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INSURANCE EXPANSIONS AND CHILDREN'S USE OF SUBSTANCE USE DISORDER TREATMENT

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ABSTRACT

This study provides the first evidence on the effects of U.S. state-level private and public insurance expansions on specialty substance use disorder (SUD) treatment use among children ages 12 to 18. We examine both private and public expansions over the period 1996 to 2010. Public insurance expansions are measured by changes in income thresholds for Medicaid and the State Children's Health Insurance Program (SCHIP). Private expansions are generated by state laws that compel private insurers to cover SUD treatment services at 'parity' with general healthcare services. We apply differences-in-differences regression models and leverage an all-payer admissions dataset. Our findings suggest that expansions, both private and public, lead to increases in admissions to treatment and increased insurance coverage among children in treatment. After public expansions, we find that treated children are more likely to be younger and to have previous experience with treatment, but less likely to be referred by the criminal justice system. We find no evidence that public expansions crowd out adult admissions, and in fact both public and private expansions increase at least some types of admissions among adults.

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1. Introduction

Childhood is a key developmental period in establishing lifelong health and human capital trajectories (Heckman, 2006).[1] Many substance use disorders (SUDs) emerge during this period, and treatment at this time can have lifecourse benefits (Winters et al., 2011, Anderson et al., 2010). According to the American Psychiatric Association (2013), the primary professional organization of psychiatrists in the United States, SUDs 'occur when the recurrent use of alcohol and/or drugs causes clinically and functionally significant impairment, such as health problems, disability, and failure to meet major responsibilities at work, school, or home.' Diagnosis is based 'on evidence of impaired control, social impairment, risky use, and pharmacological criteria.' SUDs are common, for instance, 8.2% of the U.S. population meets diagnostic criteria (Center for Behavioral Health Statistics and Quality, 2016).[2] Substance misuse imposes costs on society including healthcare costs, crime, and lowered labor market productivity (Terza, 2002, Carpenter, 2007, Balsa et al., 2009). The annual costs of substance use in the U.S. are estimated to be $544B (Caulkins et al., 2014).[3]

Effective SUD treatments are available (Rajkumar and French, 1997, Lu and McGuire, 2002, Murphy and Polsky, 2016), but unmet need for treatment remains high. For instance, in the U.S. only 10% of needs for treatment are met for children ages 12 to 17 (Center for Behavioral Health Statistics and Quality, 2016).[4] Although some individuals refuse or avoid treatment, cost and lack of insurance coverage for SUD treatment are critical barriers to treatment receipt among patients seeking treatment. Expanding insurance coverage, public and

[1] We use the terms children and childhood to refer collectively to childhood, youth, and adolescence.
[2] The prevalence rate among those 12 to 17 years is, not surprisingly as less time has passed for children to develop SUDs, slightly lower: 5.0%.
[3] This estimate is inflated by the authors from the original estimate of $481B (with $255B attributable to alcohol and $226B attributable to psychoactive drugs) in 2011 dollars to 2018 dollars using the Consumer Price Index. To the best of our knowledge, there is no cost estimate specific to SUDs for the U.S.
[4] SAMHSA does not provide a break down for our exact age range (12 to 18 years).

private, that includes SUD treatment services can allow individuals who face such barriers to access treatment and, in turn, reduce SUDs and associated harms.

This study is the first to explore the effects of state-level public and private insurance expansions on specialty SUD treatment utilization among children ages 12 to 18. A specialty SUD treatment facility is defined as a hospital, a residential SUD facility, an outpatient SUD treatment facility, or other facility with an SUD treatment program (Substance Abuse and Mental Health Services Administration, 2015). While there are numerous treatment options available to patients, specialty care accounts for 37% of all SUD spending in the U.S. (Substance Abuse and Mental Health Services Administration, 2016), with total annual spending amounting to $36B, and specialty care reflects approximately 65% of care received by children (Center for Behavioral Health Statistics and Quality, 2016).[5] [6] We leverage expansions in public insurance eligibility and SUD treatment access generated by (i) U.S. states' decisions to expand coverage to children through Medicaid and the State Children's Health Insurance Program (SCHIP), and (ii) state laws that compel private insurers to cover SUD treatment at 'parity' with general healthcare services over the period 1996 to 2010.

Several findings emerge from our analysis. First, we document that public and private insurance expansions increase the number of SUD admissions among children ages 12 to 18. For example, passage of a state parity law leads to a 26% increase in annual admissions. Second, public expansions allow children to access more intensive forms of treatment than private expansions. Third, public and private expansions increase insurance coverage among children receiving specialty SUD treatment. Fourth, we find that public and private expansions alter the

[5] Authors inflated the original figure ($34 Billion in 2014 dollars) to 2018 terms using the Consumer Price Index.
[6] This number is based on the authors' tabulations of numbers reported in Table 5.23B. We use numbers for children ages 12 to 17; we cannot more accurately match the age range we use in our analysis (12 to 18 years). Details available on request.

composition of children receiving treatment. Fifth, we find no evidence that public expansions to children crowd out adult patients; instead we document positive spillover effects for adults.

2. Framework and literature

2.1 Framework

Healthcare demand theory suggests that insurance expansions, by reducing costs to consumers or increasing quality, should increase the amount of healthcare consumed in the market (Grossman, 1972, Corman and Grossman, 1985).[7] *Ceteris paribus*, we expect that, post expansion, admissions to specialty SUD treatment will increase. However, there are factors that may interact with these price and quality effects.

For instance, on the supply side, there are well-established capacity constraints in the SUD treatment delivery system (Buck, 2011) that may prevent providers from absorbing increased demand. Further, acceptance of insurance – public and private – has historically been low among SUD treatment providers; insurance that does not apply to treatment is unlikely to increase utilization. On the demand side, stigma and/or a lack of motivation to stop using substances may temper increases in quantity demanded. Insurance may also increase substance use and need for specialty SUD treatment through in-kind income effects, moral hazard, and/or increased access to addictive substances (e.g., benzodiazepines, opioids).[8]

In terms of insurance coverage, we expect public insurance expansions to increase public coverage with offsetting declines in uninsurance and potentially private insurance through 'crowd out' effects (Lo Sasso and Buchmueller, 2004). Private insurance expansions requiring

[7] Issues related to parental consent laws may complicate the insurance-utilization relationship. For instance, states vary in terms of parental and child consent prior to children entering treatment (Kerwin et al., 2015).
[8] Benzodiazepines are medications used to treat anxiety and convulsions that produce feelings of sedation and muscle relaxation (e.g., Xanax). Opioids are medications designed to treat chronic pain that generate feelings of euphoria (e.g., oxycodone). Both classes of medications, as are many other medication classes, are addictive.

insurers to provide more generous coverage, such as parity laws, may increase or decrease coverage. Post expansion, the value of private insurance increases which may lead individuals to take up coverage. More generous coverage may increase premiums (Bailey, 2014) which may lead beneficiaries to drop private coverage. Thus, we expect SCHIP expansions to increase public coverage, but expansion effects are less clear for private insurance and uninsurance.

2.2 Medicaid and the State Children's Health Insurance Program (SCHIP)

Medicaid, a joint federal-state program, is the primary insurer for low-income, non-elderly individuals in the U.S. While the federal Medicaid program for low-income families was introduced nationally as part of the war on poverty of the 1960s, states had primary control over eligibility for Medicaid (which was usually tied to cash welfare receipt). The scope of public insurance began to change in the 1980s as the federal government and various state governments expanded Medicaid access to new populations. However, these expansions were highly targeted; federal coverage mandates applied first only to pregnant women and infants, and later to young children (i.e., through age five).

In the early 1990s federal mandates and voluntary state expansions increased Medicaid eligibility for older children (ages 6 to 18). In 1996, federal welfare reform further separated Medicaid from cash welfare benefits, such that states could expand Medicaid and welfare programs independently. SCHIP offered states a new opportunity for federal assistance in funding insurance for children. States could use SCHIP funds to expand coverage for children through direct Medicaid expansions or supplemental SCHIP programs (with eligibility thresholds above Medicaid programs). While Medicaid programs typically had meaningful coverage of SUD treatment (and many states used Medicaid to expand coverage), SCHIP programs varied

more in their coverage.[9] [10] Since then, states have expanded Medicaid programs, developed SCHIP programs, and chosen income eligibility thresholds for each program. In 2016, 46M U.S. children were covered by SCHIP or Medicaid at some point (Centers for Medicare and Medicaid Services, 2017).

