
KS	0.191**	0.394*
	[0.04,1.00]	[0.14,1.10]
KY	0.362	2.179
	[0.06,2.31]	[0.71,6.70]
LA	0.486	1.018
	[0.08,3.14]	[0.30,3.43]
MA	1.189	3.286**
	[0.27,5.22]	[1.31,8.24]
MD	1.385	1.654
	[0.34,5.65]	[0.63,4.32]
ME	0.436	2.124
	[0.05,3.95]	[0.54,8.39]
MI	0.296	0.825
	[0.06,1.44]	[0.33,2.04]
MN	0.171**	0.402**
	[0.04,0.76]	[0.17,0.95]
MO	0.165**	0.490
	[0.03,0.89]	[0.19,1.29]
MS	0.313	0.676
	[0.03,2.94]	[0.15,3.06]

MT	0.118**	0.728
	[0.02,0.66]	[0.25,2.14]
NC	0.421	1.296
	[0.10,1.79]	[0.56,2.99]
ND	0.119***	0.365**
	[0.02,0.57]	[0.14,0.96]
NE	0.130**	0.282**
	[0.02,0.75]	[0.10,0.82]
NH	0.327	1.781
	[0.04,2.59]	[0.50,6.30]
NJ	1.238	2.651*
	[0.24,6.49]	[0.89,7.89]
NM	9.217	24.63*
	[0.10,861.06]	[0.95,640.34]
NV	1.286	1.817
	[0.12,14.30]	[0.34,9.71]
NY	1.443	2.590*
	[0.31,6.72]	[0.94,7.13]
OH	0.347	1.156
	[0.07,1.84]	[0.45,3.00]
OR	0.472	1.467
	[0.08,2.72]	[0.47,4.59]
PA	0.472	1.957
	[0.09,2.40]	[0.76,5.05]
RI	1.266	5.432***
	[0.19,8.46]	[1.55,19.00]
SC	0.307	0.658
	[0.05,1.76]	[0.23,1.90]
SD	0.0901***	0.171***
	[0.02,0.37]	[0.07,0.41]
TX	1.616	2.533
	[0.05,54.86]	[0.22,29.33]
UT	0.778	1.086
	[0.13,4.61]	[0.33,3.54]
VA	0.393	0.994
	[0.12,1.32]	[0.50,1.99]
VT	0.543	3.109
	[0.06,5.24]	[0.74,13.06]
WA	0.733	1.484
	[0.22,2.48]	[0.68,3.24]
WI	0.222*	0.681
	[0.04,1.18]	[0.25,1.83]
WV	0.237	2.460
	[0.03,2.07]	[0.63,9.62]
Year		
2015	1	1
	[1.00,1.00]	[1.00,1.00]
2016	1.164***	1.120***
	[1.12,1.21]	[1.08,1.16]
2017	1.305***	1.313***
	[1.19,1.43]	[1.23,1.41]
2018	1.666***	1.571***
	[1.44,1.93]	[1.41,1.75]
2019	2.303***	1.871***
	[1.87,2.83]	[1.61,2.18]

Observations	960	960

Exponentiated coefficients; 95% confidence intervals in brackets
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix B, Table 4.

Falsification test: Prescriptions of Metoprolol (blood pressure) Dispensed in Broad vs. Narrow SOP States Before and After CARA (DID),

	Prescriptions of Metoprolol /100k Marginal Effects
Broad SOP (ref=Narrow SOP)	11.51 [-106.58,129.60]
Post-CARA (ref=pre-CARA)	17.39 [-10.08,44.86]
Broad SOP x CARA	4.242 [-70.40,78.88]
Medicaid Expansion	271.3*** [127.80,414.70]
PDMP	-35.78 [-87.71,16.16]
SUD 1115 Waiver	39.75 [-17.28,96.79]
State Prior Auth Law for BUP	-34.31 [-82.21,13.59]
Opioid Rx/100,000(1yr lag)	-1.417 [-5.24,2.41]
Fair/Poor Health(%)	-6.880 [-24.03,10.27]
Poor MH (%, 1yr lag)	14.04 [-18.32,46.40]
Black/African American (%)	2.903 [-47.99,53.79]
Hispanic (%)	62.75 [-104.73,230.22]
Other Race(%)	35.27 [-37.81,108.36]
Age 0 to 18(%)	3.434 [-58.56,65.43]
Age 65+(%)	11.58 [-24.09,47.25]
Under FPL(%)	6.161 [-15.26,27.58]
APRN/100k	0.952 [-0.29,2.19]
Waivered MD/100k	-1.773 [-12.58,9.04]
OTP/100k	263.8** [62.77,464.88]
AL	3268.8 [-24425.48,30963.03]
AR	2400.0 [-15383.17,20183.11]
AZ	-518.0 [-7484.24,6448.19]
CA	-754.1 [-7902.29,6394.13]
CO	-312.9

	[-6028.57,5402.85]
CT	482.5
	[-2965.46,3930.53]
DC	2108.3
	[-11913.25,16129.91]
DE	1818.8
	[-10041.88,13679.51]
FL	-171.5
	[-6385.73,6042.67]
GA	2336.7
	[-13714.71,18388.01]
HI	-738.5
	[-6787.04,5310.04]
IA	3672.1
	[-25534.65,32878.77]
ID	1421.9
	[-6137.62,8981.48]
IL	1206.2
	[-3152.15,5564.55]
IN	6744.7
	[-43844.04,57333.44]
KS	683.8
	[-2942.51,4310.20]
KY	23338.9
	[-170731.05,217408.87]
LA	12364.5
	[-91973.50,116702.58]
MA	1291.2
	[-5033.87,7616.35]
MD	1385.5
	[-7542.90,10313.88]
ME	7142.1
	[-54737.54,69021.75]
MI	10851.4
	[-76899.26,98602.02]
MN	5380.9
	[-38077.88,48839.78]
MO	10303.8
	[-73578.56,94186.06]
MS	11047.4
	[-90289.28,112384.05]
MT	4408.6
	[-34508.22,43325.35]
NC	2238.7
	[-12360.28,16837.58]
ND	3131.2
	[-24299.91,30562.23]
NE	1974.4
	[-9681.02,13629.74]
NH	2296.4
	[-17219.00,21811.77]
NJ	352.5
	[-3089.37,3794.44]
NM	-802.7
	[-7969.95,6364.50]

NV	-501.9
	[-7106.16,6102.30]
NY	892.9
	[-2054.48,3840.37]
OH	16857.0
	[-124283.90,157997.84]
OR	1726.2
	[-6951.69,10404.17]
PA	5358.8
	[-33338.40,44055.93]
RI	594.2
	[-3399.06,4587.53]
SC	3936.2
	[-27732.97,35605.32]
SD	1644.2
	[-13293.98,16582.47]
TX	-749.5
	[-7966.30,6467.29]
UT	-133.3
	[-3953.96,3687.28]
VA	1909.3
	[-10597.08,14415.59]
VT	3865.3
	[-29914.11,37644.66]
WA	723.7
	[-2369.09,3816.52]
WI	7826.6
	[-50437.18,66090.39]
WV	42499.7
	[-337745.23,422744.71]
2015	0
	[0.00,0.00]
2016	51.58**
	[0.96,102.20]
2017	37.67
	[-70.74,146.08]
2018	-40.71
	[-222.26,140.84]
2019	-102.1
	[-341.85,137.63]
Observations	960

95% confidence intervals in brackets
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix B. Table 5.

Effect of CARA (Comprehensive Addiction and Recovery Act) on Buprenorphine Dispensing per 100,000 population in Broad SOP states (Narrow SOP is reference), 2015-2019

Quarters relative to CARA Implementation	Coefficient Ref=Quarter before Implementation	Coefficient Ref=Quarter of CARA passage
-9	-.064 **	-.047
-8	-.063**	-.047
-7	-.051**	-.035**
-6	-.052***	-.036**
-5	-.045	-.028
-4	-.016	-.0006
-3 (CARA Enactment)	-.017	Reference
-2	-.016	.0007
-1	Reference	.016
0 CARA Implementation (Q2, 2017)	.005	.021
+1	.029***	.046***
+2	.034**	.050**
+3	.031	.046
+4	.025	0.041
+5	.030	.047
+6	.046	.062**
+7	.054**	.069**
+8	.061**	.077**
+9	.062**	.078**
+10	.062	.080**

Notes: This figure shows the difference in difference coefficient for narrow and broad SOP states for each quarter before and after CARA legislation implementation (Q2 of 2017). Analysis adjusted for state and year fixed effects as well as area level time varying covariates. **p=<.05, ***p<=.01

Appendix B. Table 6.

Sensitivity tests to examine SOP specifications: Buprenorphine Dispensing (grams) Before and After CARA in various specifications of SOP (DID), Incident Rate Ratio

Incident Rate Ratio	**Model 1** **Broad vs Narrow SOP, all states (specification used in main analysis)**	**Model 2** **Full vs Reduced vs Restricted**	**Model 3** **Full vs Reduced/ Restricted**	**Model 4** **Full/Reduced vs. Restricted**	**Model 5** **Broad vs. Narrow *States that do not change SOP***
Various Specifications of DID term					
Model 1 DID					
Broad SOP x CARA	**1.067**** **[1.01,1.12]**				
Model 2 DID					
Transition SOP x CARA		1.023 [0.98,1.07]			
Full SOP x CARA		**1.071**** **[1.01,1.14]**			
Model 3 DID					
Full SOP x CARA			**1.062**** **[1.00,1.12]**		
Model 4 DID					
Full/transition x CARA				**1.052**** **[1.00,1.10]**	
Model 5 DID					
Broad SOP x CARA					**1.067**** **[1.01,1.13]**
CARA term					
Post-CARA (ref=Pre-CARA)	1.050*** [1.03,1.07]	1.047*** [1.02,1.08]	1.055*** [1.04,1.07]	1.045*** [1.02,1.07]	1.051*** [1.03,1.07]
SOP Term, without interaction					
Broad SOP (ref=Narrow SOP)	1.016 [0.94,1.10]				0.563 [0.14,2.29]
Transition (ref= Restricted SOP)		1.028 [0.95,1.12]			
Full (ref= Restricted SOP)		0.523 [0.15,1.85]			
Full SOP (ref=Reduced/Restricted)			0.574 [0.15,2.20]		
Full/transition (ref=Restricted)				1.005 [0.92,1.10]	
Policies					
Mandatory PDMP	0.986 [0.95,1.03]	0.985 [0.95,1.03]	0.983 [0.94,1.02]	0.984 [0.95,1.02]	0.988 [0.95,1.03]
SUD 1115 Waiver	0.940*** [0.90,0.98]	0.937*** [0.90,0.98]	0.938*** [0.90,0.98]	0.935*** [0.90,0.97]	0.938*** [0.90,0.98]
State prior auth law	0.997 [0.95,1.05]	0.995 [0.95,1.05]	1.002 [0.95,1.05]	0.995 [0.95,1.05]	0.997 [0.95,1.05]
OUD Risk					
Opioid Prescribing/100k	1.002 [1.00,1.01]	1.003* [1.00,1.01]	1.003 [1.00,1.01]	1.003 [1.00,1.01]	1.002 [1.00,1.01]

