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ABSTRACT

We study spillover effects from the largest increase in Medicaid reimbursement rates in the history of the program for primary care services to behavioral health and healthcare outcomes; mental illness, substance use disorders, and tobacco product use. Much of the variation in Medicaid reimbursement rates we leverage is attributable to a large federally mandated increase between 2013 and 2014. We apply differences-in-differences models to survey data specifically designed to measure behavioral health outcomes over the period 2010 to 2016. We find that higher primary care Medicaid reimbursement rates improve behavioral health outcomes among enrollees. We find no evidence that behavioral healthcare service use is altered. Previous economic research shows that the mandated boost increased office visits. Thus our results suggest that primary care providers are efficient in improving behavioral health outcomes among Medicaid enrollees. Given established shortages of behavioral health providers, these findings are important from a healthcare workforce and policy perspective.

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1. Introduction

Provider participation in insurance markets is a critical component to healthcare access. In mixed-economy markets public payers, on average, offer lower reimbursement rates than other payers to providers for the same services (Sloan, Mitchell et al. 1978, Berman, Dolins et al. 2002). This disparity in reimbursement rates can discourage providers from participating in public markets, which likely reduces access to care and the value of insurance for enrollees. Within the United States imperfect provider participation in public markets is a long-standing concern among health policymakers (Decker 2012). The problem is particularly severe in the Medicaid market. Medicaid, a joint federal and state program, is the primary insurer of low-income individuals in the U.S., covering 77 million adults and children in 2017 (Sommers and Grabowski 2017). The program has historically offered substantially lower reimbursement rates than private insurance and other forms of public insurance; e.g., Medicare[1] (Berman, Dolins et al. 2002, Zuckerman and Goin 2012, Zuckerman, Skopec et al. 2014, Zuckerman, Skopec et al. 2017). As *prima facie* evidence that low reimbursement rates deter provider participation, in 2013 over 30% of physicians were not accepting new Medicaid patients (Hing, Decker et al. 2015). For comparison, 16% and 15% of physicians were not accepting new Medicare or private insurance patients while 5% were not accepting any new patients

To address limited provider participation, between 2013 and 2014 as part of the Affordable Care Act (ACA) the U.S. federal government mandated, and fully financed, a generous increase in the Medicaid reimbursement rate for 146 primary care services. Qualifying providers included family physicians, internists, and pediatricians, as well as other physicians who demonstrated substantial delivery of primary care services to Medicaid patients. This

[1] Medicare is a federal public insurance system for older adults and adults (regardless of age) with a set of severe medical conditions (e.g., end-stage renal disease),

mandate is referred to as the 'Medicaid fee bump.' The fee bump was not re-authorized by the federal government and ended December 31st, 2014. Some states used their own funds to continue reimbursing Medicaid services at the enhanced rate beyond 2014. Thus, the fee bump policy offers substantial variation in Medicaid reimbursement rates, a large initial increase followed by a steep decline for most states.

The objective of the fee bump policy was to induce new primary care physicians to enter the Medicaid market and to support previously participating physicians, and thus increase access to care for Medicaid enrollees in advance of ACA implementation which involved a large-scale increase in the number of individuals eligible for the program. The cost of the fee bump policy to the federal government is estimated to be $7B to $12B (Medicaid and CHIP Payment and Access Commission 2015). Hence, understanding the value of this policy is important.

Several studies show that the fee bump increased access to primary care providers and office visits, and improved health. We extend this literature to study potential spillover effects from primary care to behavioral health and healthcare service use outcomes. To the best of our knowledge, we are the first to study this question. In particular, we examine mental illness, substance use disorders (SUD), tobacco product use, and related service use. To this end, we leverage rich survey data from the National Survey on Drug Use and Health (NSDUH) between 2010 and 2016 coupled with a differences-in-differences (DD) style design. We exploit variation in the size of the fee bump in each state depending on its' pre-2013 rate. The NSDUH is designed and administered by the federal government to provide official estimates of behavioral health outcomes and service use within the U.S, making this dataset ideal for our study.

Our extension to behavioral health is important for several reasons. First, the Medicaid population has elevated rates of mental illness, SUDs, and tobacco product use and unmet needs

for treatment related to these outcomes (Busch, Meara et al. 2013, Creedon and Cook 2016, DiGiulio, Haddix et al. 2016). Second, behavioral healthcare provider participation in Medicaid is particularly scarce (Buck 2011, Bishop, Press et al. 2014) and there are overall shortages in behavioral healthcare workers in the U.S. (Hyde 2013).

Third, behavioral healthcare is increasingly being delivered in primary care settings, in particular treatment for mental illness and SUDs (Substance Abuse and Mental Health Services Administration 2016). For instance, psychotropic medications to treat mental illness (e.g., Xanax which is indicated for anxiety), medication-assisted therapies to treat SUDs (e.g., buprenorphine which is indicated for opioid use disorder [OUD]), and smoking cessation medications (e.g., Zyban and Chanitx) can be prescribed by primary care physicians and are effective (Cahill, Stevens et al. 2013, Murphy and Polsky 2016, Olfson 2016). Primary care is defined as including '…health promotion, disease prevention, health maintenance, counselling, patient education, diagnosis and treatment of acute and chronic illnesses in a variety of health settings' (American Academy of Family Physicians 2018), and thus can include management and prevention of behavioral health conditions. Indeed, over 20% of primary care visits have a mental health component (Cherry and Schappert 2014) which highlights the importance of primary care for behavioral healthcare delivery. Several recent studies suggest that the ACA Medicaid expansion, which raised eligibility through 138% of the federal poverty level (FPL) in participating states, substantially (22 to 70%) increased prescriptions for behavioral health medications that are commonly prescribed by physicians in primary care settings (Maclean, Carson et al. 2017, Maclean, Pesko et al. 2017, Maclean and Saloner 2017, Wen, Hockenberry et

al. 2017). These findings imply that there is plausibly pent up demand for behavioral healthcare services among Medicaid enrollees.[2]

Several findings emerge from our analysis. First, we document that the Medicaid fee bump led to improvements in mental illness, SUDs, and tobacco product use among Medicaid enrollees. Second, we find no statistically significant evidence that behavioral healthcare service use changed following the fee bump. Combining our findings of improved behavioral health outcomes with previous economic research that documents increased office visits post-fee bump and clinical studies establishing the effectiveness of primary care in treating behavioral health, we hypothesize that primary care providers are efficient in producing better behavioral health among Medicaid enrollees. Given established behavioral healthcare workforce shortages, our findings are relevant from a health economic, industrial relations, and policy standpoint.

The paper proceeds as follows. Section 2 offers a discussion of the Medicaid fee bump policy. Data, methods, and variables are reported in Section 3. Results are listed in Section 4. Section 5 presents extensions and sensitivity analyses. Section 6 offers a discussion.

2. Related literature and background on the ACA-related Medicaid fee bump

2.1 Related literature

Several studies suggest that the ACA fee bump raised Medicaid reimbursement rates (Kirby 2017), increased primary care provider participation in Medicaid (Polsky, Richards et al. 2015), increased prenatal care utilization among Medicaid enrolled pregnant women (Li, Pesko et al. 2018), and increased office visits and improved health outcomes among Medicaid enrollees (Alexander and Schnell 2017). When the federal fee bump policy ended in December 2014, Medicaid appointment availability declined in states that did not maintain the previously

[2] While we note that many behavioral health conditions cannot be 'cured', they can be effectively managed as is the case for other chronic conditions; e.g., diabetes and heart disease (McLellan, Lewis et al. 2000).

mandated higher reimbursement rates (Candon, Zuckerman et al. 2018). However, one paper suggests limited effects of the fee bump on physician participation in Medicaid (Decker 2016).[3]

More generally, several studies leveraging pre-fee bump data show that higher Medicaid reimbursement rates or capitation payments for primary care services increased access to primary care. For instance, boosts in the reimbursement rate increased provider acceptance of Medicaid patients (Decker 2012) and appointment availability for enrollees (Sharma, Tinkler et al. 2018). In addition to improved access to care, higher reimbursement rates increased the likelihood of patients reporting that physicians 'listened and explained things', which plausibly captures patient-assessed quality of care, among Medicaid enrollees (Shen and Zuckerman 2005).

On the patient side, higher Medicaid reimbursement rates increased appointment uptake (Decker 2009, Callison and Nguyen 2018), the likelihood of a usual source of care (Shen and Zuckerman 2005), and having at least one physician or health professional visit in the past year (Shen and Zuckerman 2005, Callison and Nguyen 2018). Further, enhanced reimbursement improved pre-natal and infant health outcomes (Gray 2001, Sonchak 2015). Hahn (2013) documents that higher reimbursement rates increased enrollment in public insurance among low income children. This finding suggests that improved access to and/or quality of healthcare can encourage program participation among eligible individuals.

To the best of our knowledge, no study has investigated the effect of the ACA-related Medicaid reimbursement fee boost on behavioral health outcomes and only one study examined the effect of pre-ACA rate increases on these outcomes. In an extension of the main analysis of general healthcare services, Decker (2009) used Medicaid reimbursement state-level variation

[3] We note that increasing the number of physicians participating in Medicaid is not necessary to enhance access, service use, or health outcomes. For instance, if the fee bump induced increased participation among incumbent physicians (i.e., the intensive margin) and/or improved quality of care, then we would expect to observe increased access and utilization, and improved health among enrollees.

from 1993 to 2003 and found that decreasing the primary care reimbursement rate from 100% to 64% of Medicare payments resulted in a 43% increase in major depressive episodes being treated in hospital outpatient departments compared to a physician's office. While this study is both important and interesting, it did not explore the effect of Medicaid reimbursement rates on the overall amount of behavioral healthcare utilization and instead focused on treatment setting for one condition. There are important differences across major classes of mental illness, SUDs, and tobacco products in terms of propensity to seek treatment overall and in primary care settings specifically (Center for Behavioral Health Statistics and Quality 2017). Further, there have been major advancements in behavioral healthcare treatment from the 1990s to the 2010s, in particular for medication prescribing in primary care settings. Perhaps most importantly, the previous study did not investigate the effect of reimbursement rates on behavioral health outcomes.

2.2 Medicaid reimbursement rates

Medicaid has historically reimbursed providers at a lower rate than any other insurer. For instance, in 2012 the fee-for-service Medicaid reimbursement rate for primary care services averaged 59% of Medicare[4] rates (Zuckerman and Goin 2012). Moreover, there has been substantial heterogeneity across states in reimbursement rates. In 2012, 5 state Medicaid programs reimbursed primary care services at less than 50% of the Medicare rate and 35 states reimbursed at less than 75% (Zuckerman and Goin 2012).

Lack of provider participation in Medicaid was a major concern among policymakers in the lead up to the ACA. As noted earlier, a core provision of the ACA was to expand Medicaid eligibility to non-disabled and childless adults with incomes through 138% of the FPL. Pre-ACA simulations predicted that this expansion would increase Medicaid enrollment by roughly

[4] Medicare regulations, including reimbursement rates, are set at the national level.

17M or 6.3% (Buettgens and Holahan 2010).[5] Section 1202 of the ACA required states to set Medicaid fee-for-service reimbursement rates for 146 primary care services at least at parity with Medicare in 2013 and 2014 (Tollen 2015).[6] The federal government financed the full amount of the Medicaid reimbursement rate increase over this period. The objective of this policy was to encourage primary care providers to participate, or increase participation, in Medicaid prior to the major 2014 expansion of this program. While the reimbursement rate increase was effective January 1st, 2013, the federal government did not release final guidance to state Medicaid programs until November 2012 (Tollen 2015).[7] The delayed federal guidance led some states to pay physicians retrospectively. The federal government was not able to re-authorize the fee bump beyond December 31st, 2014. In January 2015, only 16 states and DC used their own funds to continue to finance the enhanced reimbursement rates (Tollen 2015).