2.3 Literature

This paper builds on two literatures on the effects of SUD treatment access within the U.S.: those that studied overall insurance access expansions (public and private) and those that studied mandates specific to SUDs. We first consider the analyses of the 2006 Massachusetts healthcare reform (which increased access through public and private coverage); findings documented increases in SUD-related hospitalizations and admissions to specialty SUD treatment (Meara et al., 2014, Maclean and Saloner, 2018).[11] The Affordable Care Act (ACA) of 2010, a major expansion of insurance within the U.S., increased adult eligibility for Medicaid in many states, and also increased access to private coverage for young adults (who could remain on parental policies up to age 26 due to the dependent coverage mandate, 'DCM').[12] ACA Medicaid expansions led to increases in prescription fills for SUD-related medications in out-patient settings and increased admissions to specialty SUD treatment (Wen et al., 2017a, Maclean and Saloner, 2017). The evidence on the effects of the DCM on SUD treatment is mixed. Golberstein et al. (2015) show that DCM increased SUD-related admissions, while

[9] In 2009, 46 states offered separate SCHIP programs (Garfield et al., 2012).
[10] We attempted to gather detailed data at the state-year level for our sample period (1996 through 2010) documenting the exact nature of SUD coverage in each program, but based on several missing years and unclear data sources we determined that an analysis using those data would be ill-advised. However, our incomplete data suggests that the vast majority of states covered some form of SUD treatment in most years. When we incorporate this information into our analyses, the results are similar to our main results. However, the estimates – which necessarily use much less variation for identification – are less precise. Details available on request.
[11] Maclean and Saloner's findings are somewhat sensitive to specification. Differences-in-differences estimates show a precisely estimated increase in admissions while synthetic control methods document an imprecise increase.
[12] While the ACA brought many adults closer to the eligibility levels already enjoyed by children, this Act did not substantially increase child eligibility.

Saloner and Cook (2014) and Akosa Antwi et al. (2015) find no changes in utilization of SUD treatment. Finally, Saloner et al. (2018) document a *decrease* in admissions to specialty treatment attributable to DCM.[13] Wen and colleagues (2017b, 2015) show that pre-ACA Medicaid expansions led to increases in SUD treatment and reduced unmet need for care.

Our work also contributes to further understanding of U.S. private coverage mandates for SUD treatment.[14] These laws increase treatment use and reduce substance use (Popovici et al., 2017, Maclean et al., 2017, Dave and Mukerjee, 2011, Wen et al., 2017b, Wen et al., 2013). At the federal level, the Mental Health Parity and Addiction Equity Act (MHPAEA) was passed in 2008. MHPAEA led to modest increases in SUD treatment among adults (McGinty et al., 2015, Busch et al., 2014, Ettner et al., 2016) but had little effect on children's use (Barry et al., 2013).

3. Data, variables, and methods

3.1 SUD treatment data

Our primary source of data is the Treatment Episode Dataset (TEDS) which is an all-payer database compiled annually by the Substance Abuse and Mental Health Services Administration (SAMHSA) and state substance abuse agencies. TEDS includes administrative data on admissions to specialty SUD treatment. These data contain the near universe of specialty SUD treatment facilities that receive financial support from the state or federal government, are certified by the state to provide SUD treatment, or are tracked for some other state-specific reason. Annually, TEDS includes information on roughly two million admissions. TEDS does not include treatment received in private physician's offices, facilities that do not receive public funding, emergency departments, and self-help groups.

[13] The authors hypothesize that this finding implies that patients are able to receive care in a wider range of settings post-expansion.

[14] We refer here to full parity, or equal coverage, but note that there are earlier laws that compel private insurers to cover SUD treatment services to some extent in some states. See Dave and Mukerjee (2011) for more details.

TEDS is a standard dataset used within economics to study specialty SUD treatment (Dave and Mukerjee, 2011, Pacula et al., 2015, Saloner et al., 2018, Anderson, 2010). The U.S. federal government uses TEDS to estimate the costs of SUD treatment (Office of National Drug Control Policy, 2012). While TEDS is not a nationally representative sample, patients receiving treatment in TEDS-tracked facilities are representative of the broader SUD treatment-receiving population. For example, demographics of patients in TEDS-tracked facilities are comparable to samples of individuals who report any past year SUD treatment in survey data (Gfroerer et al., 2014). A limitation of the TEDS is that not all states report data in each year.[15]

We exclude admissions for which the patient is older than 18 years. We report analyses based on the sample of non-criminal justice system referrals, as such admissions are more likely influenced by factors outlined in models of healthcare demand (Dave and Mukerjee, 2011). In contrast, legally coerced admissions are likely influenced by features of the criminal justice system (e.g., discretion in sentencing afforded to judges). Roughly one third of the sample is excluded based on referral source. Although TEDS initiated in 1992, we begin our study period in 1996 as this is the year before SCHIP was implemented. The existing Medicaid structure is our starting point, and we follow expansions (Medicaid or SCHIP) forward. We exclude post-2010 years to avoid confounding related to the ACA.[16]

3.2 Medicaid and SCHIP data

[15] The notes under Table 2 report the states not providing data to TEDS in each year over our study period.
[16] For instance, recent work shows that ACA Medicaid expansion increased SCHIP enrollment through spillover effects (Hudson and Moriya, 2017). We note that there are some differences in the number of observations across samples that we leverage in our analysis. These differences are due to some differential missing data patterns across states. For example, in our main analyses, we report results for the sample that is not referred to treatment through the criminal justice system. However, there are small number of state-year pairs for which there is no information on referral source. Hence, the sample sizes differ for all admissions, admissions not referred through the criminal justice system, and admissions referred through the criminal justice system. Details available on request.

There is no central repository of states' Medicaid and SCHIP income eligibility thresholds. However, various agencies and organizations have compiled current thresholds periodically, including the Kaiser Family Foundation and the American Academy of Pediatrics. Further, the federal government's Center for Medicare and Medicaid Services requires states to submit filings whenever they make an eligibility change, and occasionally contracts with think tanks for comprehensive reports. Using primarily these sources, we have assembled each year's income eligibility threshold for older children (relative to the Federal Poverty Level, 'FPL') for each state's program with the most generous eligibility, whether Medicaid or SCHIP.[17] We use the January threshold to link to each year's TEDS data.

For our analysis, we classify states into four generosity categories to allow nonlinear effects of expansions at different points in the income distribution: 100-174% FPL, 175-199% FPL, 200-225% FPL, and > 225% FPL. Hamersma and Kim (2013) note that the outside insurance options of extremely-poor and less-poor prospective recipients can be very different, potentially affecting the level of take-up and crowd out for expansions occurring at different points in the income distribution.[18] Table 1 illustrates the variation in eligibility categories for public insurance across states and over time (only even years are shown for brevity). The average change in eligibility thresholds across all states over our period is approximately 40% FPL, but among states with changes, the average change is 65% FPL. In fact, numerous states increased the threshold by 100% FPL or more.

[17] Eligibility thresholds for selected years, by state, are shown in Appendix Table 1. Details of data sources are available on request. The data were assembled by Sarah Hamersma, with help from others who shared information on dates of policy changes (Matthew Kim and Lara Shore-Sheppard). When we refer to 'SCHIP' in the text we are referring to the most generous available assistance program, which in some set of states is Medicaid if they did not implement a separate SCHIP program.

[18] Hamersma and Kim (2013) find empirical evidence of this phenomenon for Medicaid expansions to parents. We also run our estimation using a simple linear model of SCHIP thresholds, but find that this specification masks the heterogeneity we uncover in our non-linear specification (especially in the coverage findings) so we do not report those results, though they are available on request.

3.3 Private insurance expansions

We also examine the effects of state laws that compel private insurers to cover SUD treatment (alcohol and psychoactive drugs) at 'parity' with general healthcare services. Under parity laws, private insurers must apply equal coverage in terms of cost-sharing, service limitations, and so forth across these services.

To construct the parity variable, we use legal data from Robinson et al. (2006), Barry and Sindelar (2007), and Wen et al. (2013).[19] The first state to pass a full parity law was Maryland in 1994. Between 1994 and 2010 (the final year of our study), 12 states passed a parity law; during our study period 10 law changes occurred, as reported in Appendix Table 2. We match law effective dates to the TEDS as of January 1st in each year.

We note that the parity law changes include initial laws (i.e., a transition from no law to a parity law) and strengthening of existing laws (e.g., increased coverage requirements from limited services to full parity). The 'dose' of the law change may vary across states based on the pre-parity law environment (Appendix Table 2).[20] We focus on full parity laws, rather than less-restrictive laws, as full parity laws have more effect on SUD treatment use (Dave and Mukerjee, 2011) and such coding is standard in recent literature (Wen et al., 2017b, Wen et al., 2013).