Fair/Poor Health (%)	0.995	0.996	0.995	0.996	0.992
	[0.98,1.01]	[0.98,1.01]	[0.98,1.01]	[0.98,1.01]	[0.98,1.01]
Poor MH (%)	1.001	1.000	1.001	1.002	1.002
	[0.99,1.01]	[0.99,1.01]	[0.99,1.01]	[0.99,1.01]	[0.99,1.02]
Demographics					
Black/AA (%)	0.995	1.000	1.004	0.998	0.989
	[0.95,1.05]	[0.95,1.05]	[0.95,1.06]	[0.95,1.05]	[0.94,1.04]
Hispanic (%)	0.923**	0.930**	0.926**	0.937*	0.927**
	[0.86,0.99]	[0.87,1.00]	[0.86,1.00]	[0.87,1.01]	[0.86,1.00]
Other Race (%)	0.981	0.983	0.980	0.990	0.979
	[0.94,1.03]	[0.94,1.03]	[0.94,1.02]	[0.95,1.03]	[0.94,1.02]
Age: 0 to 18 (%)	1.047***	1.049***	1.049***	1.052***	1.049***
	[1.01,1.08]	[1.02,1.08]	[1.02,1.08]	[1.02,1.09]	[1.01,1.09]
Age: 65+ (%)	0.992	0.985	0.988	0.985	0.991
	[0.96,1.02]	[0.96,1.01]	[0.96,1.01]	[0.96,1.01]	[0.96,1.02]
Under 100% FPL (%)	0.984**	0.983**	0.985**	0.982**	0.985**
	[0.97,1.00]	[0.97,1.00]	[0.97,1.00]	[0.97,1.00]	[0.97,1.00]
Supply					
APRN/100k	1.000	1.000	1.000	1.000	1.000
	[1.00,1.00]	[1.00,1.00]	[1.00,1.00]	[1.00,1.00]	[1.00,1.00]
MD Waiver/100k	1.004**	1.004**	1.004**	1.004**	1.004**
	[1.00,1.01]	[1.00,1.01]	[1.00,1.01]	[1.00,1.01]	[1.00,1.01]
OTP/100k	0.945	0.935	0.939	0.939	0.948
	[0.84,1.06]	[0.83,1.05]	[0.84,1.05]	[0.84,1.05]	[0.84,1.07]
States					
AL	1.305	0.629	0.578	1.584	0.837
	[0.38,4.42]	[0.20,1.99]	[0.18,1.86]	[0.56,4.48]	[0.24,2.87]
AR	0.622	0.313***	0.304***	0.736	0.368**
	[0.23,1.68]	[0.15,0.64]	[0.15,0.63]	[0.32,1.70]	[0.17,0.80]
AZ	2.904	2.574	2.657	2.503	2.568
	[0.40,21.03]	[0.33,19.96]	[0.34,20.85]	[0.32,19.68]	[0.33,19.74]
CA	5.141	2.143	2.549	3.534	2.463
	[0.52,50.83]	[0.14,32.12]	[0.16,41.66]	[0.32,39.29]	[0.15,39.61]
CO	1.121	0.553	0.626	1.125	
	[0.26,4.89]	[0.13,2.31]	[0.14,2.76]	[0.25,5.01]	
CT	2.733*	1.337	1.431	2.870**	1.468
	[0.93,8.04]	[0.49,3.62]	[0.51,4.03]	[1.00,8.20]	[0.53,4.08]
DC	2.035	1.696	1.341	2.212	2.438
	[0.44,9.33]	[0.40,7.15]	[0.28,6.41]	[0.55,8.90]	[0.49,12.03]
DE	1.472	0.714	0.705	1.666	0.883
	[0.59,3.65]	[0.29,1.76]	[0.28,1.79]	[0.79,3.53]	[0.34,2.31]
FL	3.797*	1.748	1.820	3.601*	2.049
	[0.85,17.01]	[0.35,8.74]	[0.35,9.45]	[0.79,16.51]	[0.40,10.43]
GA	0.611	0.275*	0.256*	0.649	0.383
	[0.20,1.85]	[0.07,1.14]	[0.06,1.09]	[0.25,1.70]	[0.08,1.79]
HI	1.662	1.604	1.750	1.214	1.732
	[0.34,8.04]	[0.36,7.15]	[0.37,8.32]	[0.28,5.17]	[0.35,8.58]
IA	0.128***	0.139***	0.128***	0.168***	0.125***
	[0.04,0.41]	[0.05,0.41]	[0.04,0.40]	[0.06,0.48]	[0.04,0.41]
ID	0.729	0.740	0.717	0.839	0.681
	[0.20,2.67]	[0.21,2.63]	[0.20,2.62]	[0.24,2.94]	[0.18,2.56]
IL	0.828	0.394	0.406	0.835	0.453
	[0.30,2.27]	[0.13,1.23]	[0.13,1.32]	[0.31,2.22]	[0.14,1.49]
IN	0.843	0.447***	0.441***	1.034	0.474***

	[0.31,2.31]	[0.27,0.74]	[0.26,0.74]	[0.43,2.47]	[0.27,0.82]
KS	0.356*	0.181***	0.190***	0.394*	0.192***
	[0.13,1.01]	[0.08,0.39]	[0.09,0.42]	[0.15,1.06]	[0.09,0.43]
KY	1.725	0.948	0.928	2.282	0.992
	[0.55,5.40]	[0.70,1.28]	[0.69,1.24]	[0.84,6.20]	[0.72,1.37]
LA	1.126	0.529	0.474	1.329	0.729
	[0.31,4.11]	[0.13,2.23]	[0.11,2.03]	[0.43,4.09]	[0.16,3.42]
MA	2.890**	1.556	1.593	3.354***	1.565
	[1.14,7.34]	[0.70,3.48]	[0.69,3.65]	[1.41,7.99]	[0.69,3.57]
MD	1.845	0.883	0.851	2.028	
	[0.70,4.89]	[0.22,3.59]	[0.20,3.58]	[0.86,4.77]	
ME	1.450	0.851	0.875	2.061	0.807
	[0.37,5.65]	[0.64,1.13]	[0.66,1.16]	[0.59,7.14]	[0.60,1.09]
MI	0.735	0.391***	0.376***	0.928	0.428**
	[0.28,1.92]	[0.21,0.72]	[0.20,0.69]	[0.42,2.05]	[0.22,0.82]
MN	0.320**	0.179***	0.186***	0.404**	
	[0.13,0.78]	[0.11,0.30]	[0.11,0.32]	[0.19,0.88]	
MO	0.419*	0.223***	0.218***	0.531	0.243***
	[0.15,1.13]	[0.14,0.37]	[0.13,0.36]	[0.23,1.24]	[0.14,0.42]
MS	0.775	0.355	0.308	0.932	0.526
	[0.16,3.79]	[0.06,1.96]	[0.05,1.74]	[0.23,3.83]	[0.08,3.29]
MT	0.537	0.606	0.559	0.718	0.527
	[0.18,1.58]	[0.22,1.65]	[0.19,1.61]	[0.27,1.91]	[0.17,1.61]
NC	1.366	0.661	0.635	1.535	0.816
	[0.56,3.35]	[0.25,1.74]	[0.24,1.71]	[0.74,3.20]	[0.29,2.32]
ND	0.273***	0.300***	0.277***	0.355**	0.268**
	[0.10,0.73]	[0.12,0.75]	[0.11,0.73]	[0.15,0.86]	[0.10,0.74]
NE	0.237***	0.125***	0.135***	0.275**	
	[0.08,0.71]	[0.06,0.25]	[0.06,0.28]	[0.10,0.77]	
NH	1.214	1.394	1.278	1.715	1.193
	[0.34,4.34]	[0.43,4.53]	[0.37,4.44]	[0.54,5.42]	[0.32,4.44]
NJ	2.967**	1.407	1.475	2.825*	1.605
	[1.04,8.44]	[0.35,5.70]	[0.35,6.25]	[0.98,8.17]	[0.37,6.88]
NM	33.27**	26.24*	29.45**	21.99*	26.82**
	[1.41,782.93]	[0.98,698.85]	[1.08,802.59]	[0.81,598.16]	[1.03,701.83]
NV	2.198	0.966	1.127	1.799	
	[0.45,10.80]	[0.14,6.53]	[0.16,8.17]	[0.34,9.60]	
NY	2.841**	1.373	1.406	2.828**	1.546
	[1.06,7.62]	[0.38,5.02]	[0.37,5.34]	[1.06,7.52]	[0.41,5.90]
OH	0.980	0.533**	0.512**	1.275	0.567**
	[0.36,2.65]	[0.31,0.91]	[0.30,0.87]	[0.56,2.93]	[0.32,1.00]
OR	1.229	1.275	1.227	1.419	1.174
	[0.39,3.86]	[0.42,3.88]	[0.39,3.85]	[0.47,4.29]	[0.36,3.79]
PA	1.676	0.914	0.893	2.115*	0.948
	[0.63,4.49]	[0.55,1.53]	[0.53,1.50]	[0.92,4.88]	[0.56,1.61]
RI	4.574**	4.725**	4.469**	5.304***	4.347**
	[1.28,16.30]	[1.37,16.33]	[1.25,15.98]	[1.56,18.06]	[1.18,16.07]
SC	0.686	0.336*	0.308**	0.832	0.429
	[0.22,2.17]	[0.11,1.05]	[0.10,0.98]	[0.32,2.16]	[0.13,1.46]
SD	0.135***	0.0765***	0.0804***	0.168***	
	[0.06,0.32]	[0.05,0.13]	[0.05,0.14]	[0.08,0.37]	
TX	3.633	1.426	1.641	2.543	1.772
	[0.34,38.74]	[0.10,20.25]	[0.11,25.00]	[0.21,30.15]	[0.12,26.72]
UT	1.024	0.512	0.557	1.056	0.520

