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MEDICAID EXPANSION AND THE MENTAL HEALTH OF COLLEGE STUDENTS

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ABSTRACT

Reported mental health problems have risen dramatically among U.S. college students over time, as has treatment for these problems. An open question is how healthcare access affects diagnosis of mental illness and treatments such as prescription psychotropic medication use. We examine the effect of state-level Medicaid expansion following the 2014 implementation of the Affordable Care Act on the diagnosis of mental health conditions and psychotropic prescription drug use of a national sample of college students. We find that students from disadvantaged backgrounds are more likely to report being on public insurance after 2014 in expansion states relative to non-expansion states, while more advantaged students do not see this increase. Both diagnosis of common mental health conditions and psychotropic drug use increase following expansion for disadvantaged students relative to advantaged ones, which translates into an elimination of the pre-treatment gap in these outcomes by family background in expansion states. However, these changes are not associated with short-term improvements in measures of mental health status or academic outcomes.

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Introduction

Mental health challenges are pervasive among college students. According to the University of Michigan's Healthy Minds Study, 18% of college students experienced major depression and 31% experienced anxiety disorder during the 2018-19 academic year.[1] In 2014, these percentages were 12% and 22%, respectively.[2] Treatment of mental health conditions have also risen dramatically among U.S. college students over time. The percentage of students reporting they received mental health treatment in the past year rose from 19% in 2007 to 34% in 2017 (Lipson, Lattie, and Eisenberg, 2019). Roughly 22% of students in 2017 reported using psychotropic medication in the past year for medical use (Cimini and Rivero, 2018).[3] Finally, though reports of adverse mental health symptoms are similar across family background variables or higher for more disadvantaged students, diagnosis and treatment are more common for more advantaged students (Lipson et al., 2018).

The goal of this paper is to examine how access to inexpensive healthcare—and mental health care in particular—contribute to the diagnosis, treatment, and symptoms of mental health conditions among college students. To do so, we exploit the expansion of Medicaid under the Affordable Care Act (ACA) to include all individuals with qualifying incomes up to 138% of the federal poverty line. A Supreme Court ruling gave states the option to expand Medicaid, and 27 states did so in 2014 while 24 did not (Courtemanche et al., 2017). A notable feature of Medicaid is its coverage (with little or no co-pays) of mental and behavioral health coverage, which stands in contrast to many private insurance plans.[4]

Prior to the ACA, Medicaid was traditionally confined to specific low-income populations such as children, parents, pregnant women, and the disabled. States that expanded Medicaid opened the program both to other groups (e.g. childless adults) and individuals with higher incomes than would have qualified in the past. In expansion states, college students would typically qualify for Medicaid if they were claimed as dependents (up through age 24) by their parents and their parental modified adjusted gross income were below the 138% threshold. Alternatively, if students were not claimed on another person's tax return, their own income would be used to determine their Medicaid eligibility.[5]

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[1] See https://healthymindsnetwork.org/wp-content/uploads/2019/09/HMS_national-2018-19.pdf.
[2] See https://healthymindsnetwork.org/wp-content/uploads/2019/04/HMS_national_DataReport_2014.pdf. In addition, 13.1 percent of all 18-25 year-olds had major depression in 2017, far higher than the percentage among older age groups (see https://www.nimh.nih.gov/health/statistics/major-depression.shtml).
[3] Nonmedical use of prescription drugs is also high among college students: roughly 12% reported misusing prescription drugs in the past year (see https://www.campusdrugprevention.gov/sites/default/files/Prescription%20Drug%20Misuse%20among%20College%20Students%20%28Final%29%20%285-26-17%29.pdf).
[4] See https://www.apa.org/helpcenter/parity-guide.
[5] See https://www.irs.gov/faqs/filing-requirements-status-dependents/dependents and http://www.healthreformbeyondthebasics.org/key-facts-determining-household-size-for-medicaid-and-chip/.

Medicaid expansion was not the only component of the ACA to change in 2014. Others include the individual insurance mandate, the opening of state and federal insurance exchanges, and federal subsidies for lower-income families to purchase insurance.[6] McMorrow et al. (2015) find that from 2013 to 2014, the uninsured rate among low-income young adults ages 19-25 decreased by roughly 8-10 percentage points (with no effect for high-income young adults). Notably, the reduction in uninsured rates are similar across Medicaid expansion and non-expansion states, but the increase in public insurance coverage is only in expansion states (11 percentage points).

Because Medicaid carries no premiums and little or no co-pays (Kaestner et al., 2017), its expansion may lead to increased use of healthcare services relative to private insurance (Sommers et al., 2016). Our main identifying assumption is that states that did not expand Medicaid proxy for the trend in outcomes that would have occurred in expansion states if expansion had not taken place. In particular, any effects of federal changes related to the insurance mandate and exchanges are controlled by differencing out time effects for non-expansion states. In addition, however, we expect Medicaid expansion to affect only eligible (low-income) students, which helps us to further account for any factors that might have changed particularly in expansion states. This strategy is similar to the one employed in Courtemanche et al. (2017, 2019), who examine how different components of the ACA have affected insurance coverage. We return to this point below.

Our study is not the first to examine how Medicaid expansion has affected prescription drug use. Ghosh, Sommers, and Simon (2017) use a similar strategy to examine how Medicaid expansion affects aggregate prescriptions by prescription class. One of their findings is that Medicaid mental health-related prescriptions increase by 19% overall following expansion. Maclean et al. (2019) also use state-level prescription data to examine how Medicaid expansion affects psychotropic medications specifically. They find that Medicaid-reimbursed prescriptions for anti-depressants increase by 34%, anti-anxiety drugs by 23%, and psychostimulant drugs by 16% (effects on anti-psychotic drugs and mood stabilizers were smaller).

There is likewise a new literature on Medicaid expansion and mental health diagnoses and conditions. Baicker et al. (2013) find that those who were given Medicaid via lottery in Oregon were less likely to have a positive screening for depression based on their symptoms (suggesting Medicaid improved mental health overall) but more likely to be diagnosed with depression (suggesting it increased the rate of diagnosis conditional on a positive screening). Winkelman and Chang (2018) find that Medicaid expansion was associated with an improvement in poor mental health days and a reduction in depression diagnoses among low-income adults with chronic conditions (but not among those without such conditions). Courtemanche et al. (2018) also find that lower-income adults experienced fewer days in poor mental health after Medicaid expansion.

[6] Prior to that, in 2010, the dependent coverage rule went into effect, whereby insurance plans were required to cover dependent children on family plans until age 26 (see https://www.healthaffairs.org/do/10.1377/hblog20131216.035741/full/).

Our paper makes several contributions relative to the ones addressed above. First, we examine college students specifically, a population for which mental health problems are a particularly acute issue. Second, we use individual data on self-reported usage of prescription drugs rather than administrative data on prescriptions issued (which may not all be taken as prescribed). Third, we can examine a rich set of outcomes beyond specific prescription medication use, including diagnosis by a healthcare professional, measures of mental health status, use of other drugs/alcohol, and academic outcomes. Lastly, because our data is at the individual level, we can differentiate between individuals within expansion states who are more or less likely—based on family background characteristics—to be affected by Medicaid expansion. This allows us to home in on a population of specific interest—low-income college students—and to further scrutinize our identification strategy for isolating the effects of Medicaid expansion.

We find that students from more disadvantaged family backgrounds are more likely to report being on public insurance after 2014 in expansion states relative to non-expansion states, all relative to the same difference prior to 2014. Diagnosis of mental health conditions and psychotropic drug use increases according to the same pattern. These effects are either not present for or much more muted for students from more advantaged family backgrounds. These findings imply that the pre-treatment gap in prescription rates and diagnosis for "low-SES" relative to "high-SES" students, which we highlight below, disappears following Medicaid expansion (in expansion states).