3.4 Outcomes

We consider several outcomes among children 12 to 18 years. We begin with the overall number of admissions to specialty SUD treatment.[21] Then we examine admissions in different treatment settings: detoxification (hospital-based, residential, or outpatient), residential (hospital-

[19] We thank Hefei Wen and Jason Hockenberry for sharing an updated SUD treatment parity coding scheme with us.
[20] In unreported analyses, we find that effects are larger for states transitioning from no law to full parity than for states transitioning from a less restrictive law to full parity. Results available on request.
[21] TEDS does not include information on children younger than 12 years, which is a limitation of the study. We use the term 'admission' for brevity. However, we note that this term is not entirely accurate as some modalities of treatment we study (e.g., outpatient) do not involve the patient being admitted to a facility.

based or therapeutic residential), and outpatient (intensive and non-intensive). Newly insured patients, or patients whose insurance becomes more generous, may be able to access treatment in settings that were not feasible pre-expansion.[22] We convert admissions to the rate per 100,000 children 12 to 18 years in the state. Third, we consider patient insurance status: private, any public,[23] and uninsured.[24]

Our insurance variables are limited in that they are not always provided by all states[25] and there is non-trivial missing information. We include only state-year pairs for which there is less than 25% missing insurance information (Maclean and Saloner, 2017). We have 39 states in our insurance sample (Appendix Table 3). A concern with this sample is that our results are based on a selected group of states; however, we find state-level characteristics of this sample and the full TEDS sample to be similar (Table 2).[26]

3.5 Control variables

SUD treatment outcomes are determined by myriad factors. We attempt to control for such factors in our regression models and link external sources of information to the TEDS.

First, we include state polices that potentially capture state preferences towards insurance coverage, substance use, and vulnerable populations, including: Medicaid Health Insurance Flexibility and Accountability demonstration waivers that cover SUD treatment services within

[22] Medicaid Institutions of Mental Diseases provision (which curtails use of Medicaid funds to pay for psychiatric inpatient stays) may influence where SCHIP-financed SUD treatment may be received (Geller, 2000).
[23] Any public includes Medicaid, Medicare, Tricare, and other public sources. We chose to include all public sources as based on discussions with TEDS administrators we are concerned the state-alone SCHIP programs may not be recorded as Medicaid. Including all public insurance allows us to mitigate this form of measurement error.
[24] Ideally, we would like to study payment source (Saloner et al., 2018). Discussions with TEDS administrators informed us that there is no way to separate SCHIP from other forms of payments due to the way payment information is entered into TEDS. We note our inability to study payment source as a limitation of the study. Details available on request.
[25] TEDS is composed of two sections: the minimum dataset that includes variables that all states are required to provide (e.g., treatment setting) and the supplementary dataset that includes variables that are optional for states to report. Insurance information is included in the supplementary dataset and hence not all states opt to report this information. Details are available on request.
[26] The expansions we study are not related to missingness in the insurance variable. Details available on request.

non-traditional adult populations (Wen et al., 2017b), medical marijuana legalization (Sabia and Nguyen, 2016), marijuana decriminalization (Pacula et al., 2003),[27] and a prescription drug monitoring program (Ali et al., 2017). We account for SAMHSA block grants for SUD treatment and prevention (obtained from SAMHSA). We also use data compiled by the University of Kentucky Center for Poverty Research (UKCPR, 2016) on the state Earned Income Tax Credit (EITC) as a share of the federal EITC, the minimum wage, and the maximum monthly Temporary Assistance for Needy Families benefit for a family of four.[28]

Second, we include the political party of the state governor, coded one if Democrat (UKCPR, 2016). Third, we include several state-level demographics from the Current Population Survey (share of the population 12 to 18 years, sex, race, ethnicity, and education) and economic activity measures (unemployment rate and poverty rate) (UKCPR, 2016).

3.6 Model

We estimate the following differences-in-differences (DD) regression model:

(1) $$SUD_{st} = \alpha_0 + \alpha_1 SCHIP_{st} + \alpha_2 Parity_{st} + \alpha_3' X_{st} + S_s + \tau_t + \varepsilon_{st}$$

SUD_{st} is an SUD treatment outcome among children ages 12 to 18 years in state *s* in year *t*. $SCHIP_{st}$ is a set of SCHIP threshold categories. $Parity_{st}$ is an indicator for a parity law in state *s* in time *t*. X_{st} is a vector of state-year-level characteristics. S_s and τ_t are vectors of state and year fixed effects and ε_{st} is the error term.[29] We estimate unweighted OLS and report 95% confidence intervals that account for within-state correlations (Bertrand et al., 2004).

4. Results

4.1 Summary statistics

[27] We thank Rosalie Pacula for sharing an updated version of the marijuana decriminalization coding scheme.
[28] For all monetary variables, we convert nominal values to 2010 values using the Consumer Price Index.
[29] We control for the state population ages 12 to 18 in the insurance regressions. We do not control for this variable in the admissions regressions as population is in the denominator of our left-hand side variables.

Table 2 reports summary statistics. The average number of admissions per 100,000 children ages 12 to 18 is 306, with 12 admissions to detoxification, 48 to residential treatment, and 246 to outpatient. Among children receiving treatment, 25% have private insurance, 41% have public insurance, and 35% are uninsured. The average SCHIP threshold is 197% FPL and 11% of state-years have a full parity law in place. Insurance sample values are similar.

4.3 Admissions

Table 3 reports admissions results. We find that public and private insurance expansions increase total admissions among children. For example, compared to an SCHIP threshold of 100-174% FPL, states with higher thresholds experience an estimated 82 to 133 more admissions per 100,000 children 12 to 18 years. Compared to the mean number of admissions (306), these estimates reflect a 27% to 43% increase in admissions (percent changes are calculated relative to the sample mean). Passage of an SUD parity law leads to 80 additional admissions per 100,000 children per year, which is a 26% increase. While these relative effect sizes are arguably large, 95% confidence intervals include much more modest increases.

Interestingly, we observe that public and private insurance expansions appear to increase admissions to different treatment settings. Our estimates for SUD parity laws are driven by outpatient admissions, while estimates for SCHIP expansions are only precise for residential admissions. However, estimates for SCHIP are also potentially large for outpatient admissions given the size of the confidence intervals; our limited precision leads us to avoid overstatements regarding heterogeneity in effects across treatment types.

As noted earlier, we focus our analysis on admissions not referred through the criminal justice system since our study is motivated by factors incorporated in models of consumer

choice. Indeed, estimates of SCHIP and parity law effects for admissions referred through the criminal justice system show little to no discernable effects (Appendix Table 4).

4.4 Insurance

Estimates of the effect of insurance expansions on insurance coverage among children receiving SUD treatment are reported in Table 4.[30] We find that increases in SCHIP generosity increase public coverage but only for increases to the 175 to 199% FPL threshold. This finding is in line with prior findings that take-up effects are largest lower in the income distribution where there is likely more pent-up demand (Hamersma and Kim, 2013, Card and Shore-Sheppard, 2004). Such an expansion increases public coverage by 14 percentage points or 34%; our 95% confidence intervals prevent us from ruling out more modest increases in public coverage (i.e., the bottom of the interval implies a 3 percentage point, or a 7%, increase).

While not precise for all thresholds, we find suggestive evidence that the increase in public coverage reflects reductions in both private coverage and uninsurance. The coefficients for private coverage are all negative (-4 to -5 percentage points), and are statistically indistinguishable from each other, though only one is statistically significantly different from zero. In contrast, the estimated effect of expansions on public coverage is estimated to be much smaller for higher thresholds. Taking the private coverage estimates at face value, this pattern suggests that the crowd-out effect may be larger for expansions higher into the income distribution (where private coverage is more prevalent and uninsurance less so). The passage of parity laws increases private coverage by 3 percentage points (12% of baseline), suggesting that any negative effects of higher premiums are outweighed by the improvements in quality. In the

[30] While the table uses clustered standard errors, we also applied the wild-cluster bootstrap approach to inference following Cameron et al. (2008), noting that our 39 clusters in the insurance sample may be too few clusters to consistently estimate standard errors. Estimates of precision are almost identical to the main analyses; results are available on request.

sample of admissions referred through the criminal justice system (Appendix Table 4), we find evidence that such patients experience similar changes in insurance coverage post-expansion.