	[0.31,3.36]	[0.19,1.40]	[0.19,1.61]	[0.33,3.41]	[0.18,1.53]
VA	1.027	0.499	0.496	1.117	0.605
	[0.49,2.16]	[0.18,1.37]	[0.18,1.40]	[0.61,2.06]	[0.20,1.80]
VT	2.069	1.252	1.268	3.015*	1.126
	[0.50,8.53]	[0.86,1.82]	[0.87,1.85]	[0.83,11.01]	[0.76,1.67]
WA	1.356	1.369	1.329	1.464	1.309
	[0.62,2.96]	[0.64,2.95]	[0.60,2.93]	[0.69,3.13]	[0.59,2.92]
WI	0.573	0.313***	0.314***	0.712	0.315***
	[0.21,1.56]	[0.20,0.50]	[0.19,0.51]	[0.29,1.74]	[0.19,0.51]
WV	1.744	1	1	2.441	1
	[0.45,6.79]	[1.00,1.00]	[1.00,1.00]	[0.72,8.27]	[1.00,1.00]
AL	1.305	0.629	0.578	1.584	0.837
	[0.38,4.42]	[0.20,1.99]	[0.18,1.86]	[0.56,4.48]	[0.24,2.87]
AR	0.622	0.313***	0.304***	0.736	0.368**
	[0.23,1.68]	[0.15,0.64]	[0.15,0.63]	[0.32,1.70]	[0.17,0.80]
AZ	2.904	2.574	2.657	2.503	2.568
	[0.40,21.03]	[0.33,19.96]	[0.34,20.85]	[0.32,19.68]	[0.33,19.74]
CA	5.141	2.143	2.549	3.534	2.463
	[0.52,50.83]	[0.14,32.12]	[0.16,41.66]	[0.32,39.29]	[0.15,39.61]
CO	1.121	0.553	0.626	1.125	
	[0.26,4.89]	[0.13,2.31]	[0.14,2.76]	[0.25,5.01]	
CT	2.733*	1.337	1.431	2.870**	1.468
	[0.93,8.04]	[0.49,3.62]	[0.51,4.03]	[1.00,8.20]	[0.53,4.08]
DC	2.035	1.696	1.341	2.212	2.438
	[0.44,9.33]	[0.40,7.15]	[0.28,6.41]	[0.55,8.90]	[0.49,12.03]
DE	1.472	0.714	0.705	1.666	0.883
	[0.59,3.65]	[0.29,1.76]	[0.28,1.79]	[0.79,3.53]	[0.34,2.31]
FL	3.797*	1.748	1.820	3.601*	2.049
	[0.85,17.01]	[0.35,8.74]	[0.35,9.45]	[0.79,16.51]	[0.40,10.43]
GA	0.611	0.275*	0.256*	0.649	0.383
	[0.20,1.85]	[0.07,1.14]	[0.06,1.09]	[0.25,1.70]	[0.08,1.79]
HI	1.662	1.604	1.750	1.214	1.732
	[0.34,8.04]	[0.36,7.15]	[0.37,8.32]	[0.28,5.17]	[0.35,8.58]
IA	0.128***	0.139***	0.128***	0.168***	0.125***
	[0.04,0.41]	[0.05,0.41]	[0.04,0.40]	[0.06,0.48]	[0.04,0.41]
ID	0.729	0.740	0.717	0.839	0.681
	[0.20,2.67]	[0.21,2.63]	[0.20,2.62]	[0.24,2.94]	[0.18,2.56]
Year					
2015	0	0	0	0	0
	[0.00,0.00]	[0.00,0.00]	[0.00,0.00]	[0.00,0.00]	[0.00,0.00]
2016	1.113***	1.117***	1.119***	1.115***	1.113***
	[1.08,1.15]	[1.08,1.15]	[1.08,1.16]	[1.08,1.15]	[1.08,1.15]
2017	1.236***	1.246***	1.248***	1.239***	1.237***
	[1.16,1.32]	[1.17,1.33]	[1.17,1.33]	[1.16,1.32]	[1.16,1.32]
2018	1.452***	1.481***	1.479***	1.468***	1.449***
	[1.31,1.61]	[1.34,1.64]	[1.33,1.64]	[1.32,1.63]	[1.30,1.61]
2019	1.729***	1.780***	1.774***	1.758***	1.719***
	[1.50,2.00]	[1.53,2.07]	[1.53,2.06]	[1.52,2.03]	[1.47,2.01]
Constant	1.113***	1.117***	1.119***	1.115***	1.113***
	[1.08,1.15]	[1.08,1.15]	[1.08,1.16]	[1.08,1.15]	[1.08,1.15]
Observations	960	960	960	960	840

95% confidence intervals in brackets

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix B Table 8.

Scope of Practice (SOP) Specifications

	2015	2016	2017	2018	2019
Broad vs Narrow SOP					
Broad. *Full SOP and transition states <=18 month transition*	(n=13) AK AZ DC HI IA ID MT ND NH NM OR RI WA	(n=15) AK AZ CO DC HI IA ID MD MT ND NH NM OR RI WA	(n=17) AK AZ CO DC HI IA ID MD MN MT ND NE NH NM OR RI WA	(n=19) AK AZ CO DC HI IA ID MD MN MT ND NE NH NM NV OR RI SD WA	(n=19) AK AZ CO DC HI IA ID MD MN MT ND NE NH NM NV OR RI SD WA
Narrow. *Restricted SOP and transition states <=18 month transition*	(n=35) AL AR CA CO CT DE FL GA IL IN KS KY LA MA MD ME MI MN MO MS NC NE NJ NV NY OH PA SC SD TX UT VA VT WI WV	(n=33) AL AR CA CT DE FL GA IL IN KS KY LA MA ME MI MN MO MS NC NE NJ NV NY OH PA SC SD TX UT VA VT WI WV	(n=31) AL AR CA CT DE FL GA IL IN KS KY LA MA ME MI MO MS NC NJ NV NY OH PA SC SD TX UT VA VT WI WV	(n=29) AL AR CA CT DE FL GA IL IN KS KY LA MA ME MI MO MS NC NJ NY OH PA SC TX UT VA VT WI WV	(n=29) AL AR CA CT DE FL GA IL IN KS KY LA MA ME MI MO MS NC NJ NY OH PA SC TX UT VA VT WI WV
Full | Reduced | Restricted					
Full	(n=13) AK AZ DC HI IA ID MT ND NH NM OR RI WA	(n=13) AK AZ DC HI IA ID MT ND NH NM OR RI WA	(n=13) AK AZ DC HI IA ID MT ND NH NM OR RI WA	(n=13) AK AZ DC HI IA ID MT ND NH NM OR RI WA	(n=13) AK AZ DC HI IA ID MT ND NH NM OR RI WA
Reduced	(n=6) CO CT ME MN NV VT	(n=9) CO CT DE MD ME MN NE NV VT	(n=10) CO CT DE MD ME MN NE NV VT WV	(n=11) CO CT DE MD ME MN NE NV SD VT WV	(n=13) CO CT DE IL MD ME MN NE NV SD VA VT WV
Restricted	(n=29) AL AR CA DE FL GA IL IN KS KY LA MA MD MI MO MS NC NE NJ NY OH PA SC SD TX UT VA WI WV	(n=26) AL AR CA FL GA IL IN KS KY LA MA MI MO MS NC NJ NY OH PA SC SD TX UT VA WI WV	(n=25) AL AR CA FL GA IL IN KS KY LA MA MI MO MS NC NJ NY OH PA SC SD TX UT VA WI	(n=24) AL AR CA FL GA IL IN KS KY LA MA MI MO MS NC NJ NY OH PA SC TX UT VA WI	(n=22) AL AR CA FL GA IN KS KY LA MA MI MO MS NC NJ NY OH PA SC TX UT WI
Full vs Reduced/Restricted					
Full	(n=13) AK AZ DC HI IA ID MT ND NH NM OR RI WA	(n=13) AK AZ DC HI IA ID MT ND NH NM OR RI WA	(n=13) AK AZ DC HI IA ID MT ND NH NM OR RI WA	(n=13) AK AZ DC HI IA ID MT ND NH NM OR RI WA	(n=13) AK AZ DC HI IA ID MT ND NH NM OR RI WA
Reduced/Restricted	(n=35) AL AR CA CO CT DE FL GA IL IN KS KY LA MA MD ME MI MN MO MS NC NE NJ NV NY OH PA SC	(n=35) AL AR CA CO CT DE FL GA IL IN KS KY LA MA MD ME MI MN MO MS NC NE NJ NV NY OH PA SC SD TX	(n=35) AL AR CA CO CT DE FL GA IL IN KS KY LA MA MD ME MI MN MO MS NC NE NJ NV NY OH PA SC SD TX	(n=35) AL AR CA CO CT DE FL GA IL IN KS KY LA MA MD ME MI MN MO MS NC NE NJ NV NY OH PA SC SD TX	(n=35) AL AR CA CO CT DE FL GA IL IN KS KY LA MA MD ME MI MN MO MS NC NE NJ NV NY OH PA

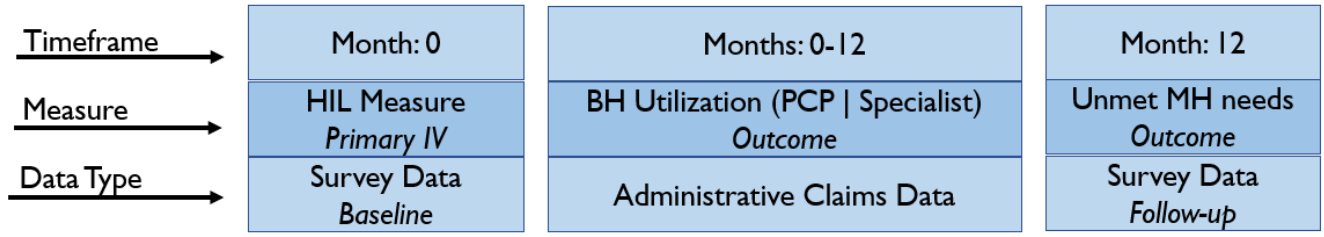
	SD TX UT VA VT WI WV	UT VA VT WI WV	UT VA VT WI WV	UT VA VT WI WV	SC SD TX UT VA VT WI WV
Full/Reduced vs Restricted					
Full/Reduced	(n=19) AK AZ CO CT DC HI IA ID ME MN MT ND NH NM NV OR RI VT WA	(n=22) AK AZ CO CT DC DE HI IA ID MD ME MN MT ND NE NH NM NV OR RI VT WA	(n=23) AK AZ CO CT DC DE HI IA ID MD ME MN MT ND NE NH NM NV OR RI VT WA WV	(n=24) AK AZ CO CT DC DE HI IA ID MD ME MN MT ND NE NH NM NV OR RI SD VT WA WV	(n=26) AK AZ CO CT DC DE HI IA ID IL MD ME MN MT ND NE NH NM NV OR RI SD VA VT WA WV
Restricted	(n=29) AL AR CA DE FL GA IL IN KS KY LA MA MD MI MO MS NC NE NJ NY OH PA SC SD TX UT VA WI WV	(n=26) AL AR CA FL GA IL IN KS KY LA MA MI MO MS NC NJ NY OH PA SC SD TX UT VA WI WV	(n=25) AL AR CA FL GA IL IN KS KY LA MA MI MO MS NC NJ NY OH PA SC SD TX UT VA WI	(n=24) AL AR CA FL GA IL IN KS KY LA MA MI MO MS NC NJ NY OH PA SC TX UT VA WI	(n=22) AL AR CA FL GA IN KS KY LA MA MI MO MS NC NJ NY OH PA SC TX UT WI