Services subject to the ACA Medicaid fee bump policy included Evaluation & Management (E&M) codes 99201 through 99449 in the Healthcare Common Procedure Coding System (HCPCS) (Tollen 2015). These codes include primary care office visits, hospital visits, and select vaccine administration codes. Importantly, the targeted E&M code range includes a set of primary care services that are important in Medicaid but not reimbursed by Medicare. Specifically, affected codes include new patient/initial comprehensive preventive medicine, established patient/periodic comprehensive preventive medicine, counseling risk factor reduction and behavioral change intervention, and E&M/non face-to-face physician services (Kaiser Commission on Medicaid and the Uninsured 2012).

[5] This estimate is for both Medicaid and the Children's Health Insurance Program.
[6] Managed care plans often receive monthly capitation payments based on what states would have paid for care on a fee-for-service basis (Zuckerman and Goin 2012), Thus, the fee-for-service reimbursement ratio that we use should proxy managed care payments as well as fee-for-service payments.
[7] The delay in payments is attributed to difficulties in applying the fee bump to managed care Medicaid and the fact that providers had to declare that they met requirements and these declarations had to be confirmed. Further, final guidance from the federal government was issued less than two months of the effective date.

Many of these services are plausibly related to behavioral healthcare. For instance, the HCPCS for smoking cessation counselling are 99406 and 99407 (Centers for Medicare Medicaid Services 2003). Preventive medicine codes 99381 to 99397 include 'counseling/anticipatory guidance/risk factor reduction interventions' and thus can include counselling services for behavioral health more broadly (e.g., screeners for depression and anxiety, and problematic alcohol use or psychoactive drug use). Finally, improvements in general health (affected codes clearly cover related services) can indirectly improve behavioral health.

Appendix Table 1 reports the average Medicaid-to-Medicare reimbursement ratio in 2012 and the increase in this ratio that was induced by the fee bump policy for the period 2013 to 2014. There was a wide range of variation in the 2012 ratio across states, and hence the intensity of fee bump policy. For instance, in 2012 the lowest ratio was 0.34 (Rhode Island) and the highest ratio was 1.37 (North Dakota), with 2 states reimbursing Medicaid at or above the Medicare rate (and hence receiving no federal funds for reimbursement rate increases). We leverage this variation in our empirical models to identify fee bump effects.

Increasing reimbursement rates to induce providers to participate in Medicaid is well founded in standard economic theory of physician behavior. The seminal Sloan, Mitchell et al. (1978) model describes the behavior of physicians operating in a mixed-payer market. In this model, there are three types of patients that can be selected by providers based on their reimbursement rates: privately insured (who are assumed to offer the highest reimbursement rate), Medicaid patients, and uninsured patients (who are assumed to offer the lowest reimbursement rates). The model abstracts from other forms of public insurance for tractability. Physicians chose to participate in specific markets based on their marginal cost curves. Physicians with the lowest marginal cost curves will participate in all three markets while those

with the highest marginal cost curves will participate in the private market only. Physicians with intermediate marginal cost curves will participate in the private and public markets.

We can use insight from the Sloan model to predict how the fee bump policy will influence physician participation in Medicaid.[8] Increasing Medicaid reimbursement rates will make participating in Medicaid relatively more attractive for all physicians. However, the higher rates will only induce changes in market participation for a sub-set of physicians; i.e., those physicians on the margin of participating pre-policy. Some physicians who only participated in the private market pre-Medicaid fee increase will opt to enter the Medicaid market when reimbursement rates increase. Further, some incumbent physicians, participating only the private and Medicaid markets or all three markets, will increase the number of Medicaid patients they treat post-policy. We expect this increased participation by new and incumbent physicians to improve access to primary care services and behavioral health among Medicaid enrollees.[9]

3. Data, variables, and methods

3.1 National Survey on Drug Use and Health (NSDUH)

Our primary dataset is the NSDUH. We use data from 2010 to 2016 and thus consider periods before, during, and after the large federally mandated fee bump policy was effective. The NSDUH is a large-scale survey dataset administered by the Substance Abuse and Mental Health Services Administration (SAMHSA) which is used to produce the primary official estimates of behavioral health in the U.S. (Center for Behavioral Health Statistics and Quality 2016). Indeed, the NSDUH is the largest behavioral health survey in the U.S.

The NSDUH is a survey of individuals aged 12 or older in non-institutional settings and is designed to be representative at the national and state level. Each year, the NSDUH surveys

[8] We note that we cannot test predictions from the Sloan model in our survey data.
[9] The Sloan model predicts the opposite pattern of results when the fee bump policy ends.

approximately 70,000 U.S. residents. The NSDUH contains items specifically designed to measure behavioral health and healthcare utilization. Further, these data are commonly used by economists to study behavioral health outcomes (Zarkin, French et al. 1998, Wen, Hockenberry et al. 2015, Carpenter, McClellan et al. 2017, McClellan 2017, Alpert, Powell et al. 2018, Evans, Lieber et al. 2018). We use the restricted access NSDUH with geographic identifiers which allow us to link each state's Medicaid-to-Medicare reimbursement ratio to the data. Following NSDUH guidelines for use of the restricted data, all sample sizes are rounded to the nearest 100.

We exclude Tennessee as this state did not a have fee-for-service Medicaid program over our study period. Hence we cannot calculate a fee-for-service fee bump ratio for this state. We note our inability to study Tennessee as a limitation. We retain respondents ages 19 to 64 years old enrolled in Medicaid; NSDUH records insurance coverage at the survey interview.

3.2 Outcome variables

We consider three measures of behavioral health and two measures of related healthcare utilization. Our measures of behavioral health are indicators for a mental illness in the past year, an SUD in the past year, and any tobacco product (tobacco cigarettes, smokeless tobacco [i.e., snuff, dip, chewing tobacco, or 'snus'], cigars, or pipe tobacco) use in the past 30 days. Broadly, the mental illness and SUD indicators are based on screeners used to capture individuals at elevated risk for these conditions in survey settings. Tobacco product use captures self-reported utilization of these products. Full details on the construction of these variables can be found in the NSDUH Methodological Summary Report (Center for Behavioral Health Statistics Quality 2016). The validity of these measures in has been established by NSDUH administrators and epidemiologists (Center for Behavioral Health Statistics Quality 2016).

Our measures of behavioral healthcare are any mental illness treatment in the past year and any SUD treatment in the past year. An important caveat to these measures is that they reflect any type of care that a patient may perceive as behavioral healthcare; regardless of whether or not such care was provided by physician affected by the fee bump, some other provider, or informal care (e.g., self-help addiction treatment, or religious counselling). A limitation of the NSDUH for our study is that the survey does not collect information on smoking cessation treatment utilization.[10] [11]

3.3 Medicaid-to-Medicare reimbursement fee ratio

For each year between 2010 and 2016, we construct annual, state-level primary care fee-for-service Medicaid-to-Medicare reimbursement fee ratios using data from various think tank reports (Zuckerman and Goin 2012, Smith, Gifford et al. 2015, Zuckerman, Skopec et al. 2017).[12] The Medicaid-to-Medicare fee index measures the ratio of each state's average Medicaid fee for primary care services to the Medicare fee for the same service. For each state, these fee ratios are averaged across major primary care procedure codes, such as procedure codes for new or established patient visits. Procedure codes are weighted by the share of total U.S. Medicaid spending across the surveyed procedure. Previous studies have also used the ratio in health and healthcare analyses (Decker 2009, Decker 2012, Polsky, Richards et al. 2015, Callison and Nguyen 2018, Candon, Zuckerman et al. 2018, Li, Pesko et al. 2018).

[10] We note the possibility that some respondents may include tobacco cessation treatment with SUD treatment, either because some respondents view tobacco as a substance or because many SUD treatment facilities offer smoking cessation services (Friedmann, Jiang et al. 2008).
[11] There are some differences in respondent non-response rates across outcome variables. Hence, sample sizes vary.
[12] For 2015 values, we use data collected by Zuckerman, Skopec et al. (2017), unless Smith, Gifford et al. (2015) note that the fee bump remained fully in place in 2015, in which case we use 100% for these states. For 2010 and 2011 values, we linearly impute Medicaid reimbursement ratios between 2008 and 2012 using data collected by Zuckerman and Goin (2012). More details are available on request.

The intensity of the federally mandated increase in Medicaid reimbursement rates between 2013 and 2014 is determined by states' pre-2013 ratio. Put differently, states with relatively low Medicaid reimbursement rates vis-à-vis Medicare pre-2013 experienced a comparatively large boost in the ratio over the period 2013 to 2014. The median increase attributable to the fee bump was 30 percentage points (p.p.) between 2012 and 2013; with a minimum of 0 p.p. and a maximum of 66 p.p. Similarly, the decline in Medicaid reimbursement rates in 2015 (as the mandate was not re-authorized) was determined by states' discretion in fee rate setting. The median decline in the ratio between 2014 and 2015 was 29.5 p.p.

The 'look back' period of our outcome variables is the past year or the past 30 days.[13] The NSDUH provides the exact date on which a respondent completed the survey. We use survey date information to construct a past year moving average of the reimbursement rate.[14]

Although there were some delays in fee bump payment to physicians in early 2013, we follow Alexander and Schnell (2017) and do not incorporate such delays into our matching of the fee bump to the NSDUH data, besides using the look back period matching described above. This decision is based on the assumption that affected physicians expected to receive payments in the future from Medicaid.[15] However, we show that our results are robust to dropping year 2013 (the time period in which the enhanced rates were paid retrospectively).

3.4 State-level control variables

[13] We note that our tobacco product use variable has a 30 day look back period. Tobacco product use is a stock variable determined by flows into (initiation) and out of (cessation) product use. We expect that in our sample of adults cessation is the most likely flow variable as most tobacco product initiation occurs before age 18. Cessation is a time-intensive activity and thus we argue that using the12 month moving average for the fee bump variable, rather than more immediate measure, is reasonable.

[14] More specifically, we construct an average of the fee bump ratio in the survey month and the 11 months prior to the interview. For instance, if a respondent was interviewed in January 2012, we calculate the average fee bump over the period February 2011 through January 2012. More details available on request.

[15] Indeed, slow payments are commonly reported by physicians who treat Medicaid patients (Rosenbaum 2014).

To minimize omitted variable bias, we control for several state-level variables in our regressions that plausibly predict both behavioral health outcomes and the Medicaid-to-Medicare fee ratio in a state. These variables are merged into the NSDUH from external sources on state and year. First, we control for the state unemployment rate. Second, we account for state policies plausibly related to behavioral health outcomes: tobacco cigarette tax per pack, indicators for an e-cigarette tax and an e-cigarette public use ban (Centers for Disease Control and Prevention 2018),[16] a prescription drug monitoring program (PDMP) (Ali, Dowd et al. 2017), and a medical marijuana law (Sabia and Nguyen 2016). Finally, we include an indicator for ACA-related Medicaid expansion following Maclean, Pesko et al. (2017). Inclusion of a Medicaid expansion control is particularly important as this policy may have altered the composition of enrollees. We examine this question further in robustness checks.