4.4 Heterogeneity in admissions by child sex

The prevalence rate of SUDs varies by child sex: boys are more likely to meet diagnostic criteria for SUDs than girls (Center for Behavioral Health Statistics and Quality, 2016). We next examine whether insurance expansions have differential effects by child sex. Results for boys and girls are reported in Table 5 Panels A and B respectively.[31] We find evidence that insurance expansions lead to statistically significant increases in admissions to residential treatment for boys and girls, and these increases are enough to generate statistically significant increases in total admissions for boys. Estimated effects on outpatient admissions are larger and noisier. We find it interesting that the estimated effects on residential admissions, while smaller for girls in absolute terms, are all in the neighborhood of 50% of their sex-specific baseline. The estimated effect of parity laws is statistically significant for outpatient and total admissions for boys, as it was in the overall sample. The estimates for girls are smaller and imprecise.

4.5 Patient characteristics and SUD profile

We next examine the effect of insurance expansions on the characteristics of children receiving specialty SUD treatment. We may expect changes in composition if different groups are more or less likely to take up public insurance post-expansion, or different groups are more likely to use the covered benefits or to hold private insurance. Further, increased coverage may allow some patients to receive treatment in non-specialty settings. For example, patients tend to find non-specialty settings (e.g., a private physician's office) more acceptable than specialty care

[31] We match the population denominator to the sample. For example, in the boys' regression we use the state population ages 12 to 18 that is male.

(Boone et al., 2004). While our data cannot allow us to explore the mechanisms that drive changes in patient characteristics, asking whether changes occur is a first order question.

We model patient demographics (race, ethnicity, age, and referral) and SUD profile (primary substance is a psychoactive drug, primary substance is an opioid, and previous treatment) as a function of insurance expansions using Equation (1). We construct the share of each characteristic in each state-year pair. We use the full sample of admissions among children ages 12 to 18. Results are reported in Tables 6A (characteristics) and 6B (SUD profile).[32]

We find no evidence that public insurance expansions lead to changes in patient race or ethnicity. However, such expansions do lead to a younger caseload with a relatively smaller share referred by the criminal justice system.[33] These are both consistent with parents of younger children accessing newly-available care for their children through SCHIP.[34] Models of provider behavior (Sloan et al., 1978) also open the door to the possibility that providers may have a preference ranking over patients based on their profitability and, for myriad reasons, admissions from the criminal justice system may be less profitable. Private insurance expansions may increase the share of children who are other race in treatment (90% confidence level) but are otherwise not predictive of changes in caseload.

Turning to the SUD profile variables, we observe that public insurance expansions increase the share of patients who have previous treatment history but do not have a measureable effect on the composition of primary substance used. Given that SUDs are chronic conditions and relapse is common, the increase in admissions among children with previous treatment

[32] More specifically, we include admissions referred through the criminal justice system. We include the state population ages 12 to 18 as a covariate.
[33] We note that our finding that the share of patients from the criminal justice system may imply that selecting our sample on referral source may lead to conditional-on-positive bias. We note this source of bias as a limitation.
[34] TEDS includes just two age groups for children: 12 to14 years and 15 to 18 years.

suggests that SCHIP expansions help children to manage their conditions. We find no evidence that private insurance expansions lead to changes in patient SUD profile.

4.6 Spillovers

Capacity constraints within the SUD treatment delivery system are well-established. Given these constraints, expansions for specific groups of patients (e.g., children) may reduce available slots for other patients. We investigate the possibility that public insurance expansions to children have the unintended consequence of reducing admissions among adults using Equation (1). We also document the effect of parity laws on adult admissions not referred through the criminal justice system.[35] Results are reported in Table 7.

Following public insurance expansions to children, we observe that admissions among adults seem to *increase*, with the increases being driven by changes in admissions to residential treatment. This pattern of results – which are the same sign but a smaller fraction of baseline than for the children – suggests that SUD treatment capacity may increase overall post-SCHIP expansions. While previous studies document that there may be spillovers across patients within a practice in terms of practice style and use of technology (Glied and Zivin, 2002), we are not aware of studies that document potential increases in capacity within the SUD treatment delivery system. There may also be demand spillovers as parents of covered children learn about services to which they themselves may also have access.

Another possibility, which we cannot study in our data, is that public insurance expansions reduce length-of-stay (LOS), which allows providers to treat newly insured children without excluding other patients. In unreported analyses, we investigate this relationship in the

[35] The denominator in the rate variables is the state population ages 19 and older. We note that previous studies have investigated the effect of parity laws on adult admissions; we report these results for completeness. Our exclusion of adults referred through the criminal justice system does not materially affect our findings. Results are available on request.

TEDS-discharge files; we use the TEDS-admissions files in our main analyses. Discharge files are available from 2006 onward. We find no evidence that expansions change LOS.[36]

Our findings for private expansions suggest a substitution across treatment settings: we find that, post-expansion, admissions to detoxification treatment decline while admissions to outpatient treatment increase. This shift in setting may result in a net increase in total admissions, though our estimate is not precise.

5. Sensitivity analyses

We next report several sensitivity analyses. We list the various sensitivity checks and provide discussion when findings depart from our main results. While our results are broadly robust, we note that point estimates lose statistical significance in some specifications.

We display estimates of four alternative specifications of the admissions equation in Appendix Table 5. All of the models suggest similar patterns to Table 3 in their effects, but in some cases the magnitudes and significance are different enough to be noted. In Panel A (Poisson regression) the magnitudes of effects are comparable to those predicted with the linear model, while in Panel B (adding state-specific linear time trends) most of the estimated effects are at least 40% smaller, though residential increases are still statistically significant. Panels C and D (excluding time-varying state controls and using lagged SCHIP limits) are similar to the Table 3 findings. The patterns in parity law effects are qualitatively similar across specifications, but in some cases do not reach statistical significance.

We also consider variations in the sample or weights applied to the admissions estimates, as reported in Appendix Table 6. When restricting to the subsample with insurance data, the estimated effects of SCHIP are smaller and estimated effects of parity laws are larger. When

[36] Details available on request. We have less policy variation in this analyses, 2006 to 2010, which is a limitation.

restricting to a balanced panel of states, or weighting by state population with the full sample, the results on SCHIP are very similar to the original, with some marginal statistical significance appearing even for outpatient admissions (unlike Table 3). However, the estimated effects of the parity law are smaller and imprecise in these cases.

Finally, we present a similar set of checks with the insurance outcomes (Appendix Tables 7 and 8).[37] The SCHIP effect estimates are similar to (or even stronger than) the original Table 4 estimates when state-specific time trends are added, or time-varying state controls removed, but get weaker if we use lagged Medicaid thresholds. The parity estimates are fairly sensitive to these specification changes, with zero in or near each confidence interval. Appendix Table 8, in contrast, shows robustness to the sample and weighting; in this case, we also vary the threshold for 'missingness' to see whether our sample inclusion criteria of 'less than 25% missing' was driving our estimates; results are not driven by this cut-off.

6. Conclusion

We provide the first evidence on the effect of U.S. state-level public and private insurance expansions on children's specialty SUD treatment use. We leverage variation in public insurance eligibility afforded by Medicaid and SCHIP income expansions, and we study state laws that require private insurers to cover SUD treatment 'at parity' with general healthcare services. Our findings imply that public and private expansions increase admissions to specialty SUD treatment and increase coverage among children receiving treatment. We find positive spillover effects from child-targeted public insurance expansions to adults; post-expansion we observe *increases* in adult admissions. We also observe some shifts in the composition of children in treatment post-expansion, with heterogeneity across public and private expansions.

[37] In this case, the outcome is binary so we leave out the Poisson analysis. We also do not separately include the 'insurance only' sample since that is the sample we are already using by necessity.

Our findings are important from a human capital development perspective. Childhood is an important period for obtaining education and establishing general health capital that will influence well-being and health across the lifecourse. In particular, childhood is a period in which many SUDs emerge and treatment can be particularly effective. In addition, our findings build on the policy literatures investigating the effects of public and private insurance expansions on SUD treatment and insurance coverage. Our contribution is to study expansion effects on SUD treatments and insurance coverage *among children*, a group that – to the best of our knowledge – has not been previously examined despite substantial policy relevance.

From a practical standpoint, given that many countries (including the U.S.) are considering how to provide affordable healthcare at reasonable cost, understanding how expansions affect service use and coverage within vulnerable populations is important. For example, in the U.S. there have been recent Congressional attempts to roll-back SUD treatment provisions of the ACA, which compelled most insurers to generously cover SUD treatment, and throughout its history SCHIP has been subject to substantial funding uncertainty (Congressional Budget Office, 2017, Kaiser Family Foundation, 2018). Our findings may help policymakers considering reshaping both SUD treatment and children's coverage.

Our study has limitations. We focus on specialty care only. Our insurance sample contains 39 states. Our findings are somewhat sensitive to specifications and sub-samples.

In summary, we provide evidence on the effects of public and private expansions on children's use of SUD treatment and find that access to care increases the use of more substantial and effective treatments. Given that treatment received in childhood may have persistent benefits in terms of reduced substance use and associated harms, our findings suggest that

insurance expansions may improve lifecourse health for affected children and provide broader benefits to society into the future.