APPENDIX C

Appendix C Table 1. Summary of measures

Summary of Measures			
Outcomes	HIL measure	MH subsample	Covariates and other measures
• Probability of unmet mental health need due to cost Utilization (ICD9/10): • No BH treatment • PCP only BH treatment • Specialist BH treatment	Confidence with health insurance terms • *Premiums, Deductible, Co-payment, Co-insurance, Maximum annual out-of-pocket spending, Provider Network*	PROMIS anxiety and depression scores (baseline) • Cutoff of standardized t-score above 50.	• Demographics: Gender, Race, Marital status, Age, Education, Income, Employment status, History of any health insurance coverage • Health: Number of chronic conditions, Severity of baseline MH symptoms • RCT incentives group

Timeline of Study and Measures



Appendix C Table 2. Predicted probability of Treatment type, Full and MH Subsample, Multinomial Logistic Regression

	Full			MH Subsample		
	No Treatment[a]	PCP	Specialist	No Treatment[a]	PCP	Specialist
Low HIL[a]	0.742	0.159	0.097	0.689	0.191	0.118
High HIL	0.69	0.154	0.155**	0.629	0.187	0.182**
Female	0.749	0.14	0.11	0.702	0.162*	0.135
Male[a]	0.688	0.173	0.137	0.629	0.213	0.159
Non-white[a]	0.744	0.155	0.1	0.679	0.195	0.124
White	0.654	0.165	0.179**	0.615	0.179	0.205**
Unmarried[a]	0.707	0.16	0.132	0.646	0.191	0.161
Married	0.789	0.136	0.074*	0.764	0.17	0.064**
21-35[a]	0.684	0.163	0.152	0.64	0.203	0.156
36-50	0.734	0.166	0.098*	0.676	0.194	0.129
51-64	0.719	0.144	0.135	0.657	0.177	0.164
Less than HS[a]	0.694	0.154	0.15	0.643	0.192	0.164
HS	0.723	0.18	0.096*	0.667	0.22	0.112
More than HS	0.728	0.143	0.127	0.666	0.166	0.166
Income, <$1500[a]	0.717	0.157	0.124	0.658	0.193	0.148
Income, $1500+	0.721	0.164	0.113	0.709	0.136	0.154
Unemployed[a]	0.708	0.168	0.123	0.651	0.197	0.151
Employed	0.743	0.127	0.129	0.694	0.164	0.14
Insurance history	0.688	0.122	0.189	0.653	0.132	0.214
No history[a]	0.724	0.167	0.108**	0.661	0.205	0.133
0 Chronic cond[a]	0.732	0.17	0.097	0.665	0.192	0.141
1 Chronic cond	0.73	0.169	0.1	0.663	0.219	0.116
2 Chronic cond	0.71	0.153	0.135	0.659	0.183	0.157
Not Incentive[a]	0.715	0.143	0.141	0.646	0.188	0.165
Incentive	0.718	0.165	0.115	0.668	0.191	0.139
Moderate/High MH	0.632	0.2**	0.166***	0.577	0.229**	0.193***

No SUD Dx[a]	0.726	0.153	0.119	0.675	0.18	0.144
SUD Dx	0.67	0.18	0.148	0.595	0.236	0.168
No Previous MH Dx[a]	0.873	0.067	0.059	0.861	0.065	0.073
Previous MH Dx	0.597	0.229***	0.172***	0.571	0.246***	0.182***

[a] Indicates reference group

Appendix C, Table 3. Association between PROMIS and BH diagnosis or BH visit, full sample

	BH Diagnosis in claims Depression	BH Diagnosis in claims Anxiety
PROMIS Depression	1.024**	
	(0.0123)	
PROMIS Anxiety		1.027**
		(0.0128)
Female	1.481**	1.460*
	(0.286)	(0.283)
Race (ref=non-white)	1.815***	1.680**
	(0.380)	(0.354)
Married/Partnered	0.588	0.579
	(0.199)	(0.197)
Age Group (ref=21-35)		
36-50	0.794	0.799
	(0.208)	(0.210)
51-64	0.851	0.906
	(0.230)	(0.248)
Education (Less than HS=Ref)		
High school	0.836	0.847
	(0.206)	(0.212)
More than HS	0.850	0.851
	(0.206)	(0.204)
Income, 1500+ (Ref=<$1500)	0.988	0.951
	(0.453)	(0.433)
Employed	0.834	0.849
	(0.192)	(0.197)
Any history of insurance	0.842	0.791
	(0.203)	(0.192)
Chronic Conditions (ref = 0 conditions)		
1	1.041	1.105
	(0.374)	(0.403)
2+	1.092	1.166
	(0.356)	(0.383)
MH symptom severity, moderate/mild (ref=severe)	1.377	1.368
	(0.372)	(0.386)
Self-Reported MH diagnosis	4.376***	4.362***
	(1.025)	(1.054)
Self-Reported Alcohol diagnosis	1.347	1.349
	(0.345)	(0.353)
Incentive group	0.976	0.968
	(0.192)	(0.190)
Constant	0.0392***	0.0325***
	(0.0294)	(0.0242)
Observations	714	711

Robust standard error in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Appendix C, Table 4: Specification to examine various HIL specifications in Unmet MH need outcome analyses, Logistic Regression

VARIABLES	Full Sample			MH Sample		
	HIL split at Median (primary specification)	HIL split into top, middle, and bottom percentiles	HIL specified as continuous	HIL split at Median (primary specification)	HIL split into top, middle, and bottom percentiles	HIL specified as continuous
HIL, binary (ref=less than 50th percentile)						
High HIL	**0.712***			**0.642****		
	(0.143)			**(0.141)**		
HIL, thirds (ref= Lower third)						
Middle Third		0.756			0.734	
		(0.179)			(0.189)	
Top Third		**0.572****			**0.555****	
		(0.144)			**(0.153)**	
HIL, continuous			**0.963****			**0.960****
			(0.0183)			**(0.0199)**
Female	0.938	0.957	0.955	0.942	0.961	0.957
	(0.195)	(0.201)	(0.200)	(0.211)	(0.217)	(0.216)
White (ref=non-white)	0.755	0.758	0.764	0.820	0.821	0.824
	(0.170)	(0.170)	(0.172)	(0.202)	(0.200)	(0.201)
Married/Partnered	1.128	1.129	1.118	1.203	1.206	1.199
	(0.359)	(0.361)	(0.357)	(0.413)	(0.417)	(0.413)
Age Group (ref=21-35)						
36-50	1.206	1.198	1.195	1.182	1.169	1.169
	(0.328)	(0.327)	(0.324)	(0.345)	(0.344)	(0.341)
51-64	1.027	1.030	1.020	1.030	1.032	1.019
	(0.279)	(0.283)	(0.278)	(0.311)	(0.315)	(0.308)
Education						
High School	0.536**	0.541**	0.556**	0.514**	0.519**	0.536**
	(0.142)	(0.144)	(0.148)	(0.145)	(0.147)	(0.152)
More than HS	0.705	0.715	0.722	0.703	0.705	0.717
	(0.168)	(0.172)	(0.174)	(0.181)	(0.183)	(0.187)
Income, 1500+ (ref=<$1500)	0.652	0.631	0.636	0.568	0.523	0.538
	(0.330)	(0.329)	(0.330)	(0.347)	(0.328)	(0.336)
Employed	0.864	0.873	0.869	0.825	0.845	0.839
	(0.211)	(0.214)	(0.213)	(0.223)	(0.229)	(0.227)
Insurance history	0.974	0.969	0.967	0.876	0.859	0.862
	(0.237)	(0.237)	(0.235)	(0.230)	(0.226)	(0.226)
Chronic conditions (ref=0)						
1	0.552*	0.556	0.555	0.498*	0.496*	0.497
	(0.199)	(0.201)	(0.201)	(0.211)	(0.209)	(0.211)
2+	0.627	0.635	0.638	0.543*	0.550	0.554
	(0.194)	(0.197)	(0.199)	(0.201)	(0.205)	(0.207)
Incentive group	0.900	0.904	0.902	0.823	0.823	0.818
	(0.189)	(0.190)	(0.189)	(0.188)	(0.189)	(0.187)

Moderate/Mild MH symptoms (ref=severe)	2.033***	1.980***	2.020***	1.743**	1.714**	1.740**
	(0.446)	(0.436)	(0.443)	(0.392)	(0.385)	(0.389)
Hx drug/alcohol	1.102	1.081	1.081	1.131	1.108	1.103
	(0.303)	(0.300)	(0.297)	(0.320)	(0.316)	(0.310)
Hx MH Dx	3.900***	3.940***	3.849***	2.726***	2.786***	2.707***
	(0.923)	(0.939)	(0.918)	(0.700)	(0.721)	(0.699)
Constant	0.297***	0.321***	0.480	0.634	0.672	1.042
	(0.122)	(0.134)	(0.238)	(0.284)	(0.305)	(0.555)
Observations	675	675	675	481	481	481

Robust standard error in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Appendix C, Table 5: Sensitivity tests of HIL specifications in BH utilization multinomial logistic regressions.

	Full Sample						MH Sample					
	HIL split at Median (primary specification)		HIL split into top, middle, and bottom percentiles		HIL specified as continuous		HIL split at Median (primary specification)		HIL split into top, middle, and bottom percentiles		HIL specified as continuous	
HIL, binary (ref=less than 50th percentile)												
High HIL	1.105	1.876**					1.141	1.822**				
	(0.254)	(0.501)					(0.297)	(0.527)				
HIL, thirds (ref= Lower third)												
Middle Third			1.239	1.090					1.356	1.093		
			(0.329)	(0.354)					(0.398)	(0.380)		
Top Third			1.054	1.719*					0.948	1.529		
			(0.304)	(0.559)					(0.313)	(0.540)		
HIL, continuous					1.015	1.038					1.018	1.028
					(0.0218)	(0.0283)					(0.0239)	(0.0306)
Female	1.425	1.460	1.434	1.426	1.413	1.436	1.570*	1.425	1.610*	1.400	1.556*	1.414
	(0.316)	(0.397)	(0.322)	(0.386)	(0.314)	(0.392)	(0.390)	(0.424)	(0.408)	(0.414)	(0.388)	(0.423)
White (ref=non-white)	1.328	2.288***	1.329	2.298***	1.323	2.279***	1.056	1.948**	1.042	1.985**	1.055	1.959**
	(0.345)	(0.597)	(0.347)	(0.595)	(0.345)	(0.591)	(0.314)	(0.559)	(0.311)	(0.566)	(0.314)	(0.561)
Married/Partnered	0.692	0.445*	0.687	0.458*	0.688	0.461*	0.676	0.296**	0.673	0.305**	0.671	0.307**
	(0.265)	(0.206)	(0.265)	(0.213)	(0.264)	(0.213)	(0.297)	(0.161)	(0.299)	(0.166)	(0.295)	(0.165)
Age Group (ref=21-35)												
36-50	0.918	0.560	0.921	0.585	0.911	0.587	0.885	0.755	0.877	0.783	0.873	0.791
	(0.290)	(0.199)	(0.292)	(0.206)	(0.288)	(0.208)	(0.307)	(0.295)	(0.308)	(0.305)	(0.304)	(0.309)
51-64	0.820	0.811	0.822	0.827	0.815	0.842	0.846	1.013	0.854	1.026	0.837	1.060
	(0.278)	(0.277)	(0.279)	(0.281)	(0.276)	(0.289)	(0.304)	(0.400)	(0.309)	(0.403)	(0.301)	(0.418)
Education												
High School	1.055	0.580	1.039	0.604	1.037	0.581	1.057	0.637	1.029	0.670	1.036	0.647
	(0.311)	(0.195)	(0.306)	(0.200)	(0.307)	(0.193)	(0.346)	(0.237)	(0.338)	(0.247)	(0.342)	(0.238)
More than HS	0.852	0.773	0.860	0.816	0.838	0.817	0.787	0.954	0.801	1.024	0.774	1.020
	(0.248)	(0.252)	(0.251)	(0.262)	(0.245)	(0.262)	(0.251)	(0.339)	(0.255)	(0.359)	(0.249)	(0.357)

