Just What the Nurse Practitioner Ordered: Independent Prescriptive Authority and Population Mental Health *

Diane Alexander† Molly Schnell‡

April 23, 2019

Abstract

We examine whether relaxing occupational licensing to allow nurse practitioners (NPs)—registered nurses with advanced degrees—to prescribe medication without physician oversight improves population mental health. Exploiting time-series variation in independent prescriptive authority for NPs from 1990–2014, we find that broadening prescriptive authority leads to improvements in self-reported mental health and decreases in mental-health-related mortality. These improvements are concentrated in areas that are underserved by physicians and among populations that have difficulty accessing physician-provided care. Our results demonstrate that extending prescriptive authority to NPs can help mitigate physician shortages and extend care to disadvantaged populations.

*Matthew Basilico, Alice Chen, Janet Currie, Henry Farber, David Krol, Ilyana Kuziemko, Ellen Meara, Karin Marton-Rollins, and Beth Rom-Rymer provided helpful comments. We thank participants in seminars at Princeton University, the 2016 Society of Labor Economists Meeting, the 2016 and 2018 American Society of Health Economists Meetings, and the 2016 Population Health Sciences Research Workshop at Boston University School of Public Health. Generous financial support from the Center for Health and Wellbeing at Princeton University is gratefully acknowledged. The statements, findings, conclusions, views, and opinions contained and expressed herein are not necessarily those of IQVIA or any of its affiliated or subsidiary entities.

†Federal Reserve Bank of Chicago (dalexander@frbchi.org)

‡Stanford University (mschnell@stanford.edu)

1 Introduction

Limited access to mental health care services in the United States is a major public health concern. While one in five Americans suffers from a mental illness—including generalized anxiety and major depressive disorders—nearly one third of the U.S. population lives in areas that are underserved by mental health care providers (Bureau of Health Workforce, 2016).[1] As mental disorders tend to develop early in life and persist over the lifecycle (Merikangas et al., 2010), the costs of not receiving treatment can be substantial. In addition to direct medical costs, untreated mental illness is associated with lower human capital accumulation, worse labor market participation and performance, and greater criminal activity (see, for example, Currie and Stabile, 2006; Ettner et al., 1997; Greenberg and Rosenheck, 2008; Kessler et al., 2008). Recent evidence demonstrates that increases in all-cause mortality among non-Hispanic whites are being driven by "deaths of despair" (deaths from suicides, drug and alcohol poisonings, and alcoholic liver disease and cirrhosis; Case and Deaton, 2015, 2017), adding energy and urgency to the search for policies that can be used to improve population mental health.

In this paper, we examine whether allowing nurse practitioners (NPs)—a class of registered nurses with advanced degrees in nursing—to prescribe medication without physician supervision or collaboration leads to improvements in measures of population mental health. Leveraging a novel dataset that documents legislative changes granting NPs independent prescriptive authority over 25 years, we find that states that broaden prescriptive authority experience improvements in population mental health. These improvements are concentrated among disadvantaged populations, suggesting that extending independent prescriptive authority to NPs is an important policy tool that can be used to improve the mental health of populations with limited access to care.

Despite a burgeoning literature demonstrating that NPs can safely and efficiently provide a variety of services, including an endorsement of the skills of NPs by the Institute of Medicine (IOM, 2011), efforts to extend prescriptive authority beyond physicians are controversial. Opponents

[1] According to the 2016 National Survey on Drug Use and Health, only 43.1% of U.S. adults aged 18 and older with a mental illness received counseling (inpatient or outpatient) or used a prescription medication for problems with mental health in the past year (SAMHSA, 2017).

worry that allowing NPs to prescribe medication will put patients in danger since NPs receive fewer years of training, are held to different legal standards, and go through a different process of licensing than medical doctors.[2] Critics further note that extending prescriptive authority beyond physicians need not expand overall use of pharmacological treatment, as the prescriptions written by non-physician providers may simply crowd out the prescriptions previously written by physicians. The American Medical Association (AMA), a national professional organization representing physicians and medical students in the Unites States, has been particularly vocal in opposing the expansion of state-level scope of practice legislation (AMA, 2010).