Table 1. Distribution of states across Medicaid/SCHIP threshold bins

Year:	**1996**	**1998**	**2000**	**2002**	**2004**	**2006**	**2008**	**2010**
Medicaid/SCHIP threshold								
< 175% FPL	44	40	12	6	5	4	4	2
175-199% FPL	4	3	9	5	6	5	5	2
200-225% FPL	2	5	19	27	28	30	24	20
> 225% FPL	1	3	11	13	12	12	18	27

Notes: Estimation uses all years; table shows just even years for brevity.

Table 2. Summary statistics among children 12-18 years not referred through the criminal justice system: TEDS 1996 to 2010

Variable:	Mean/proportion (admissions sample)	Mean/proportion (insurance sample)
Admissions per 100,000		
Total admissions	306.2	283.9
Detoxification admissions	12.1	16.0
Residential admissions	48.4	45.5
Outpatient admissions	245.7	222.3
Patient insurance		
Private insurance	--	0.25
Public insurance	--	0.41
No insurance	--	0.35
Insurance expansions		
SCHIP income threshold	196.7	190.9
SUD parity law	0.11	0.11
Controls		
HIFA waiver	0.03	0.04
Medical marijuana law	0.15	0.13
Marijuana decriminalized	0.25	0.22
Prescription drug monitoring program	0.41	0.44
Block grants for SUD treatment (millions)	35.5	27.5
Share 12-18 year olds	0.10	0.10
Male	0.49	0.49
Female	0.51	0.51
White	0.82	0.82
African American	0.11	0.11
Other race	0.07	0.07
Hispanic	0.08	0.08
Less than high school	0.37	0.37
High school	0.25	0.25
Some college	0.21	0.21
College or more	0.18	0.18
State-to-federal EITC ratio	0.05	0.03
Poverty rate	12.2	12.0
UE rate	5.27	5.19
Minimum wage ($)	6.77	6.72
TANF max. monthly benefit, family of 4 ($)	572.2	553.4
Democrat governor	0.46	0.50
Observations	747	430

Notes: The unit of observation is the state-year. Sample restricted to non-criminal justice referrals. The following state-years that did not report any data to TEDS are necessarily excluded from all analyses: Alabama (2007), Arizona (1996-97), Arkansas (2004), District of Columbia (2004-06, 2008-09), Indiana (1997), Kentucky (1996), Mississippi (2009-10), West Virginia (1997-98), and Wyoming (1996).

Table 3. Effect of insurance expansions on admissions to SUD treatment among children 12-18 years not referred through the criminal justice system: TEDS 1996 to 2010

Outcome:	Total	Detoxification	Residential	Outpatient
Sample mean:	*306.2*	*12.1*	*48.4*	*245.7*
Medicaid/SCHIP limit				
175% FPL - 199% FPL	81.79*	-0.47	24.23***	58.04
	[-8.56,172.14]	[-6.82,5.88]	[8.10,40.35]	[-28.49,144.56]
200% FPL - 225% FPL	83.19*	0.83	22.62**	59.76
	[-0.85,167.24]	[-7.74,9.40]	[5.13,40.11]	[-19.51,139.02]
> 225% FPL	132.69*	3.39	23.57**	105.73
	[-13.54,278.91]	[-5.14,11.91]	[3.87,43.28]	[-41.29,252.76]
Private SUD coverage				
Parity law indicator	80.09*	-0.39	7.57	72.85*
	[-3.91,164.10]	[-8.93,8.16]	[-5.20,20.35]	[-5.96,151.66]
Observations	747	747	747	747

Notes: The unit of observation is a state-year. Sample restricted to non-criminal justice referrals. All models estimated with OLS and control for state demographics, state fixed effects, and year fixed effects. Omitted Medicaid/SCHIP group is 0 to 175% FPL. 95% confidence intervals that account for within state clustering are reported in square brackets. ***, **, * = statistically different from zero at the 1%,5%,10% level.

Table 4. Effect of insurance expansions on insurance status among children 12-18 years not referred through the criminal justice system receiving SUD treatment: TEDS 1996 to 2010

Outcome:	Private insurance	Public insurance	Uninsured
Sample mean:	*0.25*	*0.41*	*0.35*
Medicaid/SCHIP limit			
175% FPL - 199% FPL	-0.05	0.14**	-0.10
	[-0.14,0.05]	[0.03,0.26]	[-0.26,0.07]
200% FPL - 225% FPL	-0.05**	0.00	0.05
	[-0.09,-0.01]	[-0.06,0.07]	[-0.02,0.11]
> 225% FPL	-0.04	0.06	-0.02
	[-0.10,0.01]	[-0.03,0.16]	[-0.13,0.09]
Private SUD coverage			
Parity law indicator	0.03*	-0.06	0.03
	[-0.00,0.05]	[-0.19,0.08]	[-0.12,0.18]
Observations	430	430	430

Notes: The unit of observation is a state-year. Sample restricted to non-criminal justice referrals. All models estimated with OLS model and control for state demographics, state fixed effects, and year fixed effects. Omitted SCHIP group is 0 to 175% FPL. 95% confidence intervals that account for within state clustering are reported in square brackets.
***,**,*= statistically different from zero at the 1%,5%,10% level.

Table 5. Effect of insurance expansions on admissions to SUD treatment among children 12-18 years not referred through the criminal justice system, by child sex: TEDS 1996 to 2010

Panel A: Boys only

Outcome:	**Total**	**Detoxification**	**Residential**	**Outpatient**
Sample mean:	*385.1*	*15.9*	*60.4*	*308.8*
Medicaid/SCHIP limit				
175% FPL - 199% FPL	96.36*	-0.35	29.98***	66.74
	[-7.51,200.23]	[-9.00,8.30]	[11.02,48.95]	[-33.25,166.73]
200% FPL - 225% FPL	101.11**	-0.50	26.31**	75.34*
	[6.21,196.01]	[-10.96,9.95]	[6.29,46.33]	[-14.58,165.25]
> 225% FPL	150.84*	2.99	30.32**	117.55
	[-7.85,309.53]	[-7.44,13.42]	[5.34,55.30]	[-41.57,276.67]
Private SUD coverage				
Parity law indicator	112.83**	-1.17	12.56	101.44**
	[14.28,211.37]	[-13.15,10.81]	[-3.10,28.21]	[8.70,194.17]
Observations	746	746	746	746

Panel B: Girls only

Outcome:	**Total**	**Detoxification**	**Residential**	**Outpatient**
Sample mean:	*232.2*	*8.44*	*37.1*	*186.6*
Medicaid/SCHIP limit				
175% FPL - 199% FPL	66.03	-0.55	18.67***	47.91
	[-13.77,145.83]	[-4.99,3.88]	[4.95,32.39]	[-28.08,123.90]
200% FPL - 225% FPL	63.51	2.06	19.20**	42.25
	[-12.74,139.75]	[-5.29,9.42]	[3.61,34.78]	[-29.34,113.84]
> 225% FPL	110.55	3.62	16.93**	89.98
	[-27.87,248.97]	[-3.69,10.94]	[1.63,32.23]	[-49.00,228.96]
Private SUD coverage				
Parity law indicator	54.10	0.65	3.79	49.55
	[-20.82,129.03]	[-4.98,6.28]	[-6.85,14.43]	[-20.35,119.45]
Observations	742	742	742	742

Notes: The unit of observation is a state-year. Sample restricted to non-criminal justice referrals. All models estimated with OLS and control for state demographics, state fixed effects, and year fixed effects. Omitted SCHIP group is 0 to 175% FPL. 95% confidence intervals that account for within state clustering are reported in square brackets.