Income, 1500+ (ref=<$1500)	0.989	0.894	0.997	0.926	0.993	0.920	0.580	0.935	0.562	0.998	0.588	0.958
	(0.509)	(0.583)	(0.513)	(0.614)	(0.510)	(0.605)	(0.385)	(0.701)	(0.373)	(0.769)	(0.388)	(0.731)
Employed	0.703	0.969	0.699	0.961	0.701	0.966	0.764	0.838	0.760	0.824	0.759	0.839
	(0.199)	(0.305)	(0.196)	(0.305)	(0.198)	(0.305)	(0.258)	(0.305)	(0.253)	(0.303)	(0.255)	(0.306)
Insurance history	1.241	0.499**	1.231	0.520**	1.241	0.512**	1.537	0.593	1.530	0.613	1.539	0.608
	(0.372)	(0.153)	(0.371)	(0.157)	(0.373)	(0.157)	(0.520)	(0.202)	(0.519)	(0.206)	(0.524)	(0.205)
Chronic conditions (ref=0)	0.966	1.033	0.970	1.065	0.954	1.082	1.128	0.814	1.159	0.871	1.113	0.881
1	(0.418)	(0.526)	(0.418)	(0.545)	(0.410)	(0.552)	(0.608)	(0.476)	(0.622)	(0.514)	(0.595)	(0.519)
	0.915	1.490	0.907	1.486	0.907	1.488	0.939	1.126	0.939	1.159	0.929	1.158
	(0.348)	(0.706)	(0.347)	(0.700)	(0.345)	(0.706)	(0.440)	(0.606)	(0.444)	(0.626)	(0.435)	(0.630)
Incentive group	1.135	0.804	1.149	0.779	1.143	0.791	0.957	0.799	0.969	0.777	0.972	0.786
	(0.275)	(0.210)	(0.279)	(0.205)	(0.276)	(0.205)	(0.256)	(0.229)	(0.260)	(0.224)	(0.260)	(0.223)
Moderate/Mild MH symptoms (ref=severe)	1.932**	2.154***	1.917**	2.217***	1.948***	2.145***	1.927**	2.247***	1.872**	2.260***	1.942**	2.213***
	(0.495)	(0.616)	(0.491)	(0.642)	(0.498)	(0.616)	(0.522)	(0.660)	(0.507)	(0.671)	(0.526)	(0.653)
Hx drug/alcohol	1.338	1.445	1.364	1.418	1.353	1.453	1.585	1.420	1.642	1.387	1.608	1.422
	(0.414)	(0.484)	(0.425)	(0.477)	(0.418)	(0.493)	(0.525)	(0.513)	(0.550)	(0.504)	(0.532)	(0.521)
Hx MH Dx	5.326***	4.781***	5.341***	4.568***	5.364***	4.708***	6.327***	4.218***	6.385***	3.956***	6.357***	4.092***
	(1.585)	(1.617)	(1.590)	(1.532)	(1.606)	(1.579)	(2.475)	(1.663)	(2.498)	(1.544)	(2.502)	(1.593)
Constant	0.0480***	0.0606***	0.0456***	0.0656***	0.0396***	0.0411***	0.0376***	0.0651***	0.0355***	0.0716***	0.0300***	0.0499***
	(0.0270)	(0.0361)	(0.0263)	(0.0401)	(0.0259)	(0.0301)	(0.0248)	(0.0439)	(0.0240)	(0.0495)	(0.0222)	(0.0396)
Observations	718	718	718	718	718	718	513	513	513	513	513	513

Robust standard error in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Appendix C, Table 6. Sensitivity tests exploring BH utilization outcomes as continuous. Poisson Regression.

VARIABLES	Full Sample			MH Subsample		
	MH Outpatient Visits (no.)	MH PCP Visits (no.)	MH Specialist Visits (no.)	MH Outpatient Visits (no.)	MH PCP Visits (no.)	MH Specialist Visits (no.)
High HIL, baseline	1.090	1.192	0.910	1.073	1.192	0.875
	(0.252)	(0.333)	(0.327)	(0.263)	(0.353)	(0.328)
Female	1.517	1.348	1.986*	1.633*	1.489	2.029*
	(0.404)	(0.459)	(0.748)	(0.458)	(0.535)	(0.819)
White (ref=non-white)	1.021	0.899	1.341	1.006	0.855	1.397
	(0.216)	(0.211)	(0.496)	(0.223)	(0.204)	(0.554)
Married/Partnered	0.740	0.919	0.460*	0.759	0.976	0.401*
	(0.254)	(0.383)	(0.214)	(0.281)	(0.420)	(0.212)
Age Group (ref=21-35)						
36-50	0.817	1.112	0.540	0.850	1.112	0.616
	(0.236)	(0.274)	(0.320)	(0.268)	(0.292)	(0.405)
51-64	1.069	1.345	0.858	1.165	1.475	0.922
	(0.348)	(0.428)	(0.573)	(0.407)	(0.481)	(0.669)
Education (ref=less than HS)						
High school	0.857	0.843	0.964	0.872	0.846	1.033
	(0.240)	(0.277)	(0.367)	(0.264)	(0.302)	(0.420)
More than HS	1.221	0.769	3.304***	1.296	0.795	3.816***
	(0.349)	(0.263)	(1.490)	(0.385)	(0.279)	(1.823)
Income, 1500+ (ref=<$1500)	0.850	0.362**	2.136	0.744	0.215**	2.290
	(0.437)	(0.185)	(1.517)	(0.452)	(0.143)	(1.838)
Employed	0.942	1.064	0.701	1.075	1.278	0.687
	(0.300)	(0.421)	(0.345)	(0.369)	(0.524)	(0.379)
Insurance History	0.918	1.042	0.651	0.957	1.092	0.665
	(0.293)	(0.403)	(0.366)	(0.335)	(0.460)	(0.422)
Chronic conditions (ref=0)						
	1.174	0.924	1.751	1.067	0.857	1.506
1	(0.416)	(0.337)	(1.164)	(0.413)	(0.352)	(1.025)
	1.383	1.177	1.763	1.257	1.101	1.520
2+	(0.439)	(0.365)	(1.185)	(0.439)	(0.363)	(1.112)
Incentive Group	1.613**	1.862**	1.307	1.642**	1.878**	1.335
	(0.347)	(0.480)	(0.473)	(0.372)	(0.507)	(0.493)
Moderate/Mild MH symptoms (ref=severe)	1.406	1.173	2.053*	1.271	1.073	1.837
	(0.332)	(0.309)	(0.806)	(0.311)	(0.291)	(0.752)
Hx Drug/Alcohol Dx	1.166	1.146	1.144	1.206	1.232	1.088

	(0.324)	(0.376)	(0.551)	(0.343)	(0.414)	(0.539)
Hx MH Dx	8.403***	8.790***	7.989***	9.279***	10.69***	6.751***
	(2.648)	(3.493)	(3.405)	(3.271)	(4.827)	(2.956)
Constant	0.0995***	0.0681***	0.0199***	0.0902***	0.0544***	0.0247***
	(0.0533)	(0.0455)	(0.0179)	(0.0516)	(0.0394)	(0.0226)
Observations	718	718	718	513	513	513

Robust standard error in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Appendix C, Table 7. Sensitivity test removing multiple imputation for Unmet MH needs analysis.

Logistic Regression, listwise deletion

	Full Sample			Subsample		
	Unmet MH Unadjusted	Unmet MH Demographics	Unmet MH Fully adjust	Unmet MH Unadjusted	Unmet MH Demographics	Unmet MH Fully adjust
High HIL	**0.618*** **	**0.615** **	**0.722**	**0.575*** **	**0.564*** **	**0.632** **
	(0.115)	**(0.119)**	**(0.147)**	**(0.118)**	**(0.122)**	**(0.141)**
Female		1.284	0.975		1.153	0.974
		(0.251)	(0.205)		(0.246)	(0.220)
White (ref=non-white)		0.948	0.709		0.979	0.799
		(0.207)	(0.160)		(0.239)	(0.198)
Married/Partnered		1.119	1.169		1.275	1.246
		(0.332)	(0.373)		(0.427)	(0.431)
Age Group (ref=21-35)						
36-50		1.246	1.220		1.168	1.233
		(0.318)	(0.337)		(0.319)	(0.366)
51-64		0.867	1.084		0.905	1.096
		(0.229)	(0.299)		(0.257)	(0.338)
Education						
High School		0.531***	0.529**		0.534**	0.510**
		(0.127)	(0.141)		(0.139)	(0.144)
More than HS		0.719	0.702		0.745	0.708
		(0.164)	(0.168)		(0.192)	(0.184)
Income, 1500+ (ref=<$1500)		0.530	0.655		0.524	0.567
		(0.252)	(0.333)		(0.300)	(0.346)
Employed		0.759	0.893		0.664	0.839
		(0.172)	(0.218)		(0.172)	(0.228)
Insurance history		1.073	0.929		0.904	0.852
		(0.243)	(0.228)		(0.226)	(0.225)
Chronic conditions (ref=0)						
1			0.580			0.499
			(0.213)			(0.214)
2+			0.627			0.505*
			(0.198)			(0.189)
Incentive group			0.877			0.806
			(0.186)			(0.186)
Moderate/Mild MH symptoms (ref=severe)			2.041***			1.723**
			(0.450)			(0.389)
Hx drug/alcohol			1.072			1.090
			(0.296)			(0.309)
Hx MH Dx			4.014***			2.718***
			(0.966)			(0.704)
Constant	0.377***	0.465**	0.289***	0.530***	0.787	0.664
	(0.0454)	(0.144)	(0.121)	(0.0700)	(0.266)	(0.299)
Observations	675	667	667	481	475	475

Appendix C, Table 8. Sensitivity test removing multiple imputation for BH utilization analysis. *Logistic Regression, listwise deletion*