3.5 Empirical model

We apply the differences-in-differences (DD) regression model outlined in Equation (1):

$$(1) \quad BH_{i,s,y,m} = \boldsymbol{\alpha_0} + \boldsymbol{\alpha_1 reimbursement\_ratio_{s,y,m}} + \boldsymbol{\alpha_2' P_{i,s,y,m}} + \boldsymbol{\alpha_3' X_{s,y}} + \boldsymbol{\theta_s} + \boldsymbol{\tau_y} + \boldsymbol{\eta_m} + \varepsilon_{i,s,y,m}$$

$BH_{i,s,y,m}$ is a behavioral health outcome for individual *i* in state *s* in year *y* and month *m*. $\boldsymbol{reimbursement\_ratio_{s,y,m}}$ is the 12-month moving average Medicaid-to-Medicare reimbursement fee ratio in state *s* in year *y* and month *m*, which is heavily influenced by the Medicaid fee bump in 2013 and 2014, and whether this policy was continued or not. $\boldsymbol{P_{i,s,y,m}}$ is a vector of individual characteristics (age, sex, race, ethnicity, education, and marital status) and $\boldsymbol{X_{s,y}}$ is a vector of state level characteristics. $\boldsymbol{\theta_s}$, $\boldsymbol{\tau_y}$, and $\boldsymbol{\eta_m}$ are vectors of state, year, and month

[16] States that have implemented an e-cigarette tax have done so in different ways. E.g., ad valorem or value-added tax. To the best of our knowledge, there is no standardized approach to classifying e-cigarette taxes at this time. Hence, we simply code states as implementing or not implementing such a tax.

fixed effects. These fixed effects capture time-invariant state characteristics, factors that affect the nation as a whole, and seasonality in behavioral health respectively. $\varepsilon_{i,s,y,m}$ is the error term. We cluster standard errors around the state (Bertrand, Duflo et al. 2004) and apply NSDUH survey weights. We estimate logit models and report estimates of average marginal effects.

3.6 Internal validity

A necessary assumption for a DD model to recover causal estimates is that the treatment and the comparison groups would have followed the same trend in outcomes in the post-treatment period, had the treatment group not been treated. Our empirical specification is a variant of the canonical DD as our treatment, the Medicaid-to-Medicare ratio, is a continuous variable rather than an indicator. To provide some evidence as to whether or not parallel trends exist, we classify states as 'large' and 'small' fee bump states depending on if they have above or below the median increase in the Medicaid-to-Medicare reimbursement fee ratio of 30% between 2012 and 2013.[17] We first examine unadjusted trends in the pre-treatment period in our outcome variables for large and small fee bump states. If outcomes appear to have trended similarly in states that experienced large and small increases in the Medicaid-to-Medicare reimbursement fee ratio, then this pattern would provide evidence that the parallel trends assumption has been met in the NSDUH data and support the validity of our design.

Our second approach to explore the parallel trends assumption is to use data prior to the fee bump (2010-2012) to estimate Equation (2):

$$(2) \qquad BH_{i,s,y,m} = \boldsymbol{\gamma_0} + \boldsymbol{\gamma_1 large_s} * \boldsymbol{trend_y} + \boldsymbol{\gamma_2'P_{i,s,y,m}} + \boldsymbol{\gamma_3'X_{s,y}} + \boldsymbol{\theta_s} + \boldsymbol{\tau_y} + \boldsymbol{\eta_m} + \mu_{i,s,y,m}$$

This equation is similar to Equation (1) with the exception that we replace the Medicaid-to-Medicare reimbursement fee ratio with an interaction between the large fee bump state indicator

[17] Large fee bump states are: AL, AR, CA, FL, GA, HI, IL, IN, MA, MD, ME, MI, MO, NH, NJ, NV, NY, OH, PA, RI, SD, TX, WA, and WI.

and a linear time trend ($\boldsymbol{large_s * trend_y}$).[18] If we cannot reject the null hypothesis that γ_1 is zero, then this finding provides further support that the NSDUH can satisfy the parallel trends assumption. To avoid difficulties in interpreting interaction terms in non-linear models (Popovici, Maclean et al. 2018), we estimate Equation (2) with a linear probability model.[19]

4. Results

4.1 Summary statistics

Table 1 reports summary statistics for the 2010 to 2012 pre-ACA fee bump period for Medicaid recipients. 30.8% and 11.6% of the sample met criteria for mental illness and an SUD in the past year, respectively, while 41.6% used a tobacco product in the past 30 days.[20] In terms of past year behavioral healthcare utilization, 23.4% reported any mental illness treatment and 4.5% reported any SUD treatment. The mean Medicaid-to-Medicare reimbursement fee ratio was 0.73 (compared to a median value of 0.70; not reported but available on request).

Figure 1 reports the average, maximum, and minimum Medicaid-to-Medicare reimbursement fee ratio over our study period. Prior to 2013 the average ratio was relatively low, however in 2013 the fee bump-attributable boost is evident with the average ratio increasing from 70.9% in 2012 to 101.3% in 2013. Similarly, the sharp decline in the fee bump in 2015 is

[18] This trend takes the value of 1 in January 2010, 2 in February 2010, 3 in March 2010, and so forth.

[19] A limitation of our explorations of internal validity is that both our 'treatment' (large fee bump) and 'comparison' (small fee bump) groups were both treated by the policy. The intuition of our testing is that effects should be more substantial in states that experienced a larger 'dose' of the fee bump policy (i.e. the large fee bump state group). However, we note that there is a monotonicity assumption that underlies this testing, that is the effects of the policy increase with the size of the fee bump. This assumption may be violated due to physician or patient attributes and preferences, features of healthcare delivery systems, patient health needs, and so forth. Thus, we interpret our findings based on these analyses with some caution.

[20] We note that the share of the sample reporting any tobacco use is somewhat higher than the national average cigarette smoking rate over our stud period, roughly 20% (National Center for Health Statistics 2017). However, tobacco product use is more common among Medicaid enrollees, and our measure of tobacco product use is more comprehensive than standard measures that capture only tobacco cigarette use.

evident as the federal mandate was not continued by the majority of states. The average rate continued to decline through 2016 (the last year of our study period).

4.2 Internal validity

Trend analyses of our outcomes are reported in Figures 2 to 6 for large and small fee bump states. With the possible exception of SUD treatment, which is a relatively rare outcome (4.5% of the sample reports this outcome) and appears noisy in the graphs, these figures show similar trends over the period 2010 to 2012.

We report regression-based parallel trends testing in Tables 2 (outcomes) and 3 (utilization). We cannot reject the null hypothesis that $\gamma_1 = 0$ in any of the five regressions. Indeed, the coefficient estimates on the interaction between the large fee bump indicator and time trend are small in magnitude and statistically indistinguishable from zero.

4.3 Behavioral health outcomes

Table 4 reports fee bump regression results for behavioral health outcomes. We measure reimbursement rates with the Medicaid-to-Medicare fee ratio. Thus, our estimates capture the effect of increasing this ratio from 57.2% to 100% (42.8 p.p.), which corresponds to the increase from the average fee ratio among large fee bump states prior to the fee bump policy to Medicare parity. For brevity, we refer to this change in the ratio as the 'average increase'.

We find that the average increase in the Medicaid-to-Medicare fee ratio leads to a 2.9 p.p. decrease in mental illness (9.7%; all relative effect sizes are calculated by comparing the marginal effect estimate with the sample proportion prior to the fee bump), a 1.7 p.p. decrease in SUD treatment (15.2%), and a 2.4 p.p. decrease in tobacco product use (6.0%).

Our relative effects are somewhat large in size because the baseline proportions for some of our outcomes are relatively small and we focus on a sample (Medicaid enrollees) with

elevated prevalence of behavioral health conditions. Finally, we consider an arguably non-trivial treatment 'dose' (i.e., increasing the Medicaid-to-Medicare fee ratio from 57.2% to 100%).

4.4 Behavioral healthcare outcomes

Estimates of the effect of raising the Medicaid-to-Medicare reimbursement fee ratio on behavioral healthcare use are reported in Table 5. As noted earlier, NSDUH only allows us to study mental illness and SUD treatment use. We find no statistically significant evidence that increasing the ratio changes utilization of these services.

5. Extensions and sensitivity analyses

We next report from extensions and additional analyses.

5.1 Effects on coverage

We next explore whether the fee bump had any effect on the probability of Medicaid coverage. We focus on a sample with family income less than 400% of the FPL to examine a group that is plausibly eligible for Medicaid.[21] Information on insurance status in the NSDUH to construct an indicator variable for Medicaid coverage. Increased ability to access providers, or to receive higher quality care, may induce some Medicaid-eligible individuals to enroll in the program (Hahn 2013). On the supply side, providers, when faced with a higher reimbursement rate, may be more likely to enroll eligible uninsured patients in Medicaid. Finally, for some privately insured patients who are eligible, higher quality Medicaid coverage may induce them to drop private coverage and take up Medicaid ('crowd out') (Cutler and Gruber 1996). Further, from a purely empirical standpoint, we define our sample based on Medicaid enrollment. If our treatment variable influences the probability of Medicaid coverage, then we are selecting our sample on an endogenous variable which can lead to bias (Angrist and Pischke 2009).

[21] We could have chosen a lower income threshold but we are concerned that individuals may target income to gain Medicaid eligibility (Hamersma 2013).

We report results in Table 6. We find no statistically significant evidence that the Medicaid-to-Medicare fee ratio predicts the probability of Medicaid coverage.[22] This null finding suggests that our treatment variable does not alter the composition of our sample and we are not selecting the sample on an endogenous variable.

5.2 Alternative measures of behavioral healthcare service use

Our measures of behavioral healthcare treatment capture any service use related to behavioral health. However, these measures may not reflect improvements in the quality or appropriateness of behavioral healthcare services that could have been induced by the fee bump policy. To probe deeper into changes in other dimensions of behavioral healthcare service use following the fee-bump, we consider proxies for perceived adequacy of care. To this end, we use indicators for past year perceived unmet need for mental illness and SUD treatment.[23] These measures capture broader concepts of acceptable/appropriate care from the patient's perspective that may be missed through the use of simple indicators for receiving any care. For instance, seeing a physician but not feeling that the visit adequately treated healthcare needs would be incorporated in a measure of any care receipt but, perhaps, not a measure of unmet need for care. Utilization of healthcare could also paradoxically increase unmet need if it makes patients aware of new diagnoses for which they are not immediately receiving desired treatment and/or

[22] We have also confirmed these findings in the American Community Survey (ACS). The ACS is a much larger survey than the NSDUH, roughly three million respondents per year, and is designed to provide accurate estimates of insurance outcomes. This survey does not record behavioral health outcomes or service use. Results are comparable and available on request. Interesting, in the NSDUH (but not in the ACS) we find some evidence that increases in Medicaid reimbursement rates raises the probability that a respondent is uninsured at the time of the survey. We find no evidence for changes in private coverage. We are uncertain as to the mechanism that may lead to this counter-intuitive finding for uninsurance status.

[23] Specific question wording for unmet mental illness treatment need is 'Felt a perceived need for mental health treatment/counseling that was not received.' Specific question wording for unmet SUD treatment need is 'Felt a need for illicit drug or alcohol treatment or felt need for additional illicit drug or alcohol treatment in past year'.

improved knowledge of healthcare and health generally. Thus, the extent to which the fee bump policy affects perceived unmet need is *ex ante* ambiguous.

Results are reported in Table 7. We find no statistically significant evidence that the Medicaid-to-Medicare fee ratio predicts the probability of either of these outcomes. The null findings could reflect patients switching from specialty care to primary care as higher reimbursement rates afford better access. Indeed, many patients report that they would prefer to receive care in general healthcare settings rather than through the specialty behavioral healthcare delivery system (Boone, Brown et al. 2004).

5.3 Alternative time horizons

We next explore the robustness of our findings across various time horizons. Specifically, we (i) drop 2013 (the year in which enhanced reimbursement rates were delayed to some extent) and (ii) drop 2015-2016 (the period following the federal mandate for parity between Medicaid and Medicare reimbursement rates for the 146 targeted services). Results are reported in Tables 8A (outcomes) and 8B (service use). In terms of our behavioral health measures, while we lose precision in some specifications (which is not surprising as we have less variation with which to identify treatment effects), the direction and magnitude of the relationship between the Medicaid-to-Medicare fee ratio and outcomes is the same. Turning to behavioral healthcare service use and in line with our preferred time period, none of the coefficient estimates are statistically different from zero.