To measure the impact of extending independent prescriptive authority to NPs on population mental health, we exploit time-series variation in state-level scope of practice legislation and mental health outcomes from 1990 to 2014 using a difference-in-difference framework. We use two complementary categories of health outcomes: (1) self-reported mental health at the individual-year level from the Behavioral Risk Factor Surveillance System and (2) mental-health-related mortality at the county-quarter level from the U.S. Mortality Files.[3] Our results demonstrate that extending prescriptive authority to NPs leads to significant reductions in the number of days spent in poor mental health (0.17 days per month, or 5% of the mean). We further find a negative relationship between independent prescriptive authority and mental-health-related mortality, although the effect is imprecisely estimated.

Notably, improvements in mental health outcomes resulting from independent prescriptive authority for NPs are larger and more precisely estimated in areas that are underserved by physicians and among disadvantaged populations. In particular, areas that are underserved by psychiatrists see statistically significant improvements in self-reported mental health and mental-health-related mortality that are at least twice as large as those experienced on average: respondents in underserved states see a reduction of 0.29 days per month in poor mental health (9% of the mean) and

[2]It has been estimated that NPs can safely provide 70-80% of the care provided by physicians in primary care (Scheffler et al., 1996). Furthermore, evidence suggests that there are no differences in health outcomes between patients treated by NPs rather than MDs, and patient satisfaction is, if anything, higher among patients seen by NPs (Horrocks et al., 2002; Laurant et al., 2008; Lenz et al., 2004; Mundinger et al., 2000; Naylor and Kurtzman, 2010).

[3]As described in Section 3, we define "mental-health-related mortality" as suicides, injuries of undetermined intent, and accidental deaths involving poisonings, drownings, firearms, and trains.

underserved counties see a reduction of nearly six mental-health-related deaths (11% of the mean) per quarter. Individuals with a high school degree or less also see strong improvements in both measures of mental health, with the largest benefits in percentage terms accruing to individuals with low levels of education residing in undeserved areas.

Allowing NPs to prescribe independently should disproportionately affect disadvantaged populations for two reasons. First, since psychiatrists and other physicians are more likely to locate in urban and suburban areas, populations in rural areas have the most limited access to psychotropic treatment (Hartley et al., 2004). Second, psychiatrists are less likely than all other physician specialties to accept insurance, with acceptance rates being lowest for Medicaid beneficiaries (Bishop et al., 2014). Therefore, even in areas with a sufficient number of physicians, access to psychotropic medications may still be limited for certain populations. Since NPs are more likely than physicians to locate in rural and inner-city locations and to accept public insurance (Buerhaus et al., 2015; Everett et al., 2009; Grumbach et al., 2003; Larson et al., 2003), granting independent prescriptive authority to NPs has the potential to address physician shortages and extend care to disadvantaged populations.

Finally, using detailed prescription data from 2006 to 2014, we find evidence that extending independent prescriptive authority to NPs increases the use of psychotropic medications among disadvantaged populations. Similar to our findings for mental-health-related mortality and self-reported mental health, these effects are concentrated in areas that are underserved for mental health care resources. We find the largest increases in antidepressant and antipsychotic use among Medicaid beneficiaries—a low-income population that we expect to be particularly affected by scope of practice legislation for NPs. Despite having a much shorter time frame, which greatly limits our statistical power over our analyses of mental health outcomes, we nonetheless find evidence that the use of psychotropic medications among disadvantaged populations increases when more providers can prescribe independently.

In light of rising rates of abuse of prescription pain medication (SAMHSA, 2014), one concern with broadening prescriptive authority for NPs is that such legislation could lead to a greater num-

ber of opioid analgesics available for misuse. Again using prescription data from 2006–2014, we find that broadening prescriptive authority leads to general increases in opioid prescriptions. While there is a strong, positive relationship between opioid prescriptions per capita and deaths involving drugs within locations over time (Schnell and Currie, 2018), we nevertheless find that allowing NPs to prescribe independently leads to fewer mental-health-related deaths, a figure that includes overdoses. Therefore, if anything, our main results underestimate the effects of only extending prescriptive authority for non-controlled substances such as antidepressants and antipsychotics.

Our work contributes to a growing literature in economics that empirically examines the implications of occupational licensing, most of which measures the effects of such legislation on wages, employment, and prices across related occupations and services.[4,5] We depart from this literature by focusing on outcomes of the production