	Full Sample			Subsample		
	Reference No Tx	PCP Full	Specialist Full	Reference No Tx	PCP Subsample	Specialist Subsample
High HIL		**1.109**	**1.866****		**1.091**	**1.790****
		(0.258)	**(0.499)**		**(0.288)**	**(0.519)**
Female		1.510*	1.447		1.641**	1.402
		(0.340)	(0.395)		(0.413)	(0.419)
White (ref=non-white)		1.335	2.278***		1.112	1.968**
		(0.352)	(0.594)		(0.336)	(0.565)
Married/Partnered		0.721	0.447*		0.695	0.296**
		(0.279)	(0.208)		(0.310)	(0.161)
Age Group (ref=21-35)						
36-50		0.786	0.538*		0.771	0.730
		(0.249)	(0.193)		(0.269)	(0.291)
51-64		0.735	0.781		0.747	0.968
		(0.252)	(0.270)		(0.271)	(0.387)
Education						
High School		1.080	0.577		1.088	0.634
		(0.321)	(0.194)		(0.358)	(0.236)
More than HS		0.797	0.765		0.760	0.956
		(0.234)	(0.250)		(0.243)	(0.340)
Income, 1500+ (ref=<$1500)		1.049	0.893		0.612	0.927
		(0.543)	(0.583)		(0.407)	(0.694)
Employed		0.695	0.961		0.727	0.831
		(0.202)	(0.302)		(0.253)	(0.301)
Insurance history		1.295	0.506**		1.675	0.605
		(0.395)	(0.156)		(0.571)	(0.207)
Chronic conditions (ref=0)		1.152	1.043		1.313	0.823
1		(0.525)	(0.535)		(0.734)	(0.489)
2+		1.153	1.521		1.148	1.152
		(0.460)	(0.727)		(0.553)	(0.628)
Incentive group		1.155	0.793		0.982	0.789
		(0.286)	(0.208)		(0.269)	(0.226)
Moderate/Mild MH symptoms (ref=severe)		1.954**	2.129***		1.934**	2.210***
		(0.511)	(0.609)		(0.534)	(0.650)
Hx drug/alcohol		1.454	1.493		1.713	1.459
		(0.455)	(0.500)		(0.574)	(0.528)
Hx MH Dx		5.164***	4.775***		5.727***	4.201***
		(1.555)	(1.614)		(2.234)	(1.660)
Constant		0.0395***	0.0627***		0.0329***	0.0673***
		(0.0231)	(0.0377)		(0.0221)	(0.0457)
Observations	710	710	710	507	507	507

Robust se in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Appendix C, Table 9. Sensitivity to examine potential endogeneity of HIL term.
Bivariate Probit Regression

	Unmet Need vs. No Unmet Need		Any Treatment vs No Treatment		Primary Care vs No Treatment		Specialist vs. No Treatment	
VARIABLES	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
High HIL, baseline	-0.961		-0.328		-1.329**		-1.281***	
	(0.638)		(0.815)		(0.655)		(0.253)	
Female	0.0298	0.203	0.260**	0.163	0.353**	0.240*	0.209	0.148
	(0.145)	(0.125)	(0.130)	(0.122)	(0.141)	(0.131)	(0.132)	(0.132)
White (ref=non-white)	-0.0988	0.0955	0.238*	0.105	0.122	0.0977	0.309**	0.0529
	(0.149)	(0.142)	(0.141)	(0.135)	(0.159)	(0.155)	(0.153)	(0.150)
Married/Partnered	0.138	0.0721	-0.384	0.104	-0.139	0.0723	-0.457*	0.0119
	(0.200)	(0.203)	(0.238)	(0.191)	(0.256)	(0.212)	(0.255)	(0.214)
Age Group (ref=21-35)								
36-50	0.195	0.195	-0.110	0.164	-0.108	0.0805	0.0166	0.0788
	(0.171)	(0.167)	(0.184)	(0.159)	(0.218)	(0.172)	(0.192)	(0.176)
51-64	0.116	0.166	-0.0644	0.129	-0.0840	0.123	0.0623	0.0115
	(0.179)	(0.172)	(0.177)	(0.167)	(0.229)	(0.181)	(0.185)	(0.182)
Education (ref=less than HS)								
High school	-0.314*	0.167	-0.0594	0.202	0.203	0.206	-0.118	0.0909
	(0.186)	(0.156)	(0.178)	(0.152)	(0.171)	(0.163)	(0.173)	(0.168)
More than HS	-0.0521	0.533***	0.00323	0.555***	0.165	0.540***	0.315*	0.494***
	(0.216)	(0.150)	(0.249)	(0.146)	(0.267)	(0.161)	(0.173)	(0.166)
Income, 1500+ (ref=<$1500)	-0.299	0.0237	-0.160	0.0168	-0.280	-0.123	-0.0396	0.106
	(0.315)	(0.271)	(0.319)	(0.262)	(0.327)	(0.270)	(0.355)	(0.293)
Employed	-0.141	-0.191	-0.186	-0.196	-0.205	-0.188	-0.232	-0.335**
	(0.155)	(0.146)	(0.165)	(0.141)	(0.171)	(0.154)	(0.160)	(0.150)
Insurance History	-0.0608	0.184	0.0463	0.212	0.383**	0.333**	-0.142	0.0509
	(0.161)	(0.147)	(0.171)	(0.144)	(0.164)	(0.164)	(0.165)	(0.157)
Chronic conditions (ref=0)								
1	-0.201	0.716***	0.155	0.704***	0.487	0.583**	0.313	0.898***
	(0.331)	(0.242)	(0.334)	(0.236)	(0.309)	(0.254)	(0.283)	(0.254)
2+	-0.319	0.258	0.103	0.235	0.224	0.175	0.219	0.388*
	(0.241)	(0.216)	(0.244)	(0.208)	(0.266)	(0.232)	(0.235)	(0.222)
Incentive Group	-0.131	-0.0682	-0.0822	-0.0798	-0.0372	-0.0668	-0.104	-0.0234
	(0.131)	(0.129)	(0.130)	(0.126)	(0.138)	(0.147)	(0.132)	(0.134)
Moderate/Mild MH symptoms (ref=severe)	0.243	-0.245*	0.406**	-0.140	0.277	-0.0182	0.137	-0.262*
	(0.166)	(0.134)	(0.163)	(0.132)	(0.208)	(0.160)	(0.160)	(0.151)
Hx Drug/Alcohol Dx	0.00842	-0.130	0.254	-0.105	0.146	-0.270	0.104	0.0706
	(0.171)	(0.166)	(0.172)	(0.164)	(0.240)	(0.211)	(0.199)	(0.203)
Hx MH Dx	0.524***	-0.146	0.870***	-0.171	0.588	-0.224	0.418*	-0.0868
	(0.180)	(0.139)	(0.218)	(0.136)	(0.436)	(0.143)	(0.216)	(0.153)
Constant	-.100	-0.769***	-1.202***	-0.752***	-1.273	-0.806***	-0.616*	-0.633**
	(0.314)	(0.279)	(0.409)	(0.271)	(0.797)	(0.288)	(0.362)	(0.309)
Rho	.430		0.317		0.845		0.935	
	(.502)		(0.478)		(0.419)		(0.103)	
Wald test of rho=0	0.430		0.381		0.712		4.27**	
Observations	475	475	507	507	431	431	412	412

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Appendix C, Table 10. Behavioral Health ICD-9 and ICD-10 codes

Code	ICD-9	ICD-10
Depression	"29620", "29621", "29622","29623", "29624", "29625", "29626", 29630", "29631", "29632","29633","29634", "29635", "29636", "29651","29652", "29653", "29654", "29655","29656", "29660", "29661", "29662","29663", "29664", "29665", "29666", 29689", "2980", "3004", "3091", "311"	"F3130", "F3131", "F3132", "F314", "F315", "F3160", "F3161", "F3162", "F3163", "F3164", "F3175", "F3176", "F3177", "F3178", "F3181", "F320", "F321", "F322", "F323", "F324", "F325", "F329", "F330", "F331", "F332", "F333", "F3340", "F3341", "F3342", "F338", "F339", "F341", "F4321", "F4323"
Anxiety	"29384", "30000", "30001","30002", "30009", "30010", "30020", 30021", "30022", "30023", "30029", "3003", "3005", "30089", "3009", "3080", "3081", "3082", "3083", "3084", "3089", "30981", "3130", "3131", "31321", "31322", "3133", "31382", "31383"	"F064", "F4000", "F4001", "F4002", "F4010", "F4011", "F40210", "F40218", "F40220", "F40228", "F40230", "F40231", "F40232", "F40233", "F40240", "F40241", "F40242", "F40243", "F40248", "F40290", "F40291", "F40298", "F408", "F409", "F410", "F411", "F413", "F418", "F419", "F42", "F422", "F423", "F424", "F428", "F429", "F430", "F4310", "F4311", "F4312", "F449", "F458", "F488", "F489", "F938", "F99", "R452", "R455", "R456", "R457"
ADHD	"31200", "31201", "31202","31203", "31210", "31211", "31212","31213", "31220", "31221", "31222","31223", "31230", "31231", "31232","31233", "31234", "31235", "31239", "3124", "31281", "31282", "31289", "3129", "31400", "31401", "3141", "3142", "3148", "3149"	"F630", "F631", "F632", "F633", "F6381", "F6389", "F639", "F900", "F901", "F902", "F908", "F909", "F910", "F911", "F913", "F912", "F918", "F919"
Bipolar	"29600", "29601", "29602","29603", "29604", "29605", "29606","29610", "29611", "29612", "29613","29614", "29615", "29616", "29640","29641", "29642", "29643", "29644","29645", "29646", "29650", "29651","29652", "29653", "29654", "29655","29656", "29660", "29661", "29662","29663", "29664", "29665", "29666", "2967", "29680", "29681", "29682","29689", "29690", "29699"	"F3010", "F3011", "F3012", "F3013", "F302", "F303", "F304", "F308", "F309", "F310", "F3110", "F3111", "F3112", "F3113", "F312", "F3130", "F3131", "F3132", "F314", "F315", "F3160", "F3161", "F3162", "F3163", "F3164", "F3170", "F3171", "F3172", "F3173", "F3174", "F3175", "F3176", "F3177", "F3178", "F3181", "F3189", "F319", "F338", "F3481", "F3489", "F349", "F39"
Personality Disorders	"3010", "30110", "30111", "30112", "30113", "30120", "30121","30122", "3013", "3014", "30150", "30151", "30159", "3016", "3017", "30181", "30182", "30183", "30184", "30189", "3019"	"F21", "F340", "F341", "F600", "F601", "F602", "F603", "F604", "F605", "F606", "F607", "F6081", "F6089", "F609", "F6810", "F6811", "F6812", "F6813", "F69"
Post-Traumatic Stress Disorder	"30981"	"F4310", "F4311", "F4312"
Schizophrenia	"29381", "29382", "29500","29501", "29502", "29503", "29504","29505", "29510", "29511", "29512","29513", "29514","29515","29520","29521","29522", "29523", "29524","29525","29530","29531"	"F060", "F062", "F200", "F201", "F202", "F203", "F205", "F2081", "F2089", "F209", "F21", "F22", "F23", "F24", "F250", "F251", "F258", "F259", "F28", "F29", "F323", "F333", "F4489"