We do not find evidence that these increases in diagnosis and prescription drug use are associated with mental health status (based on symptoms), changes in substance use, or academic outcomes. Effects on these variables are generally small, imprecisely estimated, or both. We note that these results do not imply that the increase in mental healthcare associated due to Medicaid expansion has had no positive impact on treated students. However, it does suggest that closer examination of the effects of treatment on these and related outcomes is warranted, a subject we return to later in the paper.

Methodology

We implement a classic difference-in-differences (DD) regression model to examine the effect of Medicaid expansion on student insurance type, mental health diagnoses, prescription drug use, and other outcomes. In particular, we estimate models of the following form:

$$(1)\ Outcome_{ist} = \beta_0 + \beta_1 treat_{st} + \alpha_s + \theta_t + X_{ist}\delta + \varepsilon_{ist}.$$

Equations (1) is estimated for many different outcomes via OLS with standard errors clustered at the state level to account for intra-state correlation in errors both in a cross section and over time (Bertrand et al., 2004). In this equation, $treat_{st}$ takes a value of one if the individual lives in a state that has expanded Medicaid and a value of zero if the individual lives in a non-expansion

state or in an expansion state but in a pre-expansion year.[7] α_s and θ_t represent state of residence dummies and year dummies, respectively. X_{ist} contains dummies for gender, race and ethnicity, and age categories as well as controls for parental education and family financial situation, and finally state-level controls for k-12 per pupil spending at age 17, total higher education expenditure per capita, medical and recreational marijuana laws, and whether the state has a Medicaid managed care program.[8] We include educational spending to control for changes in mental health treatment and outcomes that may be associated with changes in school programs (Ketchen Lipson et al., 2015). We control for marijuana laws as the past decade has seen many changes in state laws and there may be a link between marijuana use and certain mental health symptoms (Black et al., 2019). Lastly, managed care programs have been shown to affect the ADHD diagnosis rate in youths and may affect treatment of other mental health conditions as well (Chorniy, Currie, and Sonchak, 2018).

Because we do not expect Medicaid expansion to affect the insurance status or diagnosis/prescription drug use of students with ample parental resources, we further differentiate our sample by proxies for income/wealth (since we do not directly observe these in our data) and estimate Equation (1) separately for each group. We classify an individual as "low SES" if neither of their parents was a college graduate *and* if the individual reports that their financial situation growing up was "always stressful," "often stressful," or "sometimes stressful" (as opposed to "rarely stressful" or "never stressful"). If either of these conditions fail, the student is classified as "high SES."

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[7] For a list of expansion and non-expansion states in our sample, see Appendix Table 1. For those states in our sample that expanded Medicaid by the end of 2018, all but five did so on 1/1/2014. These are New Hampshire (expanded 8/15/2014), Pennsylvania (1/1/2015), Indiana (2/1/2015), Montana (1/1/2016), and Louisiana (expanded 7/1/2016). We only observe students from Indiana in 2010, from Louisiana in 2013, from Montana in 2016, and from New Hampshire in 2017. We classify all of these as expansion states, but in practice it makes no difference because with state fixed effects in the model they do not contribute to the identification of the treatment effect. We observe students from Pennsylvania in multiple years but not 2014. Thus, defining treatment as taking a value of "1" in expansion states in 2014 or later has exactly the same effect as defining treatment based on the specific year in which each state expanded Medicaid.

[8] Sources are as follows:
k-12 expenditures per pupil: U.S. Department of Education, National Center for Education Statistics, Common Core of Data (CCD), various years: http://nces.ed.gov/ccd/elsi/.
Higher education expenditures: Digest of Education Statistics, various years, U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS): https://nces.ed.gov/programs/digest/.
Population: Bureau of Economic Analysis, SAINC1 Personal Income Summary: Personal Income, Population, Per Capita Personal Income: https://apps.bea.gov/iTable/index_regional.cfm.
Marijuana laws: https://www.ncsl.org/research/health/state-medical-marijuana-laws.aspx.
Medicaid managed care enrollment: KFF analysis of the Centers for Medicare and Medicaid Services' [Medicaid Managed Care Enrollment Reports] (https://www.medicaid.gov/medicaid/managed-care/enrollment/index.html), 2019: https://www.kff.org/state-category/medicaid-chip/medicaid-managed-care-market-tracker/medicaid-managed-care-state-level-data/.

We chose to split the sample this way because the combination of both conditions predicts a larger difference in public insurance status (the closest proxy we have to Medicaid receipt in our data) than either condition alone. Roughly 9% of our "low SES" students claim they are insured through public insurance, while 2% of "high SES" students do. As we show in the Results section, Medicaid expansion is associated with a large increase in public insurance for low-SES students but not high-SES students.

Our model is identified by differences in outcomes in Medicaid expansion states from before to after the time of treatment all relative to the same differences in non-expansion states. Thus, threats to our strategy include any unobserved factors that were changing in expansion states relative to non-expansion states over this time period. We deal with such a possibility in two ways: first) because we also differentiate by family SES status, any change in outcomes that is not due to Medicaid expansion but is rather universal across family SES type should be picked up in the effect for high-SES students. Thus, the difference in DD effects for low-SES and high-SES students (i.e., the triple difference or DDD) would be immune to any threats of this type (in practice, we typically find that the DD effects for high-SES students are small or zero). Second, we perform an event study analysis that allows us to directly examine relative pre-treatment trends in the outcome variables of interest.

Data

The Healthy Minds Study (HMS) is an annual web-based survey run by the University of Michigan that focuses specifically on mental health and mental health services among college students across the U.S.[9] The HMS has been used extensively in public health research.[10] For participating colleges and universities, a random sample of students is selected for the survey. The survey was first conducted in 2007. In this study, we use data from the 2010-2017 waves of the HMS (participants interviewed from 2010-2018) because they contain all relevant variables for our analysis. The overall participation rate in these years is roughly 25%. Non-response weights are used to make the sample of responders representative of the overall student body at their institutions.

We restrict our sample to domestic students who are 25 or younger. This represents 175,322 individuals. When we include only those students with non-missing information on key dependent and independent variables included in our baseline regressions (mental health condition diagnoses, psychotropic prescriptions, and family background variables), we are left with 132,423 students from 37 states (see Appendix Table 1 for the list of states). We show how the means of several key variables compare for our regression sample and other respondents (who have at least one missing value for these variables) in Appendix Table 2. As seen in the table, those with missing information are appreciably less likely to be white, somewhat more likely to have public insurance, less likely to have taken medication, and more likely to have had

[9] See www.healthymindsnetwork.org for survey details.
[10] See https://healthymindsnetwork.org/publications/.

a mental health diagnosis. Expansion state and SES status are very similar across the two groups.

We now describe in detail the set of dependent variables used in our analysis. Our main outcomes of interest include receipt of public insurance as well as other insurance types, diagnosis of common mental health conditions, use of prescription psychotropic medications, and mental health status based on self-reports of symptoms. For diagnosis of mental health conditions, respondents are asked, "Have you ever been diagnosed with any of the following conditions by a health professional (e.g. primary care doctor, psychiatrist, psychologist, etc.)?" We focus on several potential categories then given including attention disorder or a learning disability (including ADD/ADHD), depression, anxiety, or an eating disorder.[11] These four conditions make up the vast majority of mental health diagnoses in our data.[12]

For medications, respondents were asked about prescription medications that they had taken regularly in the past year. We focus on psychostimulants (typically used to treat ADD/ADHD), anti-depressants, anti-anxiety medications, and prescription sleeping aids.[13] Once again, other medication types (mood stabilizers, anti-psychotics, and "other" medications) make up just a few percent of prescription drug use in the data.