***, **, *=statistically different from zero at the 1%,5%,10% level.

Table 6A. Effect of insurance expansions on patient characteristics among all children regardless of referral source 12-18 years: TEDS 1996 to 2010

Outcome:	White	African American	Other race	Hispanic	12 to 14 years	CJ+ referral
Sample mean:	*0.64*	*0.15*	*0.09*	*0.13*	*0.16*	*0.48*
Medicaid/SCHIP						
175% - 199% FPL	-0.01	-0.00	-0.00	0.02	0.02*	-0.04**
	[-0.03,0.02]	[-0.02,0.02]	[-0.02,0.01]	[-0.01,0.05]	[-0.00,0.04]	[-0.08,-0.00]
200% - 225% FPL	-0.02	0.01	-0.00	0.02	0.03**	-0.07***
	[-0.05,0.02]	[-0.01,0.03]	[-0.02,0.01]	[-0.01,0.05]	[0.00,0.05]	[-0.12,-0.03]
> 225% FPL	-0.00	0.01	-0.01	0.02	0.05**	-0.11***
	[-0.03,0.03]	[-0.00,0.03]	[-0.04,0.01]	[-0.02,0.06]	[0.00,0.09]	[-0.17,-0.06]
Pvt. SUD coverage						
Parity indicator	-0.03	0.02	0.02*	-0.02	0.00	0.01
	[-0.07,0.01]	[-0.04,0.07]	[-0.00,0.05]	[-0.08,0.03]	[-0.03,0.04]	[-0.05,0.08]
Observations	748	748	748	731	748	745

Notes: The unit of observation is a state-year. Criminal justice system referrals included in the analysis. All models estimated with OLS and control for state demographics, state fixed effects, and year fixed effects. Omitted SCHIP group is 0 to 175% FPL. 95% confidence intervals that account for within state clustering are reported in square brackets.
+ CJ = criminal justice system.
***, **, *=statistically different from zero at the 1%,5%,10% level.

Table 6B. Effect of insurance expansions on patient SUD profile among all children regardless of referral source 12-18 years: TEDS 1996 to 2010

Outcome:	Psychoactive drug primary substance	Opioid primary substance	Previous treatment
Sample mean:	*0.74*	*0.03*	*0.33*
Medicaid/SCHIP			
175% - 199% FPL	-0.00	-0.01	0.10**
	[-0.03,0.03]	[-0.02,0.01]	[0.00,0.19]
200% - 225% FPL	0.00	-0.02	0.07*
	[-0.03,0.03]	[-0.07,0.02]	[-0.01,0.15]
> 225% FPL	0.03	-0.00	0.10*
	[-0.02,0.08]	[-0.02,0.01]	[-0.00,0.19]
Pvt. SUD coverage			
Parity indicator	-0.00	-0.09	-0.01
	[-0.05,0.04]	[-0.25,0.07]	[-0.08,0.06]
Observations	747	747	697

Notes: The unit of observation is a state-year. Criminal justice system referrals included in the analysis. All models estimated with OLS and control for state demographics, state fixed effects, and year fixed effects. Omitted SCHIP group is 0 to 175% FPL. 95% confidence intervals that account for within state clustering are reported in square brackets.
***, **, *=statistically different from zero at the 1%,5%,10% level.

Table 7. Effect of insurance expansions on admissions to SUD treatment among adults 19 years and older not referred through the criminal justice system: TEDS 1996 to 2010

Outcome:	Total	Detoxification	Residential	Outpatient
Sample mean:	*555.0*	*175.0*	*99.7*	*280.1*
Medicaid/SCHIP limit				
175% FPL - 199% FPL	23.89	-1.53	18.66	6.79
	[-59.09,106.88]	[-37.29,34.22]	[-7.29,44.60]	[-38.19,51.77]
200% FPL - 225% FPL	81.39**	37.37*	24.64***	19.40
	[7.80,154.98]	[-1.12,75.85]	[7.11,42.16]	[-19.88,58.68]
> 225% FPL	65.10	17.93	29.64***	17.51
	[-35.02,165.22]	[-24.43,60.30]	[7.74,51.53]	[-39.02,74.04]
Private SUD coverage				
Parity law indicator	60.12	-50.77*	8.10	102.70***
	[-32.35,152.60]	[-106.34,4.81]	[-9.44,25.64]	[36.88,168.51]
Observations	749	749	749	749

Notes: The unit of observation is a state-year. Sample restricted to non-criminal justice referrals. All models estimated with OLS and control for state demographics, state fixed effects, and year fixed effects. Omitted SCHIP group is 0 to 175% FPL. 95% confidence intervals that account for within state clustering are reported in square brackets.

***, **, *=statistically different from zero at the 1%,5%,10% level.

Appendix Table 1. Selected Medicaid/SCHIP income thresholds as a percent of the Federal Poverty Level: 1996-2010

Year:	1996	1998	2000	2002	2004	2006	2008	2010
AK	100	100	200	200	175	175	175	175
AL	100	100	200	200	200	200	200	300
AR	100	200	200	200	200	200	200	200
AZ	100	150	200	200	200	200	200	200
CA	100	100	250	250	250	250	250	250
CO	100	100	185	185	185	200	200	205
CT	185	300	300	300	300	300	300	300
DC	100	200	200	200	200	200	300	300
DE	100	100	200	200	200	200	200	200
FL	100	100	200	200	200	200	200	200
GA	100	100	200	235	235	235	235	235
HI	100	100	100	200	200	200	300	300
IA	100	100	185	200	200	200	200	300
ID	100	160	150	150	150	185	185	185
IL	100	133	185	185	200	200	200	200
IN	100	100	200	200	200	200	200	250
KS	100	100	200	200	200	200	200	241
KY	100	100	200	200	200	200	200	200
LA	100	100	150	200	200	200	200	250
MA	100	200	200	200	200	200	300	300
MD	185	185	200	300	300	300	300	300
ME	125	125	185	200	200	200	200	200
MI	150	150	200	200	200	200	200	200
MN	275	275	275	275	275	275	275	275
MO	100	100	300	300	300	300	300	300
MS	100	100	200	200	200	200	200	200
MT	100	100	150	150	150	150	175	250
NC	100	100	200	200	200	200	200	200
ND	100	100	140	140	140	140	140	160
NE	100	100	185	185	185	185	185	200
NH	185	185	300	300	300	300	300	300
NJ	100	100	350	350	350	350	350	350
NM	185	185	235	235	235	235	235	235
NV	100	100	200	200	200	200	200	200
NY	100	100	192	200	200	200	250	400
OH	100	100	150	200	200	200	200	200
OK	100	100	185	185	185	185	185	185
OR	100	100	170	170	185	185	185	300
PA	100	100	200	200	200	200	300	300
RI	100	100	250	250	250	250	250	250

SC	100	100	150	150	150	150	175	200
SD	100	100	140	200	200	200	200	200
TN	100	400	400	400	200	200	200	250
TX	100	100	100	200	200	200	200	200
UT	100	100	200	200	200	200	250	200
VA	100	100	185	200	200	200	200	200
VT	225	225	300	300	300	300	300	300
WA	200	200	250	250	250	250	300	300
WI	100	100	185	185	185	185	200	300
WV	100	100	150	200	200	200	200	250
WY	100	100	133	133	185	200	235	200

Notes: See text for details on SCHIP threshold level sources. Analysis uses all years; we report even years only here for brevity.

Appendix Table 2. States that passed a full parity law by 2010

State	Effective date	Parity law transition
Arkansas	2009/10	Mandated offer to full parity
Connecticut	2000 (no month)	None to full parity
Delaware	2001 (no month)	None to full parity
Kansas	2009/07	Mandated benefits to full parity
Louisiana	2009/01	Mandated benefits to full parity
Maine	2003 (no month)	Mandated benefits to full parity
Maryland	1994 (no month)	None to full parity
Oregon	2007/07	Mandated benefits to full parity
Rhode Island	2002 (no month)	Mandated benefits to full parity
Texas	2005/04	Mandated benefits to full parity
Vermont	1998 (no month)	None to full parity
West Virginia	2004 (no month)	None to full parity

Notes: See text for details on parity law sources. Mandated offer = insurers required to offer SUD treatment services coverage to beneficiaries; offered coverage may be at parity with general healthcare services or may be less generous. Mandated benefits = insurers required to cover a specified set of SUD treatment services; copayments and service limitations may depart from general healthcare service coverage. If no effective month is provided, we assume that the effective month is January following Maclean, Popovici, and Stern (2017).

Appendix Table 3. States in the insurance sample and number of observations with <25% missing information in the insurance variable among children 12-18 years not referred through the criminal justice system: TEDS 1996 to 2010

State	Number of observations
Alaska	7
Alabama	2
Arkansas	10
Arizona	12
Colorado	12
Connecticut	4
District of Columbia	7
Delaware	6
Georgia	10
Hawaii	13
Iowa	4
Idaho	12
Illinois	15
Indiana	13
Kansas	15
Kentucky	13
Louisiana	5
Massachusetts	15
Maryland	15
Maine	7
Michigan	5
Missouri	10
Mississippi	10
Montana	15
North Dakota	15
Nebraska	13
New Hampshire	15
New Jersey	14
New Mexico	6
Nevada	9
Oklahoma	9
Oregon	15
Pennsylvania	15
South Carolina	12
South Dakota	8
Tennessee	1
Texas	13
Utah	11
West Virginia	10
Wyoming	5

Notes: States included in the insurance sample of states have less than 25% missing in the insurance variable.

Appendix Table 4. Effect of insurance expansions on admissions and insurance coverage among children 12-18 years referred by the criminal justice system, TEDS 1996-2010

Outcome:	Total	Detoxification	Residential	Outpatient
Sample mean:	*266.1*	*6.65*	*35.5*	*224.0*
Medicaid/SCHIP limit				
175% FPL - 199% FPL	-10.29	-1.45	7.47	-16.32
	[-51.07,30.49]	[-5.67,2.78]	[-8.42,23.36]	[-49.41,16.77]
200% FPL - 225% FPL	-25.47	-1.71	5.77	-29.52
	[-70.82,19.89]	[-7.08,3.67]	[-10.85,22.40]	[-70.96,11.92]
> 225% FPL	-35.61	1.06	-8.89	-27.77
	[-89.70,18.48]	[-6.26,8.38]	[-19.94,2.17]	[-76.97,21.42]
Private SUD coverage				
Parity law indicator	5.40	0.47	-9.03	13.96
	[-42.63,53.43]	[-7.43,8.38]	[-26.42,8.37]	[-28.71,56.62]
Observations	740	740	740	740

Outcome:	Private insurance	Public insurance	Uninsured
Sample mean:	*0.21*	*0.40*	*0.39*
Medicaid/SCHIP limit			
175% FPL - 199% FPL	-0.05	0.11	-0.06
	[-0.14,0.04]	[-0.04,0.26]	[-0.27,0.15]
200% FPL - 225% FPL	-0.03*	0.04	-0.01
	[-0.07,0.00]	[-0.04,0.13]	[-0.10,0.08]
> 225% FPL	-0.03	0.11	-0.08
	[-0.08,0.02]	[-0.02,0.25]	[-0.23,0.06]
Private SUD coverage			
Parity law indicator	0.07**	-0.13	0.06
	[0.00,0.14]	[-0.34,0.08]	[-0.13,0.25]
Observations	412	412	412

Notes: The unit of observation is a state-year. Sample restricted to criminal justice referrals. Omitted SCHIP group is 0 to 175% FPL. Models are estimated with OLS and control for state demographics (but no time-varying state controls), state fixed effects, and year fixed effects. 95% confidence intervals that account for within state clustering are reported in square brackets.

***,**,*= statistically different from zero at the 1%,5%,10% level.

Appendix Table 5. Effect of insurance expansions on admissions to SUD treatment among children 12-18 years not referred through the criminal justice system: TEDS 1996 to 2010, with variations in specification

Outcome:	Total	Detoxification	Residential	Outpatient
Sample mean (untransformed count):	*1507.3*	*46.8*	*247.4*	*1213.0*
Panel A: Poisson model (N = 747)				
Medicaid/SCHIP limit				
175% FPL - 199% FPL	343.64**	-27.77	82.51***	269.95*
	[8.95,678.33]	[-61.41,5.87]	[33.23,131.79]	[-39.38,579.27]
200% FPL - 225% FPL	295.29**	-10.14	54.07**	244.44**
	[33.48,557.10]	[-31.14,10.87]	[7.80,100.34]	[6.04,482.83]
> 225% FPL	409.01**	-6.68	47.16	339.52*
	[27.18,790.85]	[-46.92,33.56]	[-11.03,105.35]	[-5.06,684.10]
Private SUD coverage				
Parity law indicator	176.98	-21.77	36.11	156.83
	[-99.01,452.98]	[-62.71,19.17]	[-17.95,90.17]	[-112.28,425.94]
Sample mean (rate per 100,000 children):	*306.2*	*12.1*	*48.4*	*245.7*
Panel B: OLS including state-specific linear time trends (N = 747)				
Medicaid/SCHIP limit				
175% FPL - 199% FPL	31.40	-6.09**	13.74**	23.79
	[-31.26,94.06]	[-11.95,-0.24]	[1.09,26.40]	[-37.64,85.23]
200% FPL - 225% FPL	14.85	-1.54	12.97**	3.46
	[-35.71,65.41]	[-9.77,6.69]	[2.08,23.87]	[-43.67,50.59]
> 225% FPL	43.54	-2.25	14.26	31.58
	[-26.45,113.53]	[-11.49,6.99]	[-5.21,33.73]	[-36.80,99.95]
Private SUD coverage				
Parity law indicator	29.80	-1.79	1.34	30.20
	[-68.55,128.15]	[-7.38,3.81]	[-10.70,13.39]	[-65.41,125.81]
Panel C: OLS excluding time-varying state controls (N = 747)				
Medicaid/SCHIP limit				
175% FPL - 199% FPL	78.04*	-0.51	24.53***	54.02
	[-3.85,159.94]	[-6.81,5.78]	[6.76,42.30]	[-22.93,130.97]
200% FPL - 225% FPL	83.07**	2.21	25.99**	54.87*
	[15.09,151.04]	[-7.53,11.95]	[3.42,48.55]	[-5.17,114.91]
> 225% FPL	126.55*	3.87	24.56**	98.12
	[-7.03,260.13]	[-4.72,12.46]	[0.76,48.36]	[-36.28,232.51]
Private SUD coverage				
Parity law indicator	75.04*	-1.70	6.73	69.96*
	[-4.29,154.37]	[-10.11,6.71]	[-7.40,20.85]	[-2.11,142.04]
Panel D: OLS using lagged Medicaid/SCHIP limits (N = 699)				

Sample mean (rate per 100,000 children):	*303.8*	*11.8*	*47.4*	*244.6*
Medicaid/SCHIP limit				
175% FPL - 199% FPL	103.84**	2.78	25.87***	75.18*
	[20.46,187.22]	[-4.77,10.33]	[10.38,41.37]	[-6.20,156.55]
200% FPL - 225% FPL	79.86*	5.28	19.10*	55.49
	[-6.90,166.63]	[-5.35,15.90]	[-2.78,40.97]	[-27.46,138.44]
> 225% FPL	122.92*	7.79	20.18*	94.94
	[-20.18,266.02]	[-4.18,19.76]	[-0.85,41.22]	[-52.00,241.89]
Private SUD coverage				
Parity law indicator	59.95	-1.28	7.40	53.79
	[-40.42,160.32]	[-11.97,9.42]	[-6.73,21.52]	[-37.50,145.08]

Notes: The unit of observation is a state-year. Sample restricted to non-criminal justice referrals. Omitted SCHIP group is 0 to 175% FPL. Population ages 12 to 18 years is the exposure variable for the Poisson model (Panel A), which controls for state demographics, state fixed effects, and year fixed effects. Average marginal effects reported. Panel B model is estimated with OLS and controls for state demographics, state fixed effects, year fixed effects, and state-specific linear time trends. Panel C is estimated with OLS and controls for state fixed effects and year fixed effects. Panel D is estimated with OLS using a one-year lag of Medicaid/SCHIP income limits (note that we must drop the 1996 outcomes since we do not have 1995 policy variables.

95% confidence intervals that account for within state clustering are reported in square brackets.

***,**,*= statistically different from zero at the 1%,5%,10% level.

Appendix Table 6. Effect of insurance expansions on admissions to SUD treatment among children 12-18 years not referred through the criminal justice system, TEDS 1996 to 2010, modified samples and/or weights

Outcome:	Total	Detoxification	Residential	Outpatient
Panel A: insurance sample only (N = 430)				
Sample mean:	*283.9*	*16.0*	*45.5*	*222.3*
Medicaid/SCHIP limit				
175% FPL - 199% FPL	21.08	-6.39	17.09**	10.45
	[-81.88,124.04]	[-15.39,2.61]	[3.74,30.43]	[-84.21,105.11]
200% FPL - 225% FPL	48.52	-5.50	15.41**	38.72
	[-17.22,114.26]	[-15.30,4.29]	[2.68,28.13]	[-18.62,96.06]
> 225% FPL	22.05	-5.26	18.57*	8.83
	[-77.98,122.07]	[-14.90,4.38]	[-1.84,38.98]	[-78.10,95.77]
Private SUD coverage				
Parity law indicator	145.15***	4.06	7.10	133.89***
	[72.97,217.32]	[-4.38,12.49]	[-12.98,27.17]	[65.22,202.57]
Panel B: balanced state sample only (N = 615)				
Sample mean:	*339.0*	*13.5*	*55.2*	*270.3*
Medicaid/SCHIP limit				
175% FPL - 199% FPL	80.27	-1.30	22.96**	58.61
	[-17.66,178.20]	[-8.41,5.82]	[4.36,41.56]	[-35.10,152.31]
200% FPL - 225% FPL	91.82*	-0.31	23.93**	68.22
	[-5.67,189.31]	[-6.33,5.71]	[2.32,45.55]	[-19.77,156.21]
> 225% FPL	152.65*	2.06	24.89**	125.70
	[-11.66,316.95]	[-5.40,9.53]	[1.99,47.80]	[-38.55,289.95]
Private SUD coverage				
Parity law indicator	55.06	2.04	12.12	40.86
	[-39.85,149.96]	[-8.23,12.30]	[-5.09,29.33]	[-43.40,125.12]
Panel C: full sample using state population as weights (N = 747)				
Weighted sample mean:	*259.5*	*8.06*	*42.6*	*208.9*
Medicaid/SCHIP limit				
175% FPL - 199% FPL	82.69**	-0.56	22.86***	60.38*
	[3.63,161.75]	[-6.94,5.81]	[6.39,39.33]	[-11.18,131.94]
200% FPL - 225% FPL	67.32**	-0.22	18.29**	49.22*
	[4.24,130.39]	[-5.56,5.12]	[0.33,36.26]	[-4.17,102.61]
> 225% FPL	95.13**	4.42	16.93*	73.74**
	[21.70,168.57]	[-6.83,15.67]	[-2.07,35.93]	[7.12,140.36]
Private SUD coverage				
Parity law indicator	19.23	2.54	3.40	13.27
	[-41.87,80.33]	[-7.29,12.36]	[-6.95,13.75]	[-42.15,68.70]

Notes: The unit of observation is a state-year. Sample restricted to non-criminal justice referrals. All models estimated with OLS and control for state demographics, state fixed effects, and year fixed effects. Panel C uses state population ages 12-18 as the weights. Omitted SCHIP group is 0 to 175% FPL. 95% confidence intervals that account for within state clustering are reported in square brackets.

***, **, *=statistically different from zero at the 1%,5%,10% level.

Appendix Table 7. Effect of insurance expansions on insurance status among children 12-18 years not referred through the criminal justice system years receiving SUD treatment, TEDS 1996 to 2010, with varying specifications

Outcome:	Private insurance	Public insurance	Uninsured
Sample mean:	*0.23*	*0.40*	*0.37*
Panel A: OLS including state-specific linear time trends (N = 430)			
Medicaid/SCHIP limit			
175% FPL - 199% FPL	-0.06**	0.10***	-0.04
	[-0.12,-0.00]	[0.04,0.16]	[-0.12,0.04]
200% FPL - 225% FPL	-0.05**	0.04	0.01
	[-0.10,-0.01]	[-0.01,0.10]	[-0.05,0.08]
> 225% FPL	-0.06**	0.04	0.02
	[-0.12,-0.00]	[-0.04,0.12]	[-0.07,0.11]
Private SUD coverage			
Parity law indicator	-0.05	-0.02	0.07
	[-0.16,0.07]	[-0.09,0.05]	[-0.03,0.18]
Panel B: OLS excluding time-varying state controls (N = 430)			
Medicaid/SCHIP limit			
175% FPL - 199% FPL	-0.05	0.14**	-0.08
	[-0.17,0.06]	[0.01,0.26]	[-0.26,0.10]
200% FPL - 225% FPL	-0.06*	0.00	0.06*
	[-0.12,0.01]	[-0.06,0.06]	[-0.01,0.12]
> 225% FPL	-0.05	0.07*	-0.02
	[-0.12,0.01]	[-0.01,0.16]	[-0.11,0.07]
Private SUD coverage			
Parity law indicator	0.03*	-0.03	0.00
	[-0.00,0.06]	[-0.15,0.09]	[-0.13,0.14]
Panel C: OLS using lagged Medicaid/SCHIP limits (N = 402)			
Sample mean:	*0.25*	*0.41*	*0.34*
Medicaid/SCHIP limit			
175% FPL - 199% FPL	-0.03	0.08	-0.05
	[-0.12,0.05]	[-0.05,0.22]	[-0.20,0.11]
200% FPL - 225% FPL	-0.03	-0.04	0.07**
	[-0.07,0.01]	[-0.11,0.02]	[0.01,0.14]
> 225% FPL	0.00	-0.03	0.03
	[-0.06,0.06]	[-0.12,0.06]	[-0.08,0.14]
Private SUD coverage			
Parity law indicator	0.02	-0.06	0.04
	[-0.01,0.05]	[-0.19,0.08]	[-0.10,0.17]

Notes: The unit of observation is a state-year. Sample restricted to non-criminal justice referrals. Omitted SCHIP group is 0 to 175% FPL. Panel A model is estimated with OLS and controls for state demographics, state fixed effects, year fixed effects, and state-specific linear time trends. Panel B is estimated with OLS and controls for state fixed effects and year fixed effects. Panel C is estimated with OLS using a one-year lag of Medicaid/SCHIP income

limits (note that we must drop the 1996 outcomes since we do not have 1995 policy variables.
95% confidence intervals that account for within state clustering are reported in square brackets.
***,**,*= statistically different from zero at the 1%,5%,10% level.

Appendix Table 8. Effect of insurance expansions on insurance status among children 12-18 years not referred through the criminal justice system receiving SUD treatment, TEDS 1996 to 2010, varying samples and/or weights

Outcome:	Private insurance	Public insurance	Uninsured
Panel A: balanced state sample only (N = 331)			
Sample mean:	*0.28*	*0.39*	*0.32*
Medicaid/SCHIP limit			
175% FPL - 199% FPL	-0.03	0.13**	-0.09
	[-0.13,0.06]	[0.03,0.23]	[-0.25,0.07]
200% FPL - 225% FPL	-0.03	0.03	0.01
	[-0.08,0.01]	[-0.03,0.09]	[-0.05,0.06]
> 225% FPL	-0.02	0.05	-0.03
	[-0.08,0.04]	[-0.04,0.15]	[-0.16,0.09]
Private SUD coverage			
Parity law indicator	0.04*	0.02	-0.06
	[-0.00,0.08]	[-0.16,0.19]	[-0.24,0.13]
Panel B: full sample using state population as weights (N = 430)			
Weighted sample man:	*0.23*	*0.39*	*0.38*
Medicaid/SCHIP limit			
175% FPL - 199% FPL	-0.03	0.11*	-0.08
	[-0.09,0.04]	[-0.01,0.23]	[-0.24,0.08]
200% FPL - 225% FPL	-0.06***	0.05	0.01
	[-0.09,-0.03]	[-0.02,0.13]	[-0.06,0.08]
> 225% FPL	-0.05**	0.09	-0.04
	[-0.09,-0.01]	[-0.05,0.23]	[-0.18,0.10]
Private SUD coverage			
Parity law indicator	0.03**	-0.05	0.02
	[0.00,0.07]	[-0.13,0.03]	[-0.07,0.12]
Panel C: sample using 15% threshold for missingness (N = 367)			
Sample mean:	*0.24*	*0.41*	*0.34*
Medicaid/SCHIP limit			
175% FPL - 199% FPL	-0.04	0.16**	-0.12
	[-0.15,0.06]	[0.04,0.28]	[-0.29,0.06]
200% FPL - 225% FPL	-0.05**	0.04	0.02
	[-0.10,-0.01]	[-0.05,0.12]	[-0.07,0.11]
> 225% FPL	-0.04	0.09	-0.05
	[-0.10,0.03]	[-0.03,0.21]	[-0.20,0.09]
Private SUD coverage			
Parity law indicator	0.03*	-0.05	0.02
	[-0.00,0.07]	[-0.19,0.09]	[-0.14,0.18]
Panel D: sample using 35% threshold for missingness (N = 457)			

Sample mean:	*0.25*	*0.41*	*0.34*
Medicaid/SCHIP limit			
175% FPL - 199% FPL	-0.04	0.13**	-0.09
	[-0.13,0.06]	[0.01,0.25]	[-0.25,0.08]
200% FPL - 225% FPL	-0.03	-0.02	0.05*
	[-0.08,0.01]	[-0.09,0.05]	[-0.01,0.11]
> 225% FPL	-0.03	0.02	0.00
	[-0.08,0.03]	[-0.08,0.12]	[-0.10,0.11]
Private SUD coverage			
Parity law indicator	0.01	-0.03	0.02
	[-0.02,0.05]	[-0.16,0.10]	[-0.13,0.16]

Notes: The unit of observation is a state-year. Sample restricted to non-criminal justice referrals. All models estimated with OLS and control for state demographics, state fixed effects, and year fixed effects. Panel B uses state population ages 12-18 as the weights. Panels C and D use 15% and 35% missingness (respectively) as standards for sample exclusion. Omitted SCHIP group is 0 to 175% FPL. 95% confidence intervals that account for within state clustering are reported in square brackets.

***, **, *=statistically different from zero at the 1%,5%,10% level.

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