	, "29532", "29533", "29534", "29535", "29540", "29541", "29542", "29543", "29544", "29545", "29550", "29551", "29552", "29553", "29554", "29555", "29560", "29561", "29562", "29563", "29564", "29565", "29570", "29571", "29572", "29573", "29574", "29575", "29580", "29581", "29582", "29583", "29584", "29585", "29590", "29591", "29592", "29593", "29594", "29595", "2970", "2971", "2972", "2973", "2978", "2979", "2980", "2981", "2982", "2983", "2984", "2988", "2989"	
Other	"30011", "30012", "30013", "30014", "30015", "30016", "30019", "3004", "3006", "3007","30081", "30082", "30270", "30271", "3090", "30924", "30928", "30929", "3093", "3094", "30982", "30983", "30989", "3099", "29700", "3071", "30750", "30751"	"F348", "O906", "F5000", "F5001", "F5002", "F502", "F508", "F5081", "F5089", "F509", "F9821", "F9829", "F983", "F4521", "F4522", "R4681", "F070", "F688","F061", "F444", "F445", "F446", "F447", "F450", "F451", "F4520", "F4529", "F4541", "F4542", "F458", "F459", "F54", "F430", "F4310", "F4320", "F4321","F4322", "F4323", "F4324", "F4325", "F4329", "F348", "F439", "F440", "F441", "F442", "F4481", "F4489", "F449", "F941", "F942", "F068", "F09", "F481", "F488", "F489", "F939", "F99", "O99340", "O99341", "O99342", "O99343", "O99344", "O99345", "R45850", "F6810"
Self-Injury	"V6284", "E9500", "E9501", "E9502", "E9503", "E9504", "E9505", "E9506", "E9507", "E9508", "E9509", "E9510","E9511", "E9518", "E9520", "E9521", "E9528", "E9529","E9530", "E9530", "E9531", "E9538","E9539", "E954","E9550", "E9552", "E9554", "E9555", "E9556", "E9559","E956", "E9570", "E9571", "E9572", "E9579", "E9580", "E9581", "E9582", "E9583", "E9584", "E9585", "E9587", "E9588", "E9589"	"R45851", "T1491", "T360X2A", "T361X2A", "T362X2A", "T363X2A", "T364X2A", "T365X2A", "T366X2A", "T367X2A", "T368X2A", "T3692XA", "T370X2A", "T371X2A", "T372X2A", "T373X2A", "T374X2A", "T375X2A", "T378X2A", "T3792XA", "T380X2A", "T381X2A", "T382X2A", "T383X2A", "T384X2A", "T385X2A", "T386X2A", "T387X2A", "T38802A", "T38812A", "T38892A", "T38902A", "T38992A", "T39012A", "T39092A", "T391X2A", "T392X2A", "T39312A", "T39392A", "T394X2A", "T398X2A", "T3992XA", "T400X2A", "T401X2A", "T402X2A", "T403X2A", "T404X2A", "T405X2A", "T40602A", "T40692A", "T407X2A", "T408X2A", "T40902A", "T40992A", "T410X2A", "T411X2A", "T41202A", "T41292A", "T413X2A", "T4142XA", "T415X2A", "T420X2A", "T421X2A", "T422X2A", "T423X2A", "T424X2A", "T425X2A", "T426X2A", "T4272XA", "T428X2A", "T43012A", "T43022A", "T431X2A", "T43202A", "T43212A", "T43222A", "T43292A", "T433X2A", "T434X2A", "T43502A", "T43592A", "T43602A", "T43612A", "T43622A", "T43632A", "T43692A", "T438X2A", "T4392XA", "T440X2A", "T441X2A", "T442X2A", "T443X2A", "T444X2A", "T445X2A", "T446X2A", "T447X2A", "T448X2A", "T44902A", "T44992A", "T450X2A", "T451X2A", "T452X2A", "T453X2A", "T454X2A", "T45512A", "T45522A", "T45602A", "T45612A", "T45622A", "T45692A", "T457X2A", "T458X2A", "T4592XA", "T460X2A", "T461X2A", "T462X2A", "T463X2A", "T464X2A", "T465X2A", "T466X2A", "T467X2A", "T468X2A", "T46902A", "T46992A", "T470X2A", "T471X2A", "T472X2A", "T473X2A", "T474X2A", "T475X2A", "T476X2A", "T477X2A", "T478X2A", "T4792XA", "T480X2A",

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CURRICULUM VITAE

Heather (Guiffre) Saunders
Richmond, VA
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Profile

- **Skills:** Quasi-experimental research methods; Insurance claims analysis; Survey design; Survey analysis; Qualitative design and data collection; Qualitative analysis; IRB; Program evaluation; Discrete choice experiments
- **Data Types:** Healthcare claims—medical claims, prescription, enrollment (Medicaid; Virginia Coordinated Care; Medical Expenditure Panel); Healthcare claims linked to primary surveys and public data sources; National, state, and local surveys; Randomized controlled trial; National and state registries; National drug reporting systems; Qualitative
- **Computer skills:** STATA, SAS and SAS Enterprise (working), Excel, NVivo
- **Management skills:** Program management; Staff management; Regulatory affairs

Education

Virginia Commonwealth University, Healthcare Policy and Research, Doctor of Philosophy (2016-2021, anticipated)

- **Dissertation:** Access to Behavioral Health Services: Workforce, Coverage, and Health Insurance Literacy
- **Relevant coursework:** Health Economics, Econometrics I, Econometrics II, Economic Evaluation and Decision Analysis, Panel and Nonlinear Methods, Statistical Methods, Survey Research Methods, Health Services Research and Policy I & II, Economics of Health Disparities, Program Evaluation

Virginia Commonwealth University, Master of Social Work, clinical concentration (2010-2012)

Christopher Newport University, Bachelor of Psychology (2002-2007)

Publications in Peer Reviewed Journals

1. Saunders, H., Britton, E., Cunningham, P., Walker, L., Harrell, A., Scialli, A., & Lowe, J. (2021, In Press). Medicaid participation among practitioners authorized to prescribe buprenorphine. *Journal of Substance Abuse Treatment.*
2. Bradley, C & Saunders, H. (2021, In Press). Impact of cash incentives for low-income individuals to seek a primary care visit on mental health outcomes: evidence from a randomized controlled trial. *Social Science and Medicine*.
3. Cartwright, K. B., Bock, A. M., Clause, J. H., Coppage August, E. A., Saunders, H., & Schmidt, K. J. (2020). Near-and far-transfer effects of an executive function intervention for 2nd to 5th-grade struggling readers. *Cognitive Development*.
4. Mason, M., Light, J., Campbell, L., Keyser-Marcus, L., Crewe, S., Way, T., Saunders, H., King, L., Zaharakis, N., & McHenry, C. (2015). Peer Network Counseling with Urban Adolescents: A Randomized Controlled Trial with Moderate Substance Users. *Journal of Substance Abuse Treatment, 58, 16-24*.

5. Lynn, L. & Guiffre, H. (2009). Computer science outreach in an elementary school. *Journal of Computing Sciences in Colleges, 24*, 118-124.

Publications Submitted or in Preparation

1. Marks, S., Saunders, H., Shadowden, H., Cunningham, P. Substantial Coverage Gaps and Inequities in Voluntary Medicaid Managed Care Coverage of Dental, Vision, and Hearing Services.
2. Salehian S., Saunders, H., Cunningham, P. Health Plan switching in a Medicaid managed long-term services and supports (MLTSS) program.
3. Saunders, H., Marks, S., Shadowden, H., Walker, L., Cunningham, P. Unmet social needs in Medicaid Managed Long-Term Services and Supports (MLTSS).
4. Saunders, H., Cunningham, P. Bradley, C., Barnes, A., Moeller, G. The impact of CARA and nurse practitioner scope-of-practice laws on access to medications for opioid use disorders.
5. Saunders, H., Barnes, A., Cunningham, P., Moeller, G., Bradley, C., Health insurance literacy in low-income individuals and subsequent mental health utilization.
6. Saunders, H., & Cunningham, P., Mellor, J., Mittler, J., & Walker, L. Are member experiences with care coordinators in their Medicaid long-term services and supports program associated with subsequent utilization?

Reports/Policy Briefs

1. Saunders, H., Cunningham, P., Mellor, J., Britton, E., Guerra, L., Salehian, S., Marks, S., Shadowen, H., Mittler, J., & Barnes, A. (2021). Commonwealth Coordinated Care Comprehensive Report (2017-2020). Delivered to Virginia Medicaid.
2. Cunningham, P., Mueller, M., Britton, E., Pham, H., Guerra, L., Saunders, H., Zhao, X., Barnes, A., & Dihwa, V. (2021). Addiction and Recovery Treatment Services. Access, Utilization, and Quality of Care 2016-2019. Delivered to Virginia Medicaid and published online.
3. Marks, S., Saunders, H., Cunningham, P. (2020). Unmet Health and LTSS Needs among members enrolled in Commonwealth Coordinated Care Plus. Delivered to Virginia Medicaid
4. Mellor, J., Saunders, H. Commonwealth Coordinated Care Plus Evaluation Design. Delivered to Virginia Medicaid.
5. Salehian, S. Saunders, H., Guerra, L., Cunningham. Survey of caregivers of members enrolled in Commonwealth Coordinated Care Plus (2020). Delivered to Virginia Medicaid.
6. Saunders, H. & Cunningham, P. (2019). Member experiences with care coordinators and subsequent utilization. Delivered to Virginia Medicaid.
7. Saunders, H., Snell, L., Mittler, J., Guerra, L., & Cunningham, P. (2019). Key Facts about Care Coordinators serving in the Commonwealth Coordinated Care Plus Members. An Evaluation Report of the Commonwealth Coordinated Care Plus Program Prepared for the Virginia Department of Medical Assistance Services.
8. Saunders, H., Cunningham, P., Guerra, L., Britton, E., & Barnes, A. (2019). Commonwealth Coordinated Care Plus. Survey of Member Experiences with Care Coordination and Health Plans. An Evaluation Report of the Commonwealth Coordinated Care Plus Program Prepared for the Virginia Department of Medical Assistance Services.