Regarding mental health status based on self-reports of mental health symptoms, we focus on students' subjective overall mental health, depression, sleep problems, anxiety, and suicide ideation. We use the Diener score to measure the subjective psychological well-being of students. Calculated from a battery of 8 questions, the score ranges from 8 to 56 with higher scores representing better mental health (Diener et al., 2010). Regarding depression, we use two binary measures including screening for "moderate depression" and screening for "major depression," which are defined, respectively, as a score of 10 or higher and a score of 15 or higher on the Patient Health Questionnaire 9 (PHQ-9) that was developed by Kroenke, Spitzer, and Williams (2001). Two binary measures of sleep problems, "moderate sleep disorder" and "severe sleep disorder," are used, which are defined as having trouble sleeping (having trouble falling or staying asleep or sleeping too much) for more than half the days and having trouble sleeping nearly every day over the last 2 weeks, respectively. Regarding anxiety, we again use two binary measures, "any anxiety" and "major anxiety," which are defined, respectively, as being bothered by feeling nervous, anxious, on edge, or worried for several days and more than

[11] The survey includes the following examples for each of categories:
Attention disorder/learning disability: attention deficit disorder, attention deficit hyperactivity disorder, learning disability.
Depression: major depressive disorder, bipolar/manic depression, dysthymia, persistent depressive disorder.
Anxiety: generalized anxiety disorder, phobias, obsessive-compulsive disorder, posttraumatic stress disorder.
Eating disorder: anorexia nervosa, bulimia nervosa.
[12] Other categories include psychosis, personality disorder, and substance abuse disorder, but these make up only a few percent of individuals with diagnosed conditions.
[13] Specific examples of drugs are given to help students answer about use of medications in each category.

half the days over the past several weeks.[14] Finally, "suicide ideation" is defined as having seriously thought about attempting suicide over the past year (0 or 1).

When students are asked about their health insurance coverage, there are nine (not mutually exclusive) categories they can choose from (students can report multiple insurance types) plus being uninsured. "Public insurance" is one of these categories (there is no separate category for Medicaid coverage specifically). These categories are displayed along with summary statistics on variables used in our analysis in Tables 1a and 1b.

Lastly, we examine three measures of academic success along with three measures of substance use. The academic outcomes include self-reported GPA converted to a four point scale from categorical responses from which students are supposed to choose the one that best describes their grades (A, A-, B+, etc.), the average number of hours students report spending on schoolwork every day, and whether they report at least one day in the past four weeks on which mental or emotional problems hurt their academics. For substance use, we examine whether the student binge drank (4+ drinks at one time for females and 5+ for males) in the past two weeks, whether they smoked cigarettes in the past month, and whether they used marijuana in the past month. We note that many of these variables were not asked in all years of our data or were only asked of a subset of all students. This explains much of the difference in sample sizes for these variables relative to our full baseline regression sample.

Table 1a and 1b show summary statistics broken out by student financial background and state Medicaid expansion status, respectively. As expected, Table 1a shows that low-SES students are less likely to be white and to be on their parents' insurance but more likely to be uninsured or on public insurance (note that the survey does not ask about Medicaid coverage specifically, only public insurance). Low-SES students are somewhat less likely to be diagnosed by a doctor with a mental health condition, use psychotropic medication, or engage in risky health behaviors (binge drinking, marijuana use)—and each of these differences are significant at the 1% level. Importantly, however, they are somewhat more likely or equally likely to experience negative mental health symptoms, including more depression, sleep trouble, and anxiety.

Turning to Table 1b, we see that students in Medicaid expansion states are less likely to be white, less likely to be on their parents' health insurance or uninsured and a bit more likely to be on a student plan or public insurance, and more likely to have used marijuana. Overall, rates of

[14] HMS changed its battery of anxiety questions from the GAD-7(old) in the 2007-2012 HMS (Spitzer et al., 1999) to the GAD-7(new) (Spitzer et al., 2006) starting in 2013. The skip logic changes between these two versions of the questionnaire. As a result, we use only the first question of the GAD-7 (both old and new), which is very similar across our sample years (2010-2017). In the 2007-2012 HMS, the first question of the GAD-7 is "Over the last 4 weeks, how often have you been bothered by feeling nervous, anxious, on edge, or worrying a lot about different things?" with the choices "1=Not at all; 2=Several days; 3=More than half the days." Starting in 2013, the first question of the GAD-7 is "Over the last 2 weeks, how often have you been bothered by the following problems? Feeling nervous, anxious or on edge" with the choices "1=Not at all; 2=Several days; 3=Over half the days; 4=Nearly every day." We define "any anxiety" as "several days" or higher and define "major anxiety" as "more than (over) half the days" or higher.

diagnosis and psychotropic medication use are similar between expansion and non-expansion states. Symptoms of poor mental health are generally more pronounced in expansion states than in non-expansion states. Expansion states also spend more on education in per-capita terms, have a higher percentage of Medicaid enrollees in managed care, and are far more likely to have medical or recreational marijuana legalization.

Results

1. Baseline results

Table 2 contains results from models estimating the effect of Medicaid expansion on whether an individual is uninsured, whether they have public insurance, psychotropic medication use, and diagnosis of common mental health conditions. Medicaid expansion is associated with a 7.6 percentage point decline (significant at the 10% level) in the probability of being uninsured for low-SES students, with a small and statistically insignificant effect for high-SES students. This is almost exactly offset by a 7.2 percentage point increase (significant at 1%) in the likelihood of public insurance for low-SES students. Note that because our proxy for Medicaid eligibility is based in part on a subjective question about family economic stress, it is likely that some eligible students wind up in the "high SES" category. Nevertheless, as expected, the effect of Medicaid expansion on public insurance receipt for high-SES students is much smaller at 1.3 percentage points. The differences in corresponding coefficients between low-SES and high-SES respondents are significant at the 5% (no insurance) and 1% (public insurance) levels. The combination of these two results suggest that our identification strategy is plausibly uncovering the effects of Medicaid expansion on our outcomes of interest.[15]

In analyzing psychotropic medication use and mental health diagnoses, we begin with a binary measure indicating use of at least one of the four medication types described above in the past year and a binary measure indicating diagnosis of at least one of the four common mental health conditions described above, respectively. Treatment effects for low-SES students on prescription drug use in the past year and mental health diagnoses are estimated at 3.6 percentage points and 6.5 percentage points, respectively. Corresponding effects are much smaller and statistically insignificant for high-SES individuals. The differences in corresponding coefficients between low-SES and high-SES respondents are significant at the 10% (medication) and 1% (diagnosis) levels.

Though results for prescription drug use and diagnosis are consistent with the results on insurance status (in the sense that all effects are concentrated on low-SES students), it is striking how large these effects are: the effect on prescription drug use is half as large—and the effect on diagnosis is nearly as large—as the effect on public insurance receipt (in percentage

[15] In Appendix Table 3, we show estimates of Medicaid expansion on each of the other insurance categories. That table shows that the effects of Medicaid expansion on types of insurance other than public insurance are small and generally statistically insignificant at conventional levels (for both low-SES and high-SES students).

point terms). One possible explanation for this is that Medicaid coverage is underreported, with the majority of misreporting individuals claiming they have private health insurance instead (Sommers et al., 2012). Indeed, Boudreaux et al. (2019) find that undercounting of Medicaid in the American Community Survey became relatively worse in expansion states compared with non-expansion states following Medicaid expansion. This effect was substantial: in the full population, Medicaid expansion is estimated to have increased coverage by 5 percentage points using administrative data but only 3 percentage points using the ACS. Thus, our estimated effects on public insurance coverage using self-reports in the HMS may be biased downward.

Prior to Medicaid expansion in expansion states, 24% of "high-SES" students had been diagnosed with at least one common mental-condition and 16% were on a common prescription psychotropic medication (see Appendix Table 4a for details). The corresponding figures for "low-SES" students were 18% and 12%, respectively. These gaps are in spite of the fact that symptoms associated with poor mental health are similar or worse for low-SES students in these states over this time period.[16] Our estimation suggests that Medicaid expansion increases diagnosis of low-SES students relative to high-SES ones by 6.5 percentage points and prescription drug use by 3.6 percentage points. Thus, Medicaid expansion essentially closes the diagnosis and prescription drug use gap between low-SES and high-SES students in expansion states.

To further explore how Medicaid expansion affects these outcomes for different groups of students, we split our sample into non-white and white students. Table 3 shows how the results compare for non-whites and whites in the low-SES category. The effect on being uninsured is stronger for non-whites, though coefficients for both groups are only significant at the 10% level (possibly owing to smaller sample sizes in this sub-group analysis). However, effects on public insurance receipt are similar, suggesting that 1) low-SES white individuals are more likely to switch from another type of insurance to Medicaid after expansion rather than from no insurance to Medicaid, or 2) underreporting of Medicaid after expansion is more severe for non-whites. Notably, effects on psychotropic medication use and diagnosis are larger and more precisely estimated for non-whites, particularly in the former case. This is perhaps because the change in mental healthcare when going from no insurance to Medicaid is larger than when going from private insurance to Medicaid, as appears to be more common for white students. Appendix Table 5 repeats this same analysis for high-SES individuals; in that case, treatment effects for both non-whites and whites are generally small and statistically insignificant.

2. Effects on specific prescription drug use types and mental health diagnoses

Table 4 shows how Medicaid expansion affects use of our four specific prescription medication types for both low- and high-SES students. The first is psychostimulants, commonly used to treat Attention Deficit/Hyperactivity Disorder (ADHD). The others are anti-depressants, anti-anxiety medication, and sleeping aid medication. Effects for high-SES individuals are

[16] Appendix Tables 4a-4d show summary statistics in expansion and non-expansion states prior to treatment as well as after treatment.

consistently small and statistically indistinguishable from zero. On the other hand, treatment effect coefficients for low-SES individuals range between roughly one and four percentage points and are statistically significant at the 5% level for anti-depressants and sleeping aids. Point estimates for low-SES students are uniformly larger than their counterparts among high-SES students.

Table 5 contains results from regressions in which the dependent variables are specific diagnoses related to mental health conditions. The results are largely consistent with those for prescription drug use (Table 4), though there are some interesting differences. There is a large effect of Medicaid expansion on diagnosis of an attention/learning disability for low-SES individuals (4.5 percentage points) in spite of the fact that use of psychostimulants increases only weakly. The effect of treatment on a depression diagnosis is 3.4 percentage points for low-SES students; the effect on an anxiety diagnosis is 2.0 percentage points but insignificant at conventional levels. The effect of expansion on an eating disorder diagnosis is much smaller and statistically insignificant.

3. Effects on mental health status

We explore how Medicaid expansion is related to measures of mental health status based on self-reports of symptoms in Table 6. Strikingly, Medicaid expansion is not associated with improved mental health in any category for low-SES students in spite of meaningful effects on diagnosis and prescription drug use noted earlier. Treatment is *negatively* associated with mental health for low-SES individuals in every category though only two coefficients (Diener score, any anxiety) are statistically significant at conventional levels. We are cautious about interpreting this as evidence that expansion has hurt mental health symptoms given the corresponding (but smaller) negative effect on Diener score for high-SES students and the possibility for false positives when analyzing a large number of outcomes (8). Overall, these results run counter to some of the evidence we cited earlier suggesting Medicaid has ameliorated mental health symptoms (Baicker et al., 2013; Winkelman and Chang, 2018; Courtemanche et al., 2018)—but we note that none of those studies examined college students specifically.

We note several possibilities for these results besides the one that the increase in mental healthcare associated with Medicaid receipt has not been efficacious for low-SES college students. First, the increased mental healthcare from expansion may have created more awareness of mental health challenges leading respondents to be more likely to report associated symptoms on surveys. This of course would bias our results away from indicating positive mental health effects of Medicaid expansion. Another possibility is that we only observe students in the first few years after Medicaid expansion. Thus, over time, mental health status may respond differently to the additional care afforded by expansion. Evaluating these possibilities is beyond the scope of this paper, but we consider it an important area for further research.

4. Effects on other outcomes

Table 7 shows how Medicaid expansion has affected binge drinking, smoking, and marijuana use among college students.[17] Theoretically, if student mental health improves with proper diagnosis and treatment (including use of psychotropic medication), recreational drug use (which may be done for self-medication) may decline. At the same time, abuse of prescription drugs and recreational drugs sometimes go together (McCabe et al., 2006). Medicaid expansion may also affect recreational substance use through other channels—for example, coverage of smoking cessation therapy or treatment of substance use disorders may be more generous in Medicaid than in private insurance plans. We do not find evidence of a clear effect of expansion on these behaviors; none of the coefficients for low-SES students are statistically significant at conventional levels. Though all coefficients are negative, corresponding coefficients for high-SES students are also uniformly negative, and pairwise differences are not statistically distinguishable.

We next turn our attention to academic outcomes, which are shown in Table 8. The increases in diagnoses and medication could theoretically improve academic outcomes for low-SES students relative to high-SES students. However, our ability to measure academic outcomes is somewhat limited: we have data on self-reported GPA, average time spent doing schoolwork each day, and whether students reported that mental/emotional problems hurt their academics. The results in Table 8 do not suggest that the increase in mental health diagnosis/treatment due to Medicaid expansion has improved the academic outcomes of low-SES students. Low-SES students' GPA and schoolwork time (the latter of which could theoretically be raised or lowered by improved mental health through treatment) are essentially unaffected. The effect on whether students report that mental/emotional problems hurt their academics is positive at 4.3 percentage points and significant at the 10% level. However, as stated earlier, this may be a result of awareness of such difficulties increasing with diagnosis and treatment as opposed to a true deleterious effect of treatment on academic outcomes.

5. Robustness

In this section, we take up the question of whether our results are robust to different specifications and samples. This also allows us to indirectly examine the soundness of our identification strategy.

One possible weakness of our analysis is that the composition of our sample changes over time, since the institutions (and states) in the survey change from year to year. This may be particularly problematic if the percentage of low-SES students changes from before to after treatment in expansion states relative to non-expansion states. Appendix Table 6 displays the results of regressing "low SES" status on Medicaid expansion and our other covariates. The estimated coefficient is extremely small (0.5 percentage points) with a standard error of around

[17] We note that sample sizes with these outcomes are generally smaller than those available for our main outcomes. This is because these variables (as well as other auxiliary variables analyzed below) are often included in special modules that are only presented to a subset of students in each year.

one percentage point. As a result, we think it is unlikely that changes in the fraction of low-SES students are driving our DD results.

Another question is how changes in the representation of states over the 2010-2016 sample period affect the results. Indeed, institutions from some states appear only once in this period while other states are represented many times (though not necessarily by the same institutions). To see how our results are affected by state compositional changes, we restrict our analysis to only those states that appear at least four times over our sample period. This includes nine expansion states: California, Colorado, Illinois, Massachusetts, Michigan, Minnesota, Nevada, New York, Ohio, Pennsylvania, and Rhode Island; and three non-expansion states: Florida, North Carolina, and Virginia. We repeat the baseline analysis found in Table 2 with this restricted sample and display the results in Appendix Table 7. Compared with Table 2, the estimated treatment effects for the restricted sample are remarkably similar given that the sample of individuals is reduced by 30% and the number of states is cut from 37 to 12.

Our last analysis is an event study that explicitly examines pre-treatment trends in our outcomes of interest across expansion versus non-expansion states. In particular, we would like to know whether having no health insurance, public insurance receipt, mental health diagnosis, and prescription drug use were on an upward trajectory (relative to non-expansion states) even before Medicaid expansion. If they were, it would call into question whether expansion itself is responsible for our DD results.

To do this analysis, we aggregate our sample into four data periods: 2010-11 (baseline), 2012-13 (pre-treatment), 2014-16 (post-treatment), and 2017-18 (post-treatment). This way, our estimates are less likely to be affected by noise from changes in the sample over time. Table 9 shows the results of regressions in which expansion interacts with each of these time periods (rather than simply interacting with pre- and post-2014, as in the DD analysis). This analysis is done for low-SES students only, since they are the ones for which Medicaid expansion has been shown to have meaningful effects.

Each column of Table 9 shows no statistically significant effect of living in an expansion state in 2012-13 relative to 2010-11 (and point estimates are generally very small). This suggests that expansion states were not trending away from control states prior to treatment in 2014. The point estimates for 2014-16 and 2017-18 (relative to 2010-11) are all much larger in absolute value. 2014-16 is associated with an 8.3 percentage point increase in public insurance receipt and 2017-18 is associated with a 6.7 percentage point increase. Post-treatment increases in psychotropic medication use and diagnosis of mental health conditions are estimated with less precision than their corresponding estimates from our DD regressions, but they tell a similar story.

Our interpretation of our results as a whole is that Medicaid expansion increased the diagnosis of common mental health conditions and the use of prescription drugs to treat these conditions among relatively disadvantaged college students. We believe this interpretation is bolstered by the results presented above in several ways: first, we do not see a corresponding increase in

diagnosis/drug use for relatively advantaged college students (in expansion states relative to non-expansion states). Second, our main results are robust to the use of different estimation samples. Third, we do not observe a pre-treatment trend in diagnosis/medication for low-SES students in expansion states compared to non-expansion states.

Conclusion

This study examines the role of an increase in access to medical care (via Medicaid expansion under the ACA) in the diagnosis of common mental health conditions and associated prescription psychotropic drug use among college students. We find economically meaningful effects of Medicaid expansion on these outcomes for students from disadvantaged backgrounds, with no corresponding effects for more advantaged students. This is consistent with the fact that Medicaid expansion should have had little effect on healthcare access for richer families.

Because more advantaged students are more likely to be diagnosed with a mental health condition and use psychotropic medications to begin with, our estimates imply that Medicaid expansion effectively “closed the gap” between low-SES and high-SES students in diagnosis/prescription drug use in expansion states. The consequences of this change are of course important for public policy. We take a small step toward that goal by examining indicators of mental health status as well as substance use and academic outcomes. We do not find any protective short-term effects of expansion on these behaviors and outcomes, though we note that this is merely scratching the surface of potential consequences of the rise in diagnosis and psychotropic medication use induced by Medicaid expansion.

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Table 1a:

Summary statistics, 2010-2017 Health Minds Surveys

	Low SES students			High SES students		
	N	mean	sd	N	mean	sd
Age	28,707	20.73	1.92	103,716	20.55	1.83
Female	28,707	0.56		103,716	0.54	
Race=white	28,707	0.70		103,716	0.82	
Race=black	28,707	0.09		103,716	0.05	
Hispanic ethnicity	28,707	0.15		103,716	0.06	
Took psychostimulants in past year	28,707	0.05		103,716	0.07	
Took antidepressants in past year	28,707	0.10		103,716	0.12	
Took anti-anxiety medication in past year	28,707	0.06		103,716	0.07	
Took sleep medication in past year	28,707	0.03		103,716	0.03	
Took any of 4 medication types in past year	28,707	0.17		103,716	0.20	
Depression diagnosis	28,707	0.17		103,716	0.19	
Anxiety diagnosis	28,707	0.18		103,716	0.20	
ADD/ADHD diagnosis	28,707	0.07		103,716	0.09	
Eating disorder diagnosis	28,707	0.02		103,716	0.03	
Any of 4 diagnosis types	28,707	0.27		103,716	0.31	
Insurance: none	28,707	0.09		103,716	0.02	
Insurance: on parents' plan	28,707	0.68		103,716	0.85	
Insurance: from employer	28,707	0.03		103,716	0.02	
Insurance: from spouse's employer	28,707	0.01		103,716	0.00	
Insurance: student insurance plan	28,707	0.09		103,716	0.07	
Insurance: from international organization	28,707	0.00		103,716	0.00	
Insurance: individual plan	28,707	0.02		103,716	0.01	
Insurance: public insurance	28,707	0.09		103,716	0.02	
Insurance: not certain covered	28,707	0.01		103,716	0.00	
Insurance: covered but unknown source	28,707	0.04		103,716	0.03	
Binge drank in past 2 weeks	22,248	0.48		77,842	0.56	
Smoked cigarettes in past month	28,087	0.13		100,221	0.12	
Used marijuana in past month	27,881	0.19		99,092	0.23	
GPA (4 point scale)	17,483	3.11	0.55	61,264	3.26	0.51
School work per day (hours)	28,373	3.07	2.14	102,019	3.26	2.14
Mental/emotional problems hurt academics	28,676	0.35		103,592	0.32	
Diener score (psychological well-being)	21,374	45.04	8.01	78,570	45.40	8.04
Moderate depression	26,772	0.31		94,638	0.25	
Major depression	26,772	0.13		94,638	0.11	
Moderate sleep disorder	27,220	0.36		96,095	0.30	
Severe sleep disorder	27,220	0.16		96,095	0.13	
Any anxiety	24,127	0.75		88,402	0.72	
Major anxiety	24,127	0.26		88,402	0.25	
Suicidal ideation	28,659	0.11		103,528	0.10	
Living in Medicaid expansion state	28,707	0.64		103,716	0.68	
State higher education spending per capita ($)	28,707	1.03	0.26	103,716	1.03	0.27
State k-12 spending per pupil at age 17 ($)	28,707	10,896.10	2,348.71	103,716	11,090.11	2,468.02
State has Medicaid managed care program	28,707	0.96		103,716	0.94	
State has legal medical marijuana	28,707	0.37		103,716	0.43	
State has legal recreational marijuana	28,707	0.07		103,716	0.10	

Notes: The sample consists of all domestic students age 25 or younger with non-missing information on key variables. Standard deviations for binary variables are not shown. We assign an individual to the "low SES" category if neither of an individual's parents was a college graduate and if the individual reports that their financial situation growing up was "always stressful," "often stressful," or "sometimes stressful" (as opposed to "rarely stressful" or "never stressful"). If either of these conditions fail, the student is classified as "high SES." Estimates are weighted with HMS non-response weights.

Table 1b:

Summary statistics, 2010-2017 Health Minds Surveys						
	Expansion state			Non-expansion state		
	N	mean	sd	N	mean	sd
Age	87,450	20.63	1.88	44,973	20.53	1.80
Female	87,450	0.54		44,973	0.57	
Race=white	87,450	0.77		44,973	0.83	
Race=black	87,450	0.06		44,973	0.07	
Hispanic ethnicity	87,450	0.09		44,973	0.07	
Took psychostimulants in past year	87,450	0.06		44,973	0.07	
Took antidepressants in past year	87,450	0.12		44,973	0.11	
Took anti-anxiety medication in past year	87,450	0.07		44,973	0.06	
Took sleep medication in past year	87,450	0.03		44,973	0.04	
Took any of 4 medication types in past year	87,450	0.19		44,973	0.20	
Depression diagnosis	87,450	0.19		44,973	0.17	
Anxiety diagnosis	87,450	0.20		44,973	0.18	
ADD/ADHD diagnosis	87,450	0.08		44,973	0.09	
Eating disorder diagnosis	87,450	0.03		44,973	0.03	
Any of 4 diagnosis types	87,450	0.30		44,973	0.29	
Insurance: none	87,450	0.03		44,973	0.05	
Insurance: on parents' plan	87,450	0.80		44,973	0.83	
Insurance: from employer	87,450	0.02		44,973	0.02	
Insurance: from spouse's employer	87,450	0.00		44,973	0.01	
Insurance: student insurance plan	87,450	0.09		44,973	0.06	
Insurance: from international organization	87,450	0.00		44,973	0.00	
Insurance: individual plan	87,450	0.01		44,973	0.02	
Insurance: public insurance	87,450	0.05		44,973	0.02	
Insurance: not certain covered	87,450	0.01		44,973	0.00	
Insurance: covered but unknown source	87,450	0.03		44,973	0.03	
Binge drank in past 2 weeks	65,283	0.55		34,807	0.53	
Smoked cigarettes in past month	84,840	0.13		43,468	0.12	
Used marijuana in past month	83,972	0.24		43,001	0.18	
GPA (4 point scale)	52,118	3.24	0.52	26,629	3.19	0.54
School work per day (hours)	86,059	3.21	2.17	44,333	3.22	2.09
Mental/emotional problems hurt academics	87,346	0.35		44,922	0.29	
Diener score (psychological well-being)	64,504	44.87	8.21	35,440	46.17	7.61
Moderate depression	80,348	0.28		41,062	0.25	
Major depression	80,348	0.12		41,062	0.10	
Moderate sleep disorder	81,628	0.32		41,687	0.30	
Severe sleep disorder	81,628	0.15		41,687	0.13	
Any anxiety	73,993	0.73		38,536	0.73	
Major anxiety	73,993	0.27		38,536	0.22	
Suicidal ideation	87,285	0.11		44,902	0.09	
Low SES	87,450	0.24		44,973	0.27	
State higher education spending per capita ($)	87,450	1.06	0.29	44,973	0.98	0.20
State k-12 spending per pupil at age 17 ($)	87,450	11,635.29	2,666.79	44,973	9,852.40	1,231.44
State has Medicaid managed care program	87,450	0.98		44,973	0.87	
State has legal medical marijuana	87,450	0.61		44,973	0.03	
State has legal recreational marijuana	87,450	0.15		44,973	0.00	

Notes: The sample consists of all domestic students age 25 or younger with non-missing information on key variables. Standard deviations for binary variables are not shown. Estimates are weighted with HMS non-response weights.

Table 2:

Effects of Medicaid expansion on insurance receipt, medication, and diagnosis, 2010-2017 HMS

	Uninsured		Public insurance		Psychotropic medication		Mental health diagnosis	
	low SES	high SES	low SES	high SES	low SES	high SES	low SES	high SES
Treat	-0.076*	-0.007	0.072***	0.013**	0.036**	0.005	0.065***	0.012
	(0.040)	(0.011)	(0.014)	(0.005)	(0.015)	(0.018)	(0.019)	(0.024)
p-value*	0.03		0.00		0.08		0.01	

Notes: *** p<0.01, ** p<0.05, * p<0.1. There are 28,707 low-SES and 103,716 high-SES students. Standard errors clustered by state. "Treat" is equal to 1 if the student lives in a Medicaid expansion state after expansion (and zero otherwise). Additional covariates (not shown) include state and year dummies, dummies for gender, race, age, parental education, and family financial situation; and state-level controls for k-12 per pupil spending at age 17 and higher education spending per capita (and their squares), and dummies for whether the state has a Medicaid managed care program, medical marijuana law, and recreational marijuana law. *p-value associated with test of equality of coefficients across groups.

Table 3:

Effects of Medicaid expansion for low-SES students by race, 2010-2017 HMS

	Uninsured		Public insurance		Psychotropic medication		Mental health diagnosis	
	non-white	white	non-white	white	non-white	white	non-white	white
Treat	-0.120*	-0.037*	0.064	0.071***	0.081***	0.019	0.086***	0.054**
	(0.065)	(0.020)	(0.040)	(0.011)	(0.023)	(0.018)	(0.026)	(0.026)

Notes: *** p<0.01, ** p<0.05, * p<0.1. There are 8,449 non-white and 20,258 white students in this low-SES sample. Standard errors clustered by state. "Treat" is equal to 1 if the student lives in a Medicaid expansion state after expansion (and zero otherwise). Additional covariates (not shown) include state and year dummies, dummies for gender, race, age, parental education, and family financial situation; and state-level controls for k-12 per pupil spending at age 17 and higher education spending per capita (and their squares), and dummies for whether the state has a Medicaid managed care program, medical marijuana law, and recreational marijuana law.

Table 4:

Effects of Medicaid expansion on psychotropic medication use, 2010-2017 HMS

	Psychostimulants		Anti-depressants		Anti-anxiety		Sleep aid	
	low SES	high SES	low SES	high SES	low SES	high SES	low SES	high SES
Treat	0.012	-0.008	0.036**	0.015	0.011	0.001	0.022***	0.007
	(0.010)	(0.009)	(0.014)	(0.010)	(0.008)	(0.008)	(0.006)	(0.004)

Notes: *** p<0.01, ** p<0.05, * p<0.1. There are 28,707 low-SES and 103,716 high-SES students. Standard errors clustered by state. "Treat" is equal to 1 if the student lives in a Medicaid expansion state after expansion (and zero otherwise). Additional covariates (not shown) include state and year dummies, dummies for gender, race, age, parental education, and family financial situation; and state-level controls for k-12 per pupil spending at age 17 and higher education spending per capita (and their squares), and dummies for whether the state has a Medicaid managed care program, medical marijuana law, and recreational marijuana law.

Table 5:

Effects of Medicaid expansion on mental health diagnosis, 2010-2017 HMS

	Attention/learning disab.		Depression		Anxiety		Eating disorder	
	low SES	high SES	low SES	high SES	low SES	high SES	low SES	high SES
Treat	0.045***	0.010	0.034***	0.009	0.020	0.013	0.006	0.001
	(0.009)	(0.012)	(0.012)	(0.017)	(0.015)	(0.018)	(0.008)	(0.003)

Notes: *** p<0.01, ** p<0.05, * p<0.1. There are 28,707 low-SES and 103,716 high-SES students. Standard errors clustered by state. "Treat" is equal to 1 if the student lives in a Medicaid expansion state after expansion (and zero otherwise). Additional covariates (not shown) include state and year dummies, dummies for gender, race, age, parental education, and family financial situation; and state-level controls for k-12 per pupil spending at age 17 and higher education spending per capita (and their squares), and dummies for whether the state has a Medicaid managed care program, medical marijuana law, and recreational marijuana law.

Table 6:

Effects of Medicaid expansion on insurance status, 2010-2017 HMS

	Diener score		Moderate depression		Major depression		Moderate sleep disorder	
	low SES	high SES	low SES	high SES	low SES	high SES	low SES	high SES
Treat	-0.958**	-0.595*	0.005	-0.004	0.025	0.002	0.003	-0.019
	(0.416)	(0.344)	(0.030)	(0.018)	(0.023)	(0.009)	(0.027)	(0.016)
Observations	21,374	78,570	26,772	94,638	26,772	94,638	27,220	96,095
	Severe sleep disorder		Any anxiety		Major anxiety		Suicide ideation	
	low SES	high SES	low SES	high SES	low SES	high SES	low SES	high SES
Treat	0.004	-0.010	0.064**	0.007	0.038	0.022	0.013	0.011
	(0.022)	(0.011)	(0.031)	(0.020)	(0.031)	(0.019)	(0.018)	(0.008)
Observations	27,220	96,095	24,127	88,402	24,127	88,402	28,659	103,528

Notes: *** p<0.01, ** p<0.05, * p<0.1. Standard errors clustered by state. "Treat" is equal to 1 if the student lives in a Medicaid expansion state after expansion (and zero otherwise). Additional covariates (not shown) include state and year dummies, dummies for gender, race, age, parental education, and family financial situation; and state-level controls for k-12 per pupil spending at age 17 and higher education spending per capita (and their squares), and dummies for whether the state has a Medicaid managed care program, medical marijuana law, and recreational marijuana law.

Table 7:

Effects of Medicaid expansion on substance use, 2010-2017 HMS

	Binge drink		Smoke		Marijuana use	
	low SES	high SES	low SES	high SES	low SES	high SES
Treat	-0.038	-0.064**	-0.030	-0.014	-0.031	-0.024
	(0.036)	(0.028)	(0.019)	(0.017)	(0.030)	(0.025)
Observations	22,248	77,842	28,087	100,221	27,881	99,092

Notes: *** p<0.01, ** p<0.05, * p<0.1. Standard errors clustered by state. "Treat" is equal to 1 if the student lives in a Medicaid expansion state after expansion (and zero otherwise). Additional covariates (not shown) include state and year dummies, dummies for gender, race, age, parental education, and family financial situation; and state-level controls for k-12 per pupil spending at age 17 and higher education spending per capita (and their squares), and dummies for whether the state has a Medicaid managed care program, medical marijuana law, and recreational marijuana law.

Table 8:

Effects of Medicaid expansion on academic outcomes, 2010-2017 HMS						
	Self-reported GPA		Schoolwork time		Hurt academics	
	low SES	high SES	low SES	high SES	low SES	high SES
Treat	-0.016	0.021	0.064	-0.022	0.043*	-0.008
	(0.042)	(0.048)	(0.276)	(0.253)	(0.024)	(0.016)
Observations	17,483	61,264	28,373	102,019	28,676	103,592

Notes: *** p<0.01, ** p<0.05, * p<0.1. Standard errors clustered by state. "Treat" is equal to 1 if the student lives in a Medicaid expansion state after expansion (and zero otherwise). Additional covariates (not shown) include state and year dummies, dummies for gender, race, age, parental education, and family financial situation; and state-level controls for k-12 per pupil spending at age 17 and higher education spending per capita (and their squares), and dummies for whether the state has a Medicaid managed care program, medical marijuana law, and recreational marijuana law.

Table 9:

Effects of medicaid expansion on various outcomes, event study, 2010-2017 HMS				
	Uninsured	Public insurance	Psychotropic medication	Mental health diagnosis
Expansion state x (2012-2013)	-0.000	0.012	-0.010	-0.005
	(0.024)	(0.022)	(0.029)	(0.034)
Expansion state x (2014-2016)	-0.065	0.083***	0.023	0.061*
	(0.039)	(0.019)	(0.029)	(0.034)
Expansion state x (2017-2018)	-0.142	0.067**	0.065	0.063
	(0.087)	(0.031)	(0.050)	(0.057)

Notes: *** p<0.01, ** p<0.05, * p<0.1. There are 28,707 (low-SES) students in each regression. Standard errors clustered by state. Baseline period is 2010-2011. Additional covariates (not shown) include state and year dummies, dummies for gender, race, age, parental education, and family financial situation; and state-level controls for k-12 per pupil spending at age 17 and higher education spending per capita (and their squares), and dummies for whether the state has a Medicaid managed care program, medical marijuana law, and recreational marijuana law.

Appendix Table 1:

Medicaid expansion and non-expansion states in the 2010-2017 HMS	
Expansion states	Non-expansion states
Arizona	Florida
Arkansas	Georgia
California	Kansas
Colorado	Missouri
Connecticut	North Carolina
District of Columbia	Oklahoma
Delaware	South Carolina
Illinois	Tennessee
Indiana	Texas
Louisiana	Utah
Massachusetts	Virginia
Maryland	Wisconsin
Michigan	
Minnesota	
Montana	
Nevada	
New Hampshire	
New Jersey	
New York	
Ohio	
Oregon	
Pennsylvania	
Rhode Island	
Washington	
West Virginia	

Notes: For those states in our sample that expanded Medicaid by the end of 2018, all but five did so on 1/1/2014: New Hampshire (expanded 8/15/2014), Pennsylvania (1/1/2015), Indiana (2/1/2015), Montana (1/1/2016) and Louisiana (7/1/2016). Source: https://www.kff.org/medicaid/issue-brief/status-of-state-medicaid-expansion-decisions-interactive-map/.

Appendix Table 2:

Comparison of regression sample with other respondents, 2010-2017 Health Minds Surveys

	Regression sample			Other respondents			
	N	mean	sd	N	mean	sd	p-value*
Race=white	132,423	0.79	0.40	42,798	0.66	0.47	0.00
Insurance: none	132,423	0.04	0.19	36,852	0.05	0.22	0.02
Insurance: public insurance	132,423	0.04	0.20	37,438	0.06	0.23	0.00
Female	132,423	0.55	0.50	42,517	0.55	0.50	0.56
Living in Medicaid expansion state	132,423	0.67	0.47	42,885	0.69	0.46	0.66
Took any of 4 medication types in past year	132,423	0.19	0.39	27,975	0.17	0.38	0.00
Any of 4 diagnosis types	132,423	0.30	0.46	24,168	0.33	0.47	0.00
Low SES	132,423	0.25	0.43	18,160	0.25	0.43	0.99
Age	132,423	20.60	1.85	42,885	20.44	1.87	0.00

Notes: The sample consists of all domestic students age 25 or younger. The regression sample is composed of all repondents who had no missing values for variables used in our baseline regressions. Other respondents had at least one missing value for one of these variables. Estimates are weighted with HMS non-response weights. *p-value associated with test of equality of means across groups.

Appendix Table 3:

Effects of Medicaid expansion on insurance status, 2010-2017 HMS

	Parent insurance		Employer insurance		Spouse insurance		Student insurance	
	low SES	high SES	low SES	high SES	low SES	high SES	low SES	high SES
Treat	-0.015	-0.004	0.005	0.002	-0.002	-0.001	0.029	-0.028
	(0.024)	(0.020)	(0.010)	(0.007)	(0.003)	(0.002)	(0.037)	(0.017)
	Int'l insurance		Individual insurance		Uncertain if insured		Uncertain source	
	low SES	high SES	low SES	high SES	low SES	high SES	low SES	high SES
Treat	0.013**	0.000	0.003	-0.002	0.004	-0.000	-0.006	0.006
	(0.006)	(0.001)	(0.008)	(0.003)	(0.004)	(0.001)	(0.012)	(0.006)

Notes: *** p<0.01, ** p<0.05, * p<0.1. There are 28,707 low-SES and 103,716 high-SES students. Standard errors clustered by state. "Treat" is equal to 1 if the student lives in a Medicaid expansion state after expansion (and zero otherwise). Additional covariates (not shown) include state and year dummies, dummies for gender, race, age, parental education, and family financial situation; and state-level controls for k-12 per pupil spending at age 17 and higher education spending per capita (and their squares), and dummies for whether the state has a Medicaid managed care program, medical marijuana law, and recreational marijuana law.

Appendix Table 4a:

Summary statistics, pre-expansion sample in expansion states, 2010-2017 Health Minds Surveys

	Low SES students			High SES students		
	N	mean	sd	N	mean	sd
Age	8,156	20.86	1.95	20,900	20.71	1.88
Female	8,156	0.61	0.49	20,900	0.56	0.50
Race=white	8,156	0.63	0.48	20,900	0.79	0.40
Took any of 4 medication types in past year	8,156	0.12	0.33	20,900	0.16	0.37
Any of 4 diagnosis types	8,156	0.18	0.39	20,900	0.24	0.43
Insurance: none	8,156	0.13	0.33	20,900	0.03	0.17
Insurance: public insurance	8,156	0.05	0.23	20,900	0.01	0.11
Diener score (psychological well-being)	4,009	46.78	6.64	10,566	47.22	6.86
Moderate depression	8,004	0.27	0.44	20,566	0.23	0.42
Major depression	8,004	0.10	0.30	20,566	0.09	0.28
Moderate sleep disorder	8,131	0.33	0.47	20,849	0.29	0.46
Severe sleep disorder	8,131	0.14	0.35	20,849	0.13	0.33
Any anxiety	5,656	0.77	0.42	15,603	0.75	0.43
Major anxiety	5,656	0.18	0.38	15,603	0.18	0.38
Suicidal ideation	8,151	0.07	0.26	20,885	0.07	0.26

Notes: The sample consists of all domestic students age 25 or younger with non-missing information on key variables. We assign an individual to the "low SES" category if neither of an individual's parents was a college graduate and if the individual reports that their financial situation growing up was "always stressful," "often stressful," or "sometimes stressful" (as opposed to "rarely stressful" or "never stressful"). If either of these conditions fail, the student is classified as "high SES." Estimates are weighted with HMS non-response weights.

Appendix Table 4b:

Summary statistics, pre-expansion sample in non-expansion states, 2010-2017 Health Minds Surveys

	Low SES students			High SES students		
	N	mean	sd	N	mean	sd
Age	6,289	20.68	1.82	14,213	20.49	1.75
Female	6,289	0.61	0.49	14,213	0.57	0.50
Race=white	6,289	0.84	0.37	14,213	0.87	0.33
Took any of 4 medication types in past year	6,289	0.16	0.37	14,213	0.18	0.39
Any of 4 diagnosis types	6,289	0.24	0.43	14,213	0.26	0.44
Insurance: none	6,289	0.10	0.30	14,213	0.03	0.16
Insurance: public insurance	6,289	0.04	0.18	14,213	0.01	0.11
Diener score (psychological well-being)	4,474	47.28	6.72	7,644	47.53	6.72
Moderate depression	6,175	0.24	0.42	14,010	0.20	0.40
Major depression	6,175	0.09	0.28	14,010	0.08	0.27
Moderate sleep disorder	6,277	0.30	0.46	14,181	0.27	0.44
Severe sleep disorder	6,277	0.12	0.32	14,181	0.11	0.31
Any anxiety	5,639	0.76	0.43	11,628	0.72	0.45
Major anxiety	5,639	0.17	0.38	11,628	0.17	0.37
Suicidal ideation	6,285	0.09	0.28	14,201	0.08	0.26

Notes: The sample consists of all domestic students age 25 or younger with non-missing information on key variables. We assign an individual to the "low SES" category if neither of an individual's parents was a college graduate and if the individual reports that their financial situation growing up was "always stressful," "often stressful," or "sometimes stressful" (as opposed to "rarely stressful" or "never stressful"). If either of these conditions fail, the student is classified as "high SES." Estimates are weighted with HMS non-response weights.

Appendix Table 4c:

Summary statistics, post-expansion sample in expansion states, 2010-2017 Health Minds Surveys

	Low SES students			High SES students		
	N	mean	sd	N	mean	sd
Age	10,818	20.72	1.95	47,576	20.53	1.84
Female	10,818	0.49	0.50	47,576	0.52	0.50
Race=white	10,818	0.68	0.47	47,576	0.82	0.39
Took any of 4 medication types in past year	10,818	0.20	0.40	47,576	0.21	0.41
Any of 4 diagnosis types	10,818	0.33	0.47	47,576	0.34	0.47
Insurance: none	10,818	0.06	0.24	47,576	0.01	0.12
Insurance: public insurance	10,818	0.16	0.37	47,576	0.03	0.18
Diener score (psychological well-being)	9,604	43.33	8.65	40,325	44.50	8.39
Moderate depression	9,625	0.39	0.49	42,153	0.28	0.45
Major depression	9,625	0.19	0.39	42,153	0.12	0.33
Moderate sleep disorder	9,795	0.41	0.49	42,853	0.32	0.47
Severe sleep disorder	9,795	0.20	0.40	42,853	0.14	0.35
Any anxiety	9,811	0.74	0.44	42,923	0.71	0.45
Major anxiety	9,811	0.35	0.48	42,923	0.29	0.45
Suicidal ideation	10,789	0.14	0.35	47,460	0.12	0.32

Notes: The sample consists of all domestic students age 25 or younger with non-missing information on key variables. We assign an individual to the "low SES" category if neither of an individual's parents was a college graduate and if the individual reports that their financial situation growing up was "always stressful," "often stressful," or "sometimes stressful" (as opposed to "rarely stressful" or "never stressful"). If either of these conditions fail, the student is classified as "high SES." Estimates are weighted with HMS non-response weights.

Appendix Table 4d:

Summary statistics, post-expansion sample in non-expansion states, 2010-2017 Health Minds Surveys

	Low SES students			High SES students		
	N	mean	sd	N	mean	sd
Age	3,444	20.57	1.93	21,027	20.49	1.81
Female	3,444	0.56	0.50	21,027	0.55	0.50
Race=white	3,444	0.64	0.48	21,027	0.83	0.38
Took any of 4 medication types in past year	3,444	0.20	0.40	21,027	0.23	0.42
Any of 4 diagnosis types	3,444	0.33	0.47	21,027	0.34	0.47
Insurance: none	3,444	0.12	0.32	21,027	0.02	0.15
Insurance: public insurance	3,444	0.08	0.27	21,027	0.02	0.13
Diener score (psychological well-being)	3,287	44.10	8.17	20,035	45.18	8.17
Moderate depression	2,968	0.41	0.49	17,909	0.28	0.45
Major depression	2,968	0.17	0.38	17,909	0.12	0.33
Moderate sleep disorder	3,017	0.43	0.49	18,212	0.32	0.47
Severe sleep disorder	3,017	0.21	0.41	18,212	0.14	0.35
Any anxiety	3,021	0.73	0.44	18,248	0.71	0.45
Major anxiety	3,021	0.34	0.47	18,248	0.28	0.45
Suicidal ideation	3,434	0.13	0.34	20,982	0.11	0.31

Notes: The sample consists of all domestic students age 25 or younger with non-missing information on key variables. We assign an individual to the "low SES" category if neither of an individual's parents was a college graduate and if the individual reports that their financial situation growing up was "always stressful," "often stressful," or "sometimes stressful" (as opposed to "rarely stressful" or "never stressful"). If either of these conditions fail, the student is classified as "high SES." Estimates are weighted with HMS non-response weights.

Appendix Table 5:

Effects of Medicaid expansion for high-SES students by race, 2010-2017 HMS								
	Uninsured		Public insurance		Psychotropic medication		Mental health diagnosis	
	non-white	white	non-white	white	non-white	white	non-white	white
Treat	-0.011	-0.004	0.016	0.014***	-0.004	0.007	-0.021	0.018
	(0.026)	(0.007)	(0.020)	(0.003)	(0.022)	(0.019)	(0.031)	(0.024)

Notes: *** p<0.01, ** p<0.05, * p<0.1. There are 17,574 non-white and 86,142 white students in this high-SES sample. Standard errors clustered by state. "Treat" is equal to 1 if the student lives in a Medicaid expansion state after expansion (and zero otherwise). Additional covariates (not shown) include state and year dummies, dummies for gender, race, age, parental education, and family financial situation; and state-level controls for k-12 per pupil spending at age 17 and higher education spending per capita (and their squares), and dummies for whether the state has a Medicaid managed care program, medical marijuana law, and recreational marijuana law.

Appendix Table 6:

Effects of Medicaid expansion on the prevalence of low-SES students, 2010-2017 HMS	
Treat	0.005
	(0.011)

Notes: *** p<0.01, ** p<0.05, * p<0.1. There are 132,423 students in the regression. Standard errors clustered by state. "Treat" is equal to 1 if the student lives in a Medicaid expansion state after expansion (and zero otherwise). Additional covariates (not shown) include state and year dummies, dummies for gender, race, age, parental education, and family financial situation; and state-level controls for k-12 per pupil spending at age 17 and higher education spending per capita (and their squares), and dummies for whether the state has a Medicaid managed care program, medical marijuana law, and recreational marijuana law.

Appendix Table 7:

Effects of Medicaid expansion on insurance receipt, medication, and diagnosis, 2010-2017 HMS: restricted sample

	Uninsured		Public insurance		Psychotropic medication		Mental health diagnosis	
	low SES	high SES	low SES	high SES	low SES	high SES	low SES	high SES
Treat	-0.036	0.001	0.066***	0.016***	0.035**	0.003	0.086***	0.015
	(0.030)	(0.008)	(0.017)	(0.004)	(0.014)	(0.022)	(0.014)	(0.028)

Notes: *** p<0.01, ** p<0.05, * p<0.1. There are 19,053 low-SES and 74,952 high-SES students in this sample composed of students from states that appear at least 4 times over the sample frame. Standard errors clustered by state. "Treat" is equal to 1 if the student lives in a Medicaid expansion state after expansion (and zero otherwise).Additional covariates (not shown) include state and year dummies, dummies for gender, race, age, parental education, and family financial situation; and state-level controls for k-12 per pupil spending at age 17 and higher education spending per capita (and their squares), and dummies for whether the state has a Medicaid managed care program, medical marijuana law, and recreational marijuana law.