5.4 Alternative controls for between-state heterogeneity, weighting, and functional form

Tables 9A and 9B show results generated in models that (i) include state-specific linear time trends, (ii) exclude all individual and time-varying state-level controls, (iii) remove sample weights, and (iv) apply a linear probability model. We note that there is some difficulty in

interpreting coefficients generated in non-linear models with different sets of controls (Norton 2012, Maclean, Webber et al. 2014), which is a study limitation.

While we lose statistical significance in some specifications for behavioral health outcomes (Table 9A), the direction and magnitude of our effect sizes are broadly comparable in these sensitivity checks vis-à-vis our main specifications. Turning to our behavioral healthcare utilization variables (Table 9B), as is the case in our preferred specification, no coefficient estimates are statistically different from zero.

5.5 Heterogeneity by ACA-related Medicaid expansion status

Medicaid expansion, among the 31 states and the District of Columbia that adopted this policy by the end of our study period (January 2016), substantially increased the number of program enrollees (Frean, Gruber et al. 2017).[24] Moreover, this expansion plausibly altered the composition of Medicaid enrollees. For instance, pre-Medicaid expansion simulations suggested that the newly eligible had higher rates of SUDs and greater unmet need for SUD treatment than previously eligible populations (Garfield, Zuvekas et al. 2011, Busch, Meara et al. 2013). Further, capacity may be particularly strained within expansion states as Medicaid rolls increased substantially. However, in Section 5.1 we found no statistically significant evidence that the fee bump, our treatment variable, lead to changes in the probability of enrollment conditioning on Medicaid expansion and other factors.

We dig deeper into these issues by stratifying our sample based on Medicaid expansion status by January 2016. The sample of expansion states is subject to increased enrollment and compositional shift while the samples of non-expansion states is less vulnerable to these factors and may allow us to more cleanly identify fee bump effects. However, we note that ACA-related

[24] We note that, at the time of writing Maine and Virginia have passed legislation designed to expand Medicaid. To the best of our knowledge, no implementation dates for these expansions have been set.

changes lead to other groups enrolling in Medicaid; i.e., welcome mat effects and changes in Modified Adjusted Gross Income. Hence, non-expansion states may have been subject to similar changes although we argue that any changes are likely smaller in non-expansion states.

Results from this analysis are reported in Table 10A (outcomes) and 10B (service use). While we lose precision across the subsamples (which naturally rely on less variation in the Medicaid-to-Medicare fee ratio), the direction of magnitude and direction of the effects are broadly comparable across expansion and non-expansion states. However, in terms of behavioral healthcare service use, we find some evidence that mental illness treatment declined in non-expansion states as the Medicaid-to-Medicare fee ratio increased.

5.6 Heterogeneity by sex

There are well-established differences in both behavioral health and service use. Women are more likely to experience mental illness and are more likely to use both general and behavioral healthcare services than men, while men are more likely to use substances (Center for Behavioral Health Statistics and Quality 2017, Centers for Disease Control and Prevention 2017). Given these differences across men and women, we explore heterogeneity in the Medicaid-to-Medicare fee ratio across gender. Results are reported in Tables 11A and 11B.

The fee bump has differential effects across sex in terms of behavioral health outcomes. Increases in the Medicaid-to-Medicare fee ratio lead to reductions in mental illness among women, and SUDs and tobacco product use among men. Turning to measures of service use, we observe no statistically significant evidence that women experience changes in behavioral healthcare service use when the Medicaid-to-Medicare ratio increases. However, among men, we document that increases in this ratio leads to a *decrease* in SUD treatment. One possible explanation for this counter-intuitive finding is that men, who are more likely to be diagnosed

with OUD (Center for Behavioral Health Statistics and Quality 2017) which can be treated in primary care office-based settings, substitute specialty care for primary care treatment.

5.7 Alternative samples based on income and insurance coverage

We next test for spillovers to higher income groups following Alexander and Schnell (2017). In particular we select a group of respondents that is unlikely to be Medicaid eligible at any point over our study period (i.e., before or after the ACA Medicaid expansion): adults with family incomes >400% FPL. Individuals with this income level are above all state Medicaid thresholds for all years of our study (Kaiser Commission on Medicaid and the Uninsured 2017). On the one hand, capacity constraints (e.g., a physician can only work so many hours per day) or income effects (e.g., higher income from Medicaid patients may lead some physicians to reduce overall work time) may lead to worse care and outcomes for higher income patients through reduced access and/or quality. On the other hand, previous work suggests spillovers across patients with different insurance coverage within a practice (Glied and Zivin 2002, Finkelstein 2007, Glied and Hong 2018). For instance, increased delivery of targeted services (e.g., behavioral health counselling services) may lead to increases in these services for all patients regardless of insurance status. Hence, the effects on non-targeted patients is *ex ante* ambiguous.

Results are reported in the top panels of Tables 12A (outcomes) and 12B (service use). While there are numerous hypotheses that suggest changes in our behavioral health outcomes among higher income groups not likely eligible for Medicaid, we find no statistically significant evidence that the outcomes are affected. We note that our null findings are in line with findings for general healthcare services (Alexander and Schnell 2017).

Medicaid coverage is likely reported with error by some respondents (Lo Sasso and Buchmueller 2004, Kolstad and Kowalski 2012). To probe the sensitivity of our results (which

are based on a sample of reported Medicaid enrollees), we next expand our analysis sample to include NSDUH respondents who report Medicaid or Medicare coverage (Hamersma and Maclean 2018). Results are reported in the bottom panels of Tables 12A (outcomes) and 12B (service use), and are very similar to our main findings. We interpret these findings to suggest that our main results cannot be fully explained by reporting error in Medicaid enrollment.

5.8 Event-study design

A standard concern in analyses of healthcare policies is that changes in outcomes prompt decision makers to implement policies. In other words, healthcare policy evaluation may be vulnerable to reverse-causality at the state-level. To explore this possibility we estimate an event-study design in the spirit of Autor (2003). We use the large fee bump indicator (see Section 3.5) and estimate Equation (3):

(3) $Y_{i,s,y,m} = \boldsymbol{\gamma_0} + \sum_{j=2010}^{2011} \boldsymbol{\delta_j}(large\ feee_{s,j} = 1) + \sum_{j=2013}^{2016} \boldsymbol{\rho_j}(large\ feee_{s,j} = 1) + \boldsymbol{\gamma_1'P_{s,y}} + \boldsymbol{\gamma_2'X_{i.s,y,m}} + \boldsymbol{\theta_s} + \boldsymbol{\tau_y} + \boldsymbol{\eta_m} + \mu_{i,s,y,m}$

The reference period in the event-study design is the year prior to the federally mandated fee increased (2012). The vector $\boldsymbol{\rho_j}$ reflects the effect of the fee increase in the post-mandate period while the vector $\boldsymbol{\delta_j}$ captures effects prior to the mandate. Studying estimates of pre-mandate effects allow us to examine anticipatory behaviors and probe parallel trends after conditioning on covariates. Results are reported in Tables 13A (outcomes) and 13B (service use).

The coefficient estimates on the lead variables are imprecise which provides additional support for the hypothesis that the NSDUH data satisfy parallel trends. However, turning to the lag estimates, we lose power to detect effects except for a 5.7 p.p. decrease in mental illness. Coefficient estimates for tobacco use in 2013 and 2014 are also large in magnitude but not statistically different from zero, potentially because the event study does not provide sufficient

power to detect even sizable increases in the post period. Moreover, as noted in Section 3.6, both the large and small fee-bump states were treated by the policy. We suspect that a 'treated' comparison group may attenuate effects in the post-period. However, it is reassuring that our event studies do not reveal evidence of differential pre-trends across groups.

5.9 Utilization of general healthcare services

We next focus on a broader set of general services to further examine the extent to which primary care can improve behavioral health; either as a substitute for specialty or informal care and/or addressing unmet need for care. We consider the following past year outcomes: the number of outpatient visits, the number of emergency department (ED) episodes, and the number of hospitalizations. However, outpatient visit information, an important location in which primary care services targeted by the fee bump are likely to be delivered, is only available from 2013 onward in the NSDUH. Thus, we cannot leverage the large variation driven by the fee bump between 2012 and 2013 and earlier (smaller) within state changes. We apply Poisson models given that the outcomes are counts. We convert beta coefficients to average marginal effects. Results are reported in Table 14.

We find no evidence that changes in the Medicaid-to-Medicare fee ratio leads to changes in the number of office visits or the number of ED episodes. However, we do find that the average increase in this ratio leads to 0.7 fewer hospital admissions in the past year. We have also estimated logit models in which the outcomes are indicators for using any of these services in the past year and results (available on request) are similar.

6. Discussion

In this study we examine the effects of federal mandate that substantially increased Medicaid reimbursement rates for a range of common primary care services. The rate boost

attributable to the policy we study is the largest federal increase within Medicaid; with pre-mandate estimates suggesting that this policy would increase Medicaid rates by 73% (Zuckerman and Goin 2012). Previous work had documented that this mandate was effective in increasing Medicaid reimbursement rates, induced providers to participate in Medicaid, and increased use of primary care visits and improved health among Medicaid enrollees (Polsky, Richards et al. 2015, Alexander and Schnell 2017, Kirby 2017, Li, Pesko et al. 2018). Our contribution to this literature is to test for spillover effects to behavioral health outcomes and service use. To the best of our knowledge, we are the first to explore this question. Given the ability of primary care providers to cost-effectively treat behavioral health conditions (e.g., prescribing medications, patient education, counselling services, disease management) (American Academy of Family Physicians 2018), testing for such spillovers is important.

We show that the mandated increase in primary care reimbursement rates within Medicaid had positive spillovers to behavioral health outcomes: mental illness, substance use disorders (SUD), and tobacco product use. Following the fee boost, behavioral health outcomes improved while behavioral health service use was not altered. Interestingly, our results may imply that primary care is efficient in delivering services to Medicaid enrollees that improve behavioral health, perhaps more efficiently than specialty care; where a substantial amount of behavioral health, particularly SUD, treatment has been delivered historically (Substance Abuse and Mental Health Services Administration 2016).

Given established workforce shortages within the behavioral healthcare delivery system, this finding is important as it suggests a feasible approach to addressing the behavioral healthcare needs of Medicaid enrollees (Rosenbaum 2014). Further, patients who are reluctant to seek care within the specialty delivery system may be more willing to receive treatment in non-specialty

settings such as primary care physicians' offices (Boone, Brown et al. 2004). Allowing patients to receive care in their preferred setting may, over time, allow for better treatment and in turn outcomes. Indeed, an objective of the ACA was to better integrate behavioral health, in particular SUD treatment, into general healthcare delivery (McLellan and Woodworth 2014).

In extensions to the main analyses, we show that the fee bump had differential effects across states that did and did not expand Medicaid with the ACA, and men and women. Further, we find no statistically significant evidence that the fee bump led to changes in the probability of Medicaid coverage. Hence, the value of better access to care and/or higher quality care was not sufficient to lead individuals to enroll in Medicaid. Finally, we note that the temporary nature of the fee policy may have muted such effects. Policies that permanently increase Medicaid reimbursement rates may have larger effects on outcomes.

The policy we study increased physician reimbursement rates for Medicaid patients (albeit temporarily for many states). Low reimbursement rates have long been cited as a barrier for participation in the program by physicians but increasing these rates is costly and politically difficult. However, there are other aspects of treating Medicaid patients that may deter physician participation in this market. For instance, physicians report that the administrative burdens (e.g., filling out numerous documents), delays in payment, and complex caseloads are barriers to Medicaid participation (Rosenbaum 2014). If enhanced funding for elevated Medicaid reimbursement rates is not feasible, either financially or politically, then policymakers may wish to consider targeting other commonly cited barriers to program participation by providers. While altering the health status of Medicaid enrollees is likely beyond the scope of near-term policies, reducing administrative burdens and/or ensuring timely payments to physicians may be more feasible. Providers consider both the costs and returns to treating patients. Hence both of these

objects could be targeted by policies and, in turn, potentially increase the number of providers participating in Medicaid.

While we emphasize the direct role of obtaining more (or any) primary care services within a group of patients with established healthcare access challenges in improving behavioral health, other mechanisms may also play a role in our findings. First, in addition to being able to access services, Medicaid patients may receive higher quality care. Given the wide range of services covered by the fee bump, either new or incumbent patients may have access to a broader set of services that allows for better and more comprehensive care. Similarly, physicians may spend more time with Medicaid patients, new or incumbent, and this extended interaction may offer more time for behavioral health conditions to be diagnosed (e.g., physicians may ask more probing questions about mental health and use of substances), the correct treatment regime (e.g., carefully discussing the importance of regularly taking medications at required times), and/or lifestyle changes (e.g., avoiding situations that may prompt substance use or lead to anxiety). Or higher reimbursement rates may simply improve patient-provider interactions in other intangible ways. We explore this avenue to some extent through indicators for unmet need but likely cannot capture all aspects of care quality. Second, akin to the benefits of 'conditional coverage' (Marton and Yelowitz 2015, Burns and Dague 2017), simply knowing that quality care can be accessed if needed may improve behavioral health (i.e., less anxiety, less self-medication through substances and tobacco products).[25] Third, improvements in general health outcomes as documented by Alexander and Schnell (2017) may have spillover effects for behavioral health (e.g., better management of chronic conditions such as diabetes may improve mental health). Fourth, among parents, improved access to services and health outcomes among children

[25] However, we expect that an individual must be enrolled in Medicaid to experience the effects of the fee bump and hence the phenomena we capture here is somewhat different from conditional coverage.

(Alexander and Schnell 2017) may have further health benefits (e.g., earlier diagnoses and treatment of communicable illnesses such as the flu, less stress related to poor child health). These pathways likely do not operate independently and instead interact to generate the improvements in behavioral health that we observe.

Our study has limitations. (i) We have imperfect information on the settings in which targeted primary care services are likely to be received (i.e., outpatient visits) in the NSDUH. (ii) We are not able to explore whether the fee bump induced new physicians to participate in Medicaid, increased participation among incumbent physicians, and/or (iii) altered practice styles (e.g., use of substitutes such as nurse practitioners). These are economically interesting and policy-relevant questions that could be explored in other datasets. (iii) Our measures of behavioral health are based on survey data and thus may be subject to reporting bias. However, we note that the NSDUH measures have been validated and are collected by trained survey administrators in a government survey designed to provide official statistics on behavioral health for the nation. Moreover, we suspect that any reporting error is orthogonal to the fee bump policy. (iv) The majority of our variation in Medicaid reimbursement rates occurred over a relatively short period of time (two years) and the policy was temporary for many states, thus the effects we observe may not reflect the effects of a permanent policy.

Overall, our findings provide evidence that increasing Medicaid reimbursement rates for primary care services can substantially increase behavioral health outcomes among lower income populations. While the costs of the federal Medicaid fee bump were non-trivial -- $7B to $12B over a two year period (Medicaid and CHIP Payment and Access Commission 2015)) -- given the enormous social costs of behavioral health, estimated to be as high as $1.31T per year in the U.S. (Caulkins, Kasunic et al. 2014, Insel 2015) and the current opioid epidemic that leads to 116

deaths per day (Centers for Disease Control and Prevention 2017), our findings provide suggestive evidence that this policy was potentially worthwhile financially.[26] [27] Indeed, at the time of writing, both the U.S. House of Representatives and Senate had advanced legislation designed to mitigate harms associated with the opioid epidemic (Kaiser Family Foundation 2018). While we do not study opioids directly, our results suggest that financially incentivizing primary care physicians to treat Medicaid enrollees, who are at elevated risk for OUD (Center for Behavioral Health Statistics and Quality 2017), may be a potential policy alternative.

[26] The original numbers ($467B in 2012 dollars for mental illness and $711B for substance use [alcohol, psychoactive drugs, and tobacco] in 2011) were inflated to 2018 dollars using the Consumer Price Index by the authors.

[27] We acknowledge that we are not incorporating the full costs of treatment which extend beyond enhanced funding to physicians (e.g., facility fees, medications) which Medicaid finances with some cost-sharing by patients.

Table 1. Summary statistics among adults 19 to 64 years enrolled in Medicaid: NSDUH 2010-2012

Sample:	**Proportion/mean**
Behavioral health outcomes:	
Mental illness (any; past year)	0.308
SUD (any; past year)	0.116
Tobacco product use (any; past 30 days)*	0.416
Behavioral healthcare utilization outcomes:	
Mental healthcare treatment (any; past year)	0.234
SUD treatment (any; past year)	0.045
Medicaid fee-bump:	
12-month Moving Average Medicaid-to-Medicare fee ratio**	0.730
Individual level characteristics:	
Age	38.40
Male	0.368
White	0.656
African American	0.246
Asian	0.046
Hispanic	0.240
Less than high school	0.277
High school	0.365
Some college	0.276
College	0.082
Married	0.281
Divorced	0.034
Widowed	0.225
Single	0.460
State level characteristics:	
Unemployment rate	7.018
Cigarette excise tax per pack ($)	1.640
Prescription drug monitoring program (PDMP)	0.941
E-cigarette tax (any)	0.037
E-cigarette ban	0.050
Medical marijuana law	0.470
ACA Medicaid expansion	0.407
Observations	41,000

Notes: The unit of observation is the individual-state-year. NSDUH sample weights applied. Excluded categories for the individual level characteristics are female, other race, non-Hispanic, divorced, and college or more education. Observations are rounded to the nearest 100.

*Current tobacco product user includes an individual who reports using tobacco cigarettes, smokeless tobacco (i.e., snuff, dip, chewing tobacco, or 'snus'), cigars, or pipe tobacco.

**Medicaid-to-Medicare ratio is constructed as a 12-month average to account for the look back period in NSDUH variables (past year or past 30 days).

Table 2. Parallel trends testing for fee bump and behavioral health outcomes among adults ages 19-64 years enrolled in Medicaid: NSDUH 2010-2012

Outcome:	Mental illness	SUD	Tobacco product use
Sample proportion in 2010-2012:	0.299	0.112	0.403
Large fee bump*linear time trend	-0.0004	-0.0003	0.0002
	(0.0002)	(0.0002)	(0.0003)
Observations	14,800	14,800	14,800

Notes: The unit of observation is the individual-state-year. Large fee bump = fee bump > 30%. All models estimated with a linear probability model and control for individual characteristics, state characteristics, and state, month, and year fixed effects. NSDUH sample weights applied. Standard errors clustered around the state and reported in parentheses. Observations are rounded to the nearest 100.
***,**,*= statistically different from zero at the 1%,5%,10% level.

Table 3. Parallel trends testing for fee bump and behavioral healthcare utilization among adults ages 19-64 years enrolled in Medicaid: NSDUH 2010-2012

Outcome:	Mental healthcare treatment	SUD treatment
Sample proportion in 2010-2012:	0.222	0.044
Large fee bump*linear time trend	-0.0001	-0.00001
	(0.0004)	(0.0002)
Observations	14,800	14,800

Notes: The unit of observation is the individual-state-year. Large fee bump = fee bump > 30%. All models estimated with a linear probability model and control for individual characteristics, state characteristics, and state, month, and year fixed effects. NSDUH sample weights applied. Standard errors clustered around the state and reported in parentheses. Observations are rounded to the nearest 100.
***,**,*= statistically different from zero at the 1%,5%,10% level.

Table 4. Effect of Medicaid fee bump on behavioral health among adults ages 19-64 years enrolled in Medicaid: NSDUH 2010-2016

Outcome:	Mental illness	SUD	Tobacco product use
Proportion in 2010-12:	0.299	0.112	0.403
12-month moving average Medicaid-to-Medicare fee ratio	-0.029**	-0.017**	-0.024*
	(0.013)	(0.008)	(0.014)
Observations	41,000	41,000	41,000

Notes: The unit of observation is the individual-state-year. All models estimated with a logit model and control for individual characteristics, state characteristics, and state, month, and year fixed effects. Beta coefficients are converted to average marginal effects. NSDUH sample weights applied. Standard errors clustered around the state and reported in parentheses. Observations are rounded to the nearest 100. Interpreting effect sizes: Medicaid-to-Medicare fee ratio is the effect of going from 57.16% Medicaid-to-Medicare reimbursement ratio to 100%. ***,**,*= statistically different from zero at the 1%,5%,10% level.

Table 5. Effect of Medicaid fee bump on behavioral healthcare utilization among adults ages 19-64 years enrolled in Medicaid: NSDUH 2010-2016

Outcome:	Mental healthcare treatment	SUD treatment
Proportion in 2010-12:	0.222	0.044
12-month moving average Medicaid-to-Medicare fee ratio	-0.001	-0.007
	(0.013)	(0.006)
Observations	41,700	41,000

Notes: The unit of observation is the individual-state-year. All models estimated with a logit model and control for individual characteristics, state characteristics, and state, month, and year fixed effects. Beta coefficients are converted to average marginal effects. NSDUH sample weights applied. Standard errors clustered around the state and reported in parentheses. Observations are rounded to the nearest 100. Interpreting effect sizes: Medicaid-to-Medicare fee ratio is the effect of going from 57.16% Medicaid-to-Medicare reimbursement ratio to 100%. ***,**,*= statistically different from zero at the 1%,5%,10% level.

Table 6. Effect of Medicaid fee bump on insurance coverage among adults ages 19-64 years with family income <=400% FPL: NSDUH 2010-2016

Outcome:	Medicaid
Proportion in 2010-12:	0.18
12-month moving average Medicaid-to-Medicare fee ratio	-0.008 (0.006)
Observations	207,000

Notes: The unit of observation is the individual-state-year. All models estimated with a logit model and control for individual characteristics, state characteristics, and state, month, and year fixed effects. Beta coefficients are converted to average marginal effects. NSDUH sample weights applied. Standard errors clustered around the state and reported in parentheses. Observations are rounded to the nearest 100. Interpreting effect sizes: Medicaid-to-Medicare fee ratio is the effect of going from 57.16% Medicaid-to-Medicare reimbursement ratio to 100%. ***,**,*= statistically different from zero at the 1%,5%,10% level.

Table 7. Effect of Medicaid fee bump on unmet need for behavioral healthcare among adults ages 19-64 years enrolled in Medicaid: NSDUH 2010-2016

Outcome:	Unmet need for mental healthcare	Unmet need for SUD treatment
Proportion in 2010-12	0.089	0.012
12-month moving average Medicaid-to-Medicare fee ratio	-0.008 (0.013)	-0.002 (0.004)
Observations	40,800	41,000

Notes: The unit of observation is the individual-state-year. All models estimated with a logit model and control for individual characteristics, state characteristics, and state, month, and year fixed effects. Beta coefficients are converted to average marginal effects. NSDUH sample weights applied. Standard errors clustered around the state and reported in parentheses. Observations are rounded to the nearest 100. Interpreting effect sizes: Medicaid-to-Medicare fee ratio is the effect of going from 57.16% Medicaid-to-Medicare reimbursement ratio to 100%. ***,**,*= statistically different from zero at the 1%,5%,10% level.

Table 8A. Effect of Medicaid fee bump on behavioral health outcomes among adults ages 19-64 years enrolled in Medicaid using alternative time horizons: NSDUH 2010-2016

Outcome:	Mental illness	SUD	Tobacco product use
Proportion in 2010-12	0.296	0.113	0.401
Drop 2013	-0.032**	-0.017	-0.022
	(0.013)	(0.011)	(0.019)
Observations	36,000	36,000	36,000
Proportion in 2010-12	0.309	0.11	0.413
Drop 2015 and 2016	-0.038*	0.004	-0.008
	(0.022)	(0.013)	(0.021)
Observations	26,000	26,000	26,000

Notes: The unit of observation is the individual-state-year. All models estimated with a logit model and control for individual characteristics, state characteristics, and state, month, and year fixed effects. Beta coefficients are converted to average marginal effects. NSDUH sample weights applied. Standard errors clustered around the state and reported in parentheses. Observations are rounded to the nearest 100. Interpreting effect sizes: Medicaid-to-Medicare fee ratio is the effect of going from 57.16% Medicaid-to-Medicare reimbursement ratio to 100%. ***,**,*= statistically different from zero at the 1%,5%,10% level.

Table 8B. Effect of Medicaid fee bump on behavioral healthcare utilization among adults ages 19-64 years enrolled in Medicaid using alternative time horizons: NSDUH 2010-2016

Outcome:	Mental healthcare treatment	SUD treatment
Proportion in 2010-12	0.219	0.044
Drop 2013	0.001	-0.014
	(0.013)	(0.009)
Observations	35,800	36,000
Proportion in 2010-12	0.236	0.045
Drop 2015 and 2016	0.001	0.004
	(0.019)	(0.009)
Observations	25,800	26,000

Notes: The unit of observation is the individual-state-year. All models estimated with a logit model and control for individual characteristics, state characteristics, and state, month, and year fixed effects. Beta coefficients are converted to average marginal effects. NSDUH sample weights applied. Standard errors clustered around the state and reported in parentheses. Observations are rounded to the nearest 100. Interpreting effect sizes: Medicaid-to-Medicare fee ratio is the effect of going from 57.16% Medicaid-to-Medicare reimbursement ratio to 100%. ***,**,*= statistically different from zero at the 1%,5%,10% level.

Table 9A. Effect of Medicaid fee bump on behavioral health outcomes among adults ages 19-64 years enrolled in Medicaid using alternative specifications: NSDUH 2010-2016

Outcome:	Mental illness	SUD	Tobacco product use
Proportion in 2010-12:	0.299	0.112	0.403
State-specific linear trends	-0.022	-0.014*	-0.026*
	(0.013)	(0.008)	(0.013)
Exclude individual and time-varying controls	-0.029*	-0.015*	-0.023
	(0.015)	(0.008)	(0.017)
Unweighted logit model┼	-0.011	-0.002	-0.022**
	(0.010)	(0.005)	(0.010)
Linear probability model	-0.025	-0.004	-0.051**
	(0.023)	(0.011)	(0.024)
Observations	41,000	41,000	41,000

Notes: The unit of observation is the individual-state-year. All models estimated with a logit model and control for individual characteristics, state characteristics, and state, month, and year fixed effects unless otherwise noted. Beta coefficients are converted to average marginal effects. NSDUH sample weights applied unless otherwise noted. Standard errors clustered around the state and reported in parentheses. Observations are rounded to the nearest 100. Interpreting effect sizes: Medicaid-to-Medicare fee ratio is the effect of going from 57.16% Medicaid-to-Medicare reimbursement ratio to 100%.

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

┼Unweighted proportions 2010-2012 are 0.275 for mental illness, 0.123 for SUDs, and 0.410 for tobacco product use.

Table 9B. Effect of Medicaid fee bump on behavioral healthcare utilization among adults ages 19-64 years enrolled in Medicaid using alternative specifications: NSDUH 2010-2016

Outcome:	Mental healthcare treatment	SUD treatment
Proportion in 2010-12:	0.222	0.044
State-specific linear trends	0.001	-0.002
	(0.015)	(0.007)
Exclude individual and time-varying controls	-0.006	-0.008
	(0.014)	(0.006)
Unweighted logit model┼	0.007	0.003
	(0.008)	(0.005)
Linear probability model	0.012	0.007
	(0.018)	(0.010)
Observations	40,700	41,000

Notes: The unit of observation is the individual-state-year. All models estimated with a logit model and control for individual characteristics, state characteristics, and state, month, and year fixed effects unless otherwise noted. Beta coefficients are converted to average marginal effects. NSDUH sample weights applied unless otherwise noted. Standard errors clustered around the state and reported in parentheses. Observations are rounded to the nearest 100. Interpreting effect sizes: Medicaid-to-Medicare fee ratio is the effect of going from 57.16% Medicaid-to-Medicare reimbursement ratio to 100%.

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

┼Unweighted proportions 2010-2012 are 0.205 for mental healthcare and 0.041 for SUD treatment.

Table 10A. Heterogeneity by ACA-Medicaid expansion effect of Medicaid fee bump on behavioral health among adults ages 19-64 years enrolled in Medicaid: NSDUH 2010-2016

Outcome:	Mental illness	SUD	Tobacco product use
Expansion states			
Proportion in 2010-12	0.293	0.116	0.399
12-month moving average Medicaid-to-Medicare fee ratio	-0.014	-0.015*	-0.040***
	(0.016)	(0.009)	(0.012)
Observations	30,100	30,100	30,100
Non-expansion states			
Proportion in 2010-12	0.321	0.1	0.417
12-month moving average Medicaid-to-Medicare fee ratio	-0.053***	-0.016	0.025
	(0.017)	(0.019)	(0.027)
Observations	11,000	11,000	11,000

Notes: The unit of observation is the individual-state-year. All models estimated with a logit model and control for individual characteristics, state characteristics, and state, month, and year fixed effects. Beta coefficients are converted to average marginal effects. NSDUH sample weights applied. Standard errors clustered around the state and reported in parentheses. Observations are rounded to the nearest 100. Interpreting effect sizes: Medicaid-to-Medicare fee ratio is the effect of going from 57.16% Medicaid-to-Medicare reimbursement ratio to 100%. ***,**,*= statistically different from zero at the 1%,5%,10% level.

Table 10B. Heterogeneity by ACA-Medicaid expansion in the effect of Medicaid fee bump on behavioral healthcare utilization among adults ages 19-64 years enrolled in Medicaid: NSDUH 2010-2016

Outcome:	Mental healthcare treatment	SUD treatment
Expansion states		
Proportion in 2010-12	0.214	0.046
12-month moving average Medicaid-to-Medicare fee ratio	0.019	-0.003
	(0.017)	(0.007)
Observations	29,800	30,100
Non-expansion states		
Proportion in 2010-12	0.25	0.037
12-month moving average Medicaid-to-Medicare fee ratio	-0.042*	-0.014
	(0.024)	(0.009)
Observations	10,900	11,000

Notes: The unit of observation is the individual-state-year. All models estimated with a logit model and control for individual characteristics, state characteristics, and state, month, and year fixed effects. Beta coefficients are converted to average marginal effects. NSDUH sample weights applied. Standard errors clustered around the state and reported in parentheses. Observations are rounded to the nearest 100. Interpreting effect sizes: Medicaid-to-Medicare fee ratio is the effect of going from 57.16% Medicaid-to-Medicare reimbursement ratio to 100%. ***,**,*= statistically different from zero at the 1%,5%,10% level.

Table 11A. Heterogeneity by sex in the effect of Medicaid fee bump on behavioral health among adults ages 19-64 years enrolled in Medicaid: NSDUH 2010-2016

Outcome:	Mental illness	SUD	Tobacco product use
Sample: Women			
Proportion in 2010-12	0.319	0.085	0.368
12-month moving average Medicaid-to-Medicare fee ratio	-0.029*	0.006	-0.011
	(0.016)	(0.009)	(0.018)
Observations	27,900	27,900	27,900
Sample: Men			
Proportion in 2010-12	0.266	0.159	0.462
12-month moving average Medicaid-to-Medicare fee ratio	-0.028	-0.052***	-0.043**
	(0.019)	(0.019)	(0.020)
Observations	13,200	13,200	13,200

Notes: The unit of observation is the individual-state-year. All models estimated with a logit model and control for individual characteristics, state characteristics, and state, month, and year fixed effects. Beta coefficients are converted to average marginal effects. NSDUH sample weights applied. Standard errors clustered around the state and reported in parentheses. Observations are rounded to the nearest 100. Interpreting effect sizes: Medicaid-to-Medicare fee ratio is the effect of going from 57.16% Medicaid-to-Medicare reimbursement ratio to 100%. ***,**,*= statistically different from zero at the 1%,5%,10% level.

Table 11B. Heterogeneity by sex in the effect of Medicaid fee bump on behavioral healthcare utilization among adults ages 19-64 years enrolled in Medicaid: NSDUH 2010-2016

Outcome:	Mental healthcare treatment	SUD treatment
Sample: Women		
Proportion in 2010-12	0.239	0.032
12-month moving average Medicaid-to-Medicare fee ratio	-0.006	0.007
	(0.016)	(0.008)
Observations	27,700	27,900
Sample: Men		
Proportion in 2010-12	0.194	0.064
12-month moving average Medicaid-to-Medicare fee ratio	0.007	-0.032***
	(0.016)	(0.009)
Observations	13,000	13,200

Notes: The unit of observation is the individual-state-year. All models estimated with a logit model and control for individual characteristics, state characteristics, and state, month, and year fixed effects. Beta coefficients are converted to average marginal effects. NSDUH sample weights applied. Standard errors clustered around the state and reported in parentheses. Observations are rounded to the nearest 100. Interpreting effect sizes: Medicaid-to-Medicare fee ratio is the effect of going from 57.16% Medicaid-to-Medicare reimbursement ratio to 100%. ***,**,*= statistically different from zero at the 1%,5%,10% level.

Table 12A. Effect of Medicaid fee bump on behavioral health in different samples: NSDUH 2010-2016

Outcome:	Mental illness	SUD	Tobacco product use
Sample: > 400% FPL			
Proportion in 2010-12:	0.15	0.085	0.225
12-month moving average Medicaid-to-Medicare fee ratio	0.010 (0.009)	-0.007 (0.006)	0.007 (0.008)
Observations	79,200	79,200	79,200
Sample: Medicaid or Medicare coverage			
Proportion in 2010-12:	0.313	0.105	0.394
12-month moving average Medicaid-to-Medicare fee ratio	-0.028** (0.014)	-0.019** (0.009)	-0.028*** (0.010)
Observations	45,100	45,100	45,100

Notes: The unit of observation is the individual-state-year. All models estimated with a logit model and control for individual characteristics, state characteristics, and state, month, and year fixed effects. Beta coefficients are converted to average marginal effects. NSDUH sample weights applied. Standard errors clustered around the state and reported in parentheses. Observations are rounded to the nearest 100. Interpreting effect sizes: Medicaid-to-Medicare fee ratio is the effect of going from 57.16% Medicaid-to-Medicare reimbursement ratio to 100%. ***,**,*= statistically different from zero at the 1%,5%,10% level.

Table 12B. Effect of Medicaid fee bump on behavioral healthcare utilization in different samples: NSDUH 2010-2016

Outcome:	Mental healthcare treatment	SUD treatment
Sample: > 400% FPL		
Proportion in 2010-12:	0.148	0.01
12-month moving average Medicaid-to-Medicare fee ratio	0.010 (0.008)	-0.003 (0.004)
Observations	79,000	79,200
Sample: Medicaid or Medicare coverage		
Proportion in 2010-12:	0.245	0.04
12-month moving average Medicaid-to-Medicare fee ratio	-0.006 (0.015)	-0.009 (0.007)
Observations	44,800	45,100

Notes: The unit of observation is the individual-state-year. All models estimated with a logit model and control for individual characteristics, state characteristics, and state, month, and year fixed effects. Beta coefficients are converted to average marginal effects. NSDUH sample weights applied. Standard errors clustered around the state and reported in parentheses. Observations are rounded to the nearest 100. Interpreting effect sizes: Medicaid-to-Medicare fee ratio is the effect of going from 57.16% Medicaid-to-Medicare reimbursement ratio to 100%. ***,**,*= statistically different from zero at the 1%,5%,10% level.

Table 13A. Effect of Medicaid fee bump on behavioral health among adults ages 19-64 years enrolled in Medicaid: NSDUH 2010-2016

Outcome:	Mental illness	SUD	Tobacco product use
Proportion in 2010-12:	0.299	0.112	0.403
2010*large fee bump	-0.032	0.017	0.017
	(0.048)	(0.027)	(0.046)
2011*large fee bump	-0.019	0.026	0.018
	(0.030)	(0.029)	(0.038)
2012*large fee bump	Ref┼	Ref┼	Ref┼
	-	-	-
2013*large fee bump	0.010	0.010	0.032
	(0.033)	(0.032)	(0.032)
2014*large fee bump	-0.057**	-0.001	0.045
	(0.028)	(0.021)	(0.038)
2015*large fee bump	-0.044	0.017	0.008
	(0.037)	(0.020)	(0.040)
2016*large fee bump	-0.022	0.034	0.047
	(0.033)	(0.027)	(0.042)
Observations	41,000	41,000	41,000

Notes: The unit of observation is the individual-state-year. Large fee bump = fee bump > 30%. All models estimated with a logit model and control for individual characteristics, state characteristics, and state, month, and year fixed effects. Beta coefficients are converted to average marginal effects. NSDUH sample weights applied. Standard errors clustered around the state and reported in parentheses. Observations are rounded to the nearest 100. Interpreting effect sizes: Medicaid-to-Medicare fee ratio is the effect of going from 57.16% Medicaid-to-Medicare reimbursement ratio to 100%.

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

┼Reference year.

Table 13B. Effect of Medicaid fee bump on behavioral healthcare utilization among adults ages 19-64 years enrolled in Medicaid: NSDUH 2010-2016

Outcome:	Mental healthcare treatment	SUD treatment
Proportion in 2010-12:	0.222	0.044
2010*large fee bump	0.010	0.003
	(0.033)	(0.011)
2011*large fee bump	0.003	0.021
	(0.030)	(0.015)
2012*large fee bump	Ref┼	Ref┼
	-	-
2013*large fee bump	0.018	0.004
	(0.025)	(0.012)
2014*large fee bump	0.022	0.003
	(0.025)	(0.011)
2015*large fee bump	-0.006	0.017
	(0.025)	(0.011)
2016*large fee bump	0.029	-0.004
	(0.033)	(0.010)
Observations	40,700	41,000

Notes: The unit of observation is the individual-state-year. Large fee bump = fee bump > 30%. All models estimated with a logit model and control for individual characteristics, state characteristics, and state, month, and year fixed effects. Beta coefficients are converted to average marginal effects. NSDUH sample weights applied. Standard errors clustered around the state and reported in parentheses. Observations are rounded to the nearest 100. Interpreting effect sizes: Medicaid-to-Medicare fee ratio is the effect of going from 57.16% Medicaid-to-Medicare reimbursement ratio to 100%.

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

┼Reference year.

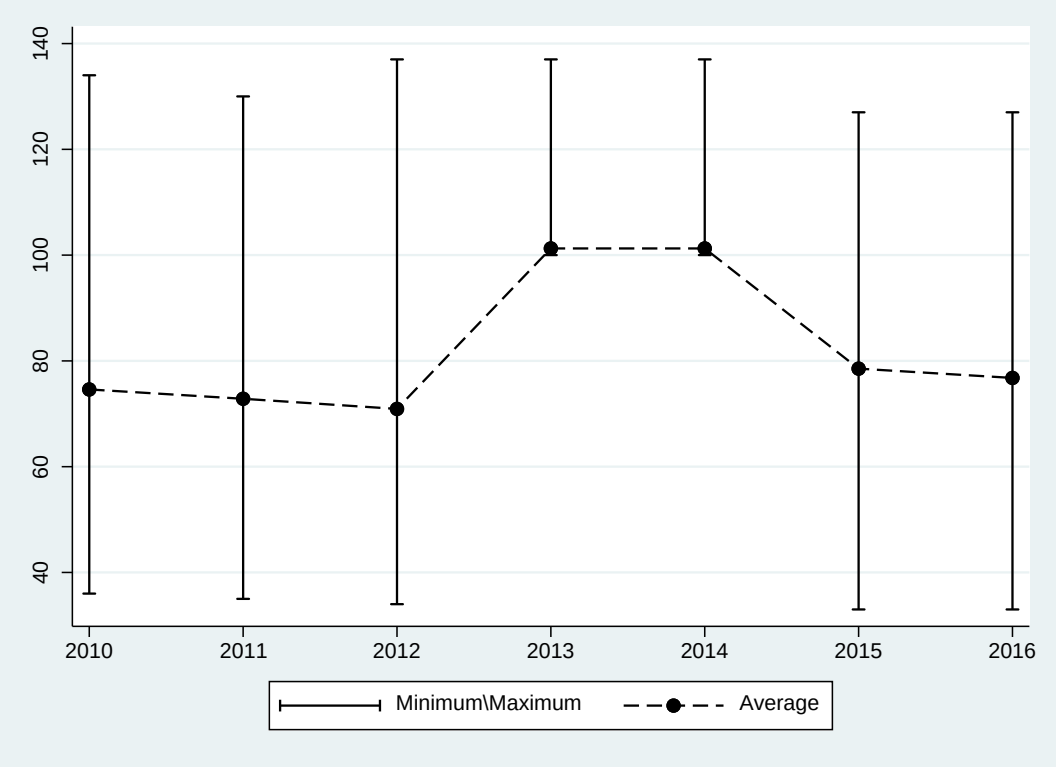
Table 14. Effect of Medicaid fee bump on general healthcare utilization among adults ages 19-64 years enrolled in Medicaid: NSDUH 2010-2016

Outcome:	Outpatient visits	ED episodes	Hospitalizations
Mean in 2010-12	5.581	1.233	1.273
12-month moving average Medicaid-to-Medicare fee ratio	-0.943 (0.782)	-0.190 (0.162)	-0.736** (0.327)
Observations	25,200	39,700	40,700

Notes: The unit of observation is the individual-state-year. All models estimated with a Poisson model and control for individual characteristics, state characteristics, and state, month, and year fixed effects. Beta coefficients are converted to average marginal effects. NSDUH sample weights applied. Standard errors clustered around the state and reported in parentheses. Outpatient visits are not collected in the NSDUH until 2013 and the mean value for this variable is for the period 2013-2016. Observations are rounded to the nearest 100. Interpreting effect sizes: Medicaid-to-Medicare fee ratio is the effect of going from 57.16% Medicaid-to-Medicare reimbursement ratio to 100%.

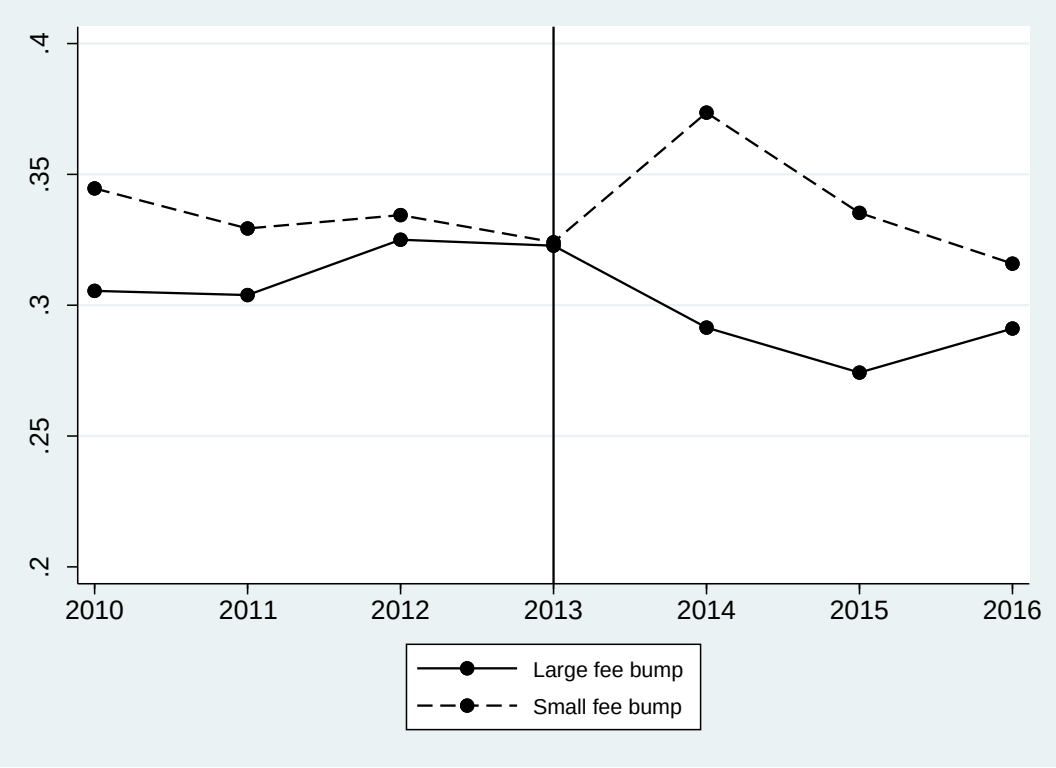
***,**,*= statistically different from zero at the 1%,5%,10% level.

Figure 1. Trends in the Medicaid-to-Medicare fee ratio: 2010-2016



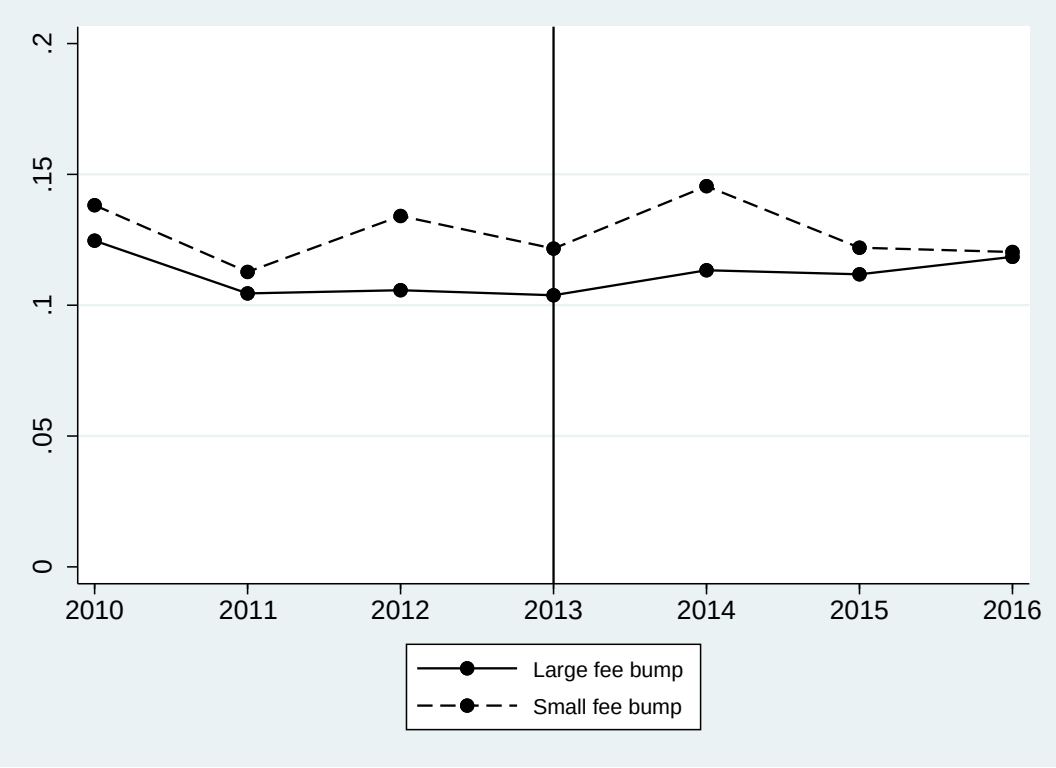
Notes: See text for data sources. Intervals show the state minimum and maximum reimbursement rate for a given year. Data are unweighted and averaged to the state-year level.

Figure 2. Trends in mental illness among adults ages 19-64 years enrolled in Medicaid: NSDUH 2010-2016



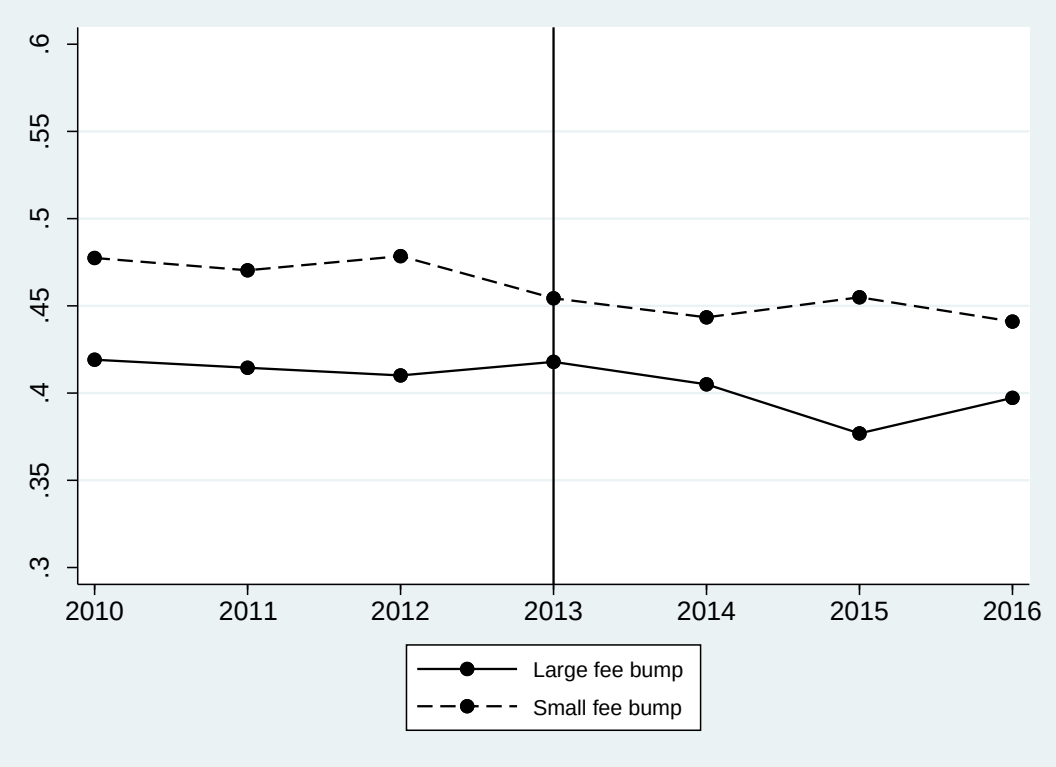
Notes: Data are aggregated to the treatment-year level. NSDUH sample weights applied. Treatment is large fee bump vs. small fee bump state. Large fee bump = fee bump > 30%.

Figure 3. Trends in SUD among adults ages 19-64 years enrolled in Medicaid: NSDUH 2010-2016



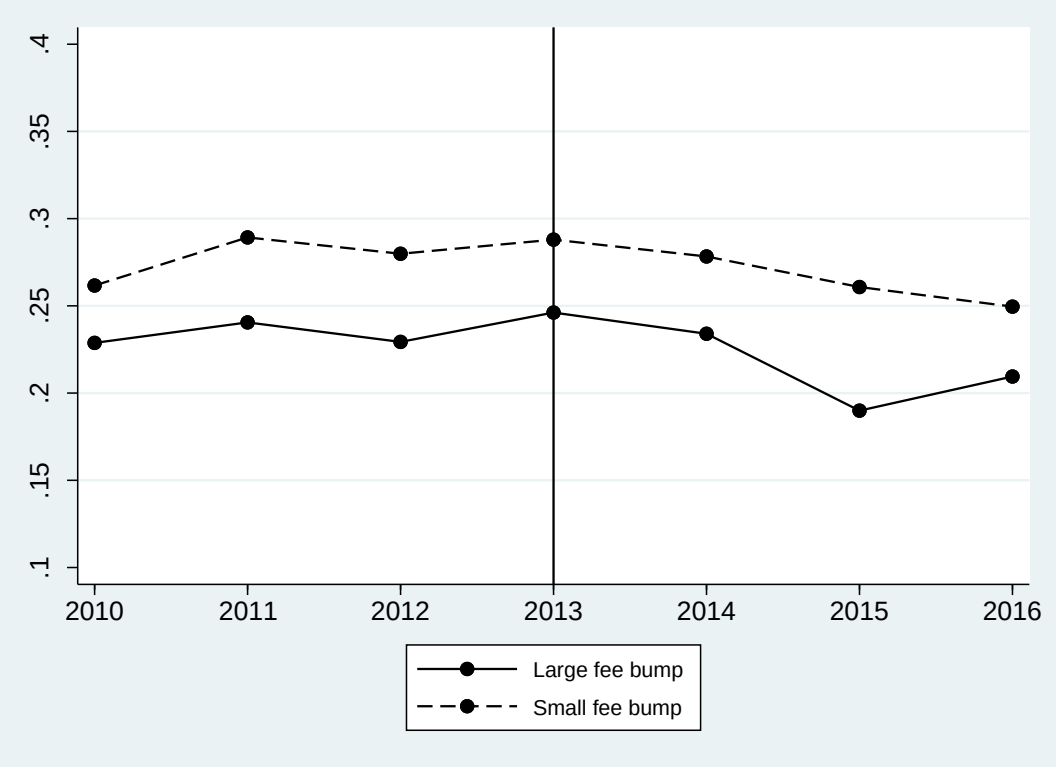
Notes: Data are aggregated to the treatment-year level. NSDUH sample weights applied. Treatment is large fee bump vs. small fee bump state. Large fee bump = fee bump > 30%.

Figure 4. Trends in tobacco product use among adults ages 19-64 years with a family income <= 200% FPL: NSDUH 2010-2016



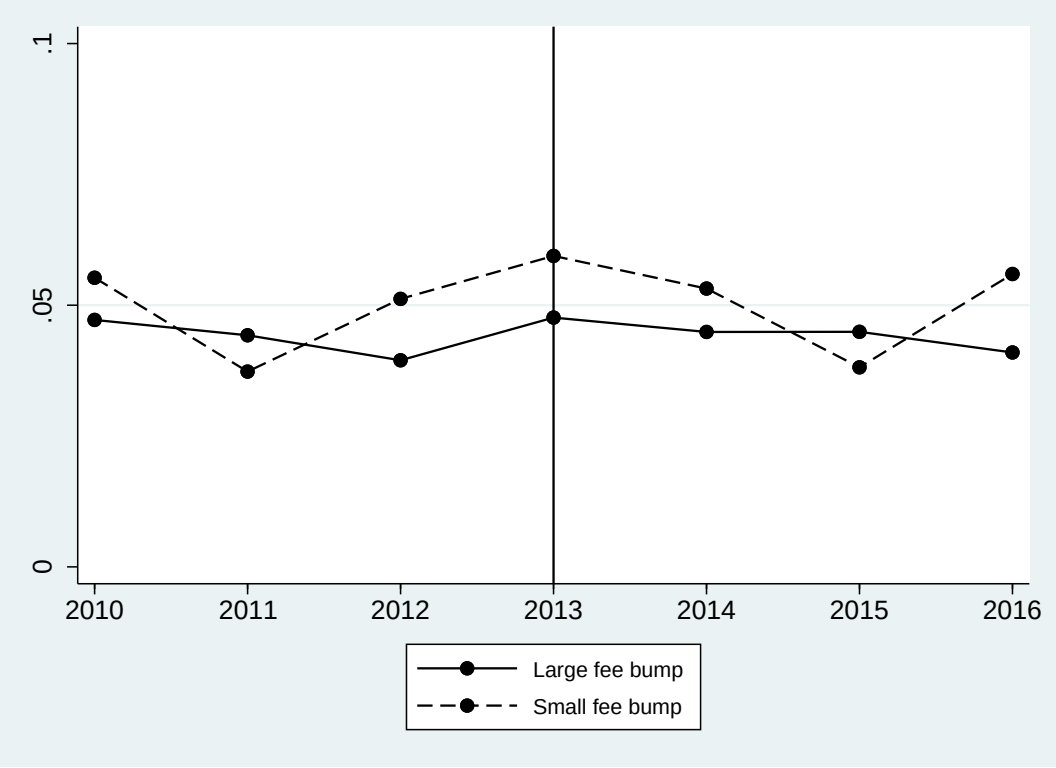
Notes: Data are aggregated to the treatment-year level. NSDUH sample weights applied. Treatment is large fee bump vs. small fee bump state. Large fee bump = fee bump > 30%.

Figure 5. Trends in mental healthcare treatment among adults ages 19-64 years enrolled in Medicaid: NSDUH 2010-2016



Notes: Data are aggregated to the treatment-year level. NSDUH sample weights applied. Treatment is large fee bump vs. small fee bump state. Large fee bump = fee bump > 30%.

Figure 6. Trends in SUD treatment among adults ages 19-64 years enrolled in Medicaid: NSDUH 2010-2016



Notes: Data are aggregated to the treatment-year level. NSDUH sample weights applied. Treatment is large fee bump vs. small fee bump state. Large fee bump = fee bump > 30%.

Appendix Table 1. Medicaid-to-Medicare reimbursement fee ratio in 2012 and relative size of the fee bump policy 2012-2013 by state

State	Medicaid-to-Medicare reimbursement ratio in 2012	Relative size of the fee bump policy 2012-2013	Large fee bump state (Y/N)
AK	1.26	0.00	N
AL	0.68	0.32	Y
AR	0.68	0.32	Y
AZ	0.75	0.25	N
CA	0.42	0.58	Y
CO	0.75	0.25	N
CT	0.71	0.29	N
DC	0.80	0.20	N
DE	0.98	0.02	N
FL	0.49	0.51	Y
GA	0.67	0.33	Y
HI	0.56	0.44	Y
IA	0.75	0.25	N
ID	0.89	0.11	N
IL	0.52	0.48	Y
IN	0.54	0.46	Y
KS	0.77	0.23	N
KY	0.70	0.30	N
LA	0.75	0.25	N
MA	0.68	0.32	Y
MD	0.69	0.31	Y
ME	0.62	0.38	Y
MI	0.44	0.56	Y
MN	0.73	0.27	N
MO	0.57	0.43	Y
MS	0.90	0.10	N
MT	0.94	0.06	N
NC	0.85	0.15	N
ND	1.37	0.00	N
NE	0.72	0.28	N
NH	0.59	0.41	Y
NJ	0.48	0.52	Y
NM	0.82	0.18	N
NV	0.66	0.34	Y
NY	0.39	0.61	Y
OH	0.57	0.43	Y
OK	0.97	0.03	N
OR	0.72	0.28	N
PA	0.51	0.49	Y
RI	0.34	0.66	Y
SC	0.74	0.26	N
SD	0.67	0.33	Y
TX	0.60	0.40	Y
UT	0.74	0.26	N
VA	0.74	0.26	N
VT	0.82	0.18	N
WA	0.66	0.34	Y
WI	0.56	0.44	Y
WV	0.74	0.26	N
WY	0.96	0.04	N

Notes: Calculations based on Medicaid-to-Medicare reimbursement fee ratios for select primary care services targeted by the Medicaid fee bump policy collected from various sources. Tennessee is excluded because it does not have a fee-for-service component to its Medicaid program. See associated text for more details on calculations and data sources. Large fee bump state = increase in the Medicaid-to-Medicare reimbursement rate > 30% (median increase in the sample).

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