9. Mittler, J., Saunders, H., Snell, M. (2019). Understanding MLTSS Care Coordination in Virginia's CCC Plus Program: The view from the care coordinator. An Evaluation Report of the Commonwealth Coordinated Care Plus Program Prepared for the Virginia Department of Medical Assistance Services
10. Saunders, H., Walker, L., & Cunningham, P. (2019). Number of Buprenorphine Prescribers Have Increased Since ARTS. Delivered to Virginia Medicaid.
11. Barnes, A., Snell, M., Guerra, L., Mueller, M., Pham, H., Britton, E., Saunders, H., Brooks, M., Krist, A., & Cunningham, P. (2019). Experiences Prior to Enrollment in Medicaid. New Medicaid Expansion Members Describe Health and Healthcare experiences from the Year before Enrolling. A report delivered to Virginia Medicaid and published online.
12. Cunningham, P., Barnes, A., Sheng, Y., Walker, L., Saunders, H., Brooks, M., & Tong, S. (2018). Addiction and Recovery Treatment Services. Access and Utilization during the First Year (April 2017 to March 2018). An Evaluation Report Prepared for the Virginia Department of Medical Assistance Services. Delivered to Virginia Medicaid.
13. Brooks, M., Tong, S., Walker, L., Saunders, H., Sheng, F., Barnes, A., & Cunningham, P. (2018). Preferred OBOT Implementation Experiences, Clinic Models and Treatment Strategies during the First Year (April 2017 to June 2018). Addiction and Recovery Treatment Services. An Evaluation Report Prepared for the Virginia Department of Medical Assistance Services.
14. Cunningham, P., Barnes, A., Tong, S., Brooks, M., Aycock, R., Sheng, Y., Saunders, H., & Walker, L. (December 2017). Addiction and Recovery Treatment Services. Access, Utilization, and Spending for the Period of April 1-August 31, 2017. Report prepared for the Virginia Department of Medical Assistance Services.
15. Cunningham, P., Barnes, A., Saunders, H., Walker, L., Sheng, Y., Tong, S., Brooks, M., Aycock, R. (2017). Treatment for addiction disorders increases during first three months of new Medicaid program. VCU ARTS Evaluation Update. Published by the Department of Health Behavior and Policy at Virginia Commonwealth University.
16. Mason, M., Nay, Wilkinson, C., Ickes, A., Saunders, H., Markowicz, M., Zhang, J., & Campbell, L (2013). Project MOST (Measuring Outcomes Study) feasibility study outcome report. Report to the Department of Psychiatry, Virginia Commonwealth University, Richmond, VA.

Invited Presentations

Medicaid or Community Presentations

1. Results from Qualitative Interviews with Virginia Medicaid Addiction Recovery Treatment Services (ARTS) receiving Opioid Use Disorder Services.
    a. Presentation to BRAVO Equity workgroup. December 2021
    b. Presentation to SUPPORT grant stakeholder group. November 2021
    c. Presentation to Virginia Medicaid. September 2021
2. Virginia's OUD Brightspots: Preliminary Findings. Presentation to SUPPORT grant stakeholder group. February 2021

Scholarly Presentations

1. Exploring the Black Box of MLTSS Care Coordination: Are Member Experiences with Care Coordinators Associated with Subsequent Utilization? State-University Partnership Learning Network; AcademyHealth. June 2020.
2. Increase in Buprenorphine Waivered Prescribers Following Expanded Coverage for Addiction Treatment Services in Virginia Medicaid. Presented at Addiction Health Services Research Conference. Park City, Utah. June 2019
3. Increase in Buprenorphine Waivered Prescribers Following Expanded Coverage for Addiction Treatment Services in Virginia Medicaid. Presented at Department Health Behavior and Policy, Virginia Commonwealth University, Department Seminar.

Poster Presentations (select)

1. Saunders, H., Cunningham, P., Barnes, A., Moeller, G. (June 2021). Does Health Insurance Literacy in those Experiencing Depression/Anxiety Predict Subsequent Access to Mental Health Services and Unmet Mental Health Needs? Academy Health.
2. Saunders, H., Cunningham, P., Mellor, J., Mittler, J., Walker, L. (June 2020). Exploring the Black Box of MLTSS Care Coordination: Are Member Experiences with Care Coordinators Associated with Subsequent Utilization. Academy Health, 2020, Abstract accepted but not presented due to COVID-19.
3. Saunders, H., Britton, E., Cunningham, P., Rachel, J., Berhans, M. (June 2019). Intention to switch

   health plans at open enrollment: The pivotal role of patient experiences with care coordinators, Academy Health, June 2019.
4. Miller, C., Guidry, J., Saunders, H. (February 2019). A tale of two diverse Qualtrics samples: Information for online survey researchers, American Academy of Cancer Research, San Diego, CA.
5. Saunders, H., Cunningham, P., & Tong, S. (June 2018). Combatting the Opioid Crisis: Characteristics of buprenorphine providers in Virginia who accept Medicaid. Presented at Academy Health, Seattle Washington.
6. Saunders, H., Walker, L., Thomson, M., Bradley, C. (November 2017). Healthcare Utilization Patterns in Individuals with Symptoms of Anxiety and/or Depression, *American Public Health Association, Atlanta, GA.*
7. Walker, L., Saunders, H., Thomson, M., Bradley, C. (October 2017). The "Difficult Patient": Are Substance Use Disorder Patients Really Harder to Please? *American Public Health Association, Atlanta, GA*
8. Saunders, H., Walker, L., Sheng, Y., Cunningham, P., Neuhausen, K., Barnes, A., Tong, S., Brooks, M., & Aycock, R. (2017, October). Impact of Virginia Medicaid's Addiction and Recovery Treatment Services (ARTS) reform on opioid use disorder (OUD) providers and the change in waivered buprenorphine providers for all payers across Virginia. Poster session presented at the meeting of the Virginia Society of Addiction Medicine, Norfolk, VA.
9. Saunders, H. (2012). Traumatic events: A secondary data analysis. School of Social Work Student Research Symposium.

10. Cartwright, K., Guiffre, H., Bock, A., Montano, M., Coppage, E. (2007). A cross-sectional comparison of general and reading-specific cognitive flexibility in second to fifth grad struggling readers. (Poster Session). Society for Research in Child Development.
11. Bock, A., Guiffre, H. Coppage, E., Montaño, M., & Cartwright, K. B. (2007, April). Effects of a flexibility intervention on reading comprehension. Poster presented at the sixth annual Paideia Conference for Student Research, Christopher Newport University, Newport News, VA.
12. Guiffre, H., Bock, A. M., Montaño, M. J., Cartwright, K. B., & Marshall, T. R. (2007, March).

    Cognitive inflexibility: a potential relation between children's sex-typed reading choices and reading skill. Poster presented at the 78th annual meeting of the Eastern Psychological Association, Philadelphia, PA.
13. Guiffre, H., Martenak, L., Frederick, J., Cartwright, K. B., & Marshall, T. R. (2006, March). Sex differences in first and second grade children's book choices. Poster presented at the 77th annual meeting of the Eastern Psychological Association, Baltimore, MD.

Professional and Research Experience

Graduate Research Assistant, Health Behavior and Policy, Virginia Commonwealth University, 2016-
Advisor: Peter Cunningham, Ph.D.

- Led and participated in studies evaluating Virginia Medicaid waiver programs and a federal needs assessment grant. Addiction Recovery and Treatment Services (1115 waiver) | Commonwealth Coordinated Care Plus Program (1915b waiver) | Opioid Needs Assessment (CMS SUPPORT Act Grant)
- Presentation of Medicaid program evaluation findings to Medicaid policymakers and stakeholders in presentations, reports, and peer-reviewed journal articles.
- Managed or participated in all aspects of study conceptualization, design, analysis, and execution of various studies involving multiple faculty from internal and external departments/universities.
- Led survey development, data collection, analysis, and dissemination of results for multiple large surveys. Populations include patients who receive Medicaid long-term services and supports, medical providers, and facility-level surveys. Excellent response rates.
- Designed and developed novel databases by linking Medicaid claims data to multiple sources of survey and publicly available data. Requests for linking methods by external researchers.
- Led Institutional Review Board submissions and maintenance.
- Developed a proposal for subsequent evaluation activities that was adopted. Program evaluation logic model and driver diagram development.
- Qualitative lead or assistant for multiple qualitative studies: MLTSS care coordinators, Medicaid members receiving opioid treatment services, and Office Based Opioid Treatment facilities.
- Led the comprehensive report for 3-years of evaluation activities for Virginia's Long-term services and supports (MLTSS) program. This detailed report summarized evaluation findings, identified program strengths, and identified opportunities for improvement.
- Led several studies to evaluate the shortage of buprenorphine waivered providers, including developing a survey with a discrete choice experiment for Virginia physicians, nurse practitioners, and physician assistants.

Research Consultant, University of Colorado, 2016-2018

Supervisor: Cathy Bradley, Ph.D.

- Data analysis of secondary outcomes for an AHRQ-funded randomized controlled trial
- Dissemination of findings in a peer reviewed journal.

Research Manager, Healthcare Policy and Research, Virginia Commonwealth University, 2014-2016

Supervisor: Cathy Bradley, Ph.D.

- Managed a team of 10 research assistants.
- Data collection and data quality assurance for an AHRQ-funded randomized controlled trial to examine patient incentives to encourage primary care visits.

Research Coordinator, Psychiatry, Virginia Commonwealth University, 2012-2014

- Managed data collection and research assistant oversight for a randomized controlled trial to reduce substance abuse in teens in a primary care. Findings disseminated in a peer review journal.
- Maintenance and development of regulatory documentation.
- Delivered motivational interviewing intervention to teens with substance use disorder.
- Provided oversight and data analysis of patient-reported outcome measurement pilot in pediatric and adult psychiatric clinics.

Research Coordinator, Psychology, Virginia Commonwealth University, 2008-2010

- Oversight of 8 research assistants.
- Data collection and data quality assurance for an NIH-funded randomized controlled trial to increase parental involvement in the management of type 1 diabetes in a teenage population.

Laboratory Coordinator, Psychology, College of William and Mary, 2007-2008

Research Assistant, Psychology and Computer Science, Christopher Newport University, 2004-2008

Clinical Experience

Clinical Social Worker, Pediatric oncology, Children's Hospital of the King's Daughters, 2012

- Provided supportive counseling for pediatric oncology patients and families. Connected patients to resources.
- Wrote grants to obtain funding for pediatric families with financial needs.
- Functioned as the social component of a medical oncology team in a pediatric hospital.

Clinical Social Worker Intern, Center for Family Services, 2011-2012

School Social Worker Intern, James City County, 2011

Teaching Experience

An Introduction to Survey Methods. Invited class lecture. Virginia State University, 2020.

Introduction to STATA workshop. Presented to first-year PhD students. Virginia Commonwealth University, 2019.

Econometrics Lab. Co-taught econometrics lab for first-year PhD students. Virginia Commonwealth University, 2019.

Service

Positions

President, Student AcademyHealth. Virginia Commonwealth University Chapter, 2019-2021

Vice President, Student AcademyHealth, Virginia Commonwealth University Chapter, 2019

Committee work

Healthcare Policy and Research Academic Program Review, Office of the Provost, Virginia Commonwealth University. 2021

Healthcare Policy and Research, Curriculum Subcommittee, Virginia Commonwealth University, 2020

Events

Changing the Face of the Public Health Ph.D. Workforce: Outreach Panel to Increase the Diversity of Ph.D. Applicants and Leaders. Event development/organization. Event moderator. AcademyHealth Event. Professional and Community Engagement, 2021

Post Ph.D. Graduate Panel. Event Development/organization. Event moderator. AcademyHealth Event, 2020

State Policy Seminar Speaker. Event organization and hosting. Student AcademyHealth Event, 2019

Awards/Honors

CC Clayton Student Achievement Award, School of Medicine, Virginia Commonwealth University, 2019

Susan G Komen Scholar in Training Travel Award, American Association for Cancer Research, 2019

VCU Travel Awards, School of Medicine, Virginia Commonwealth University, 2017 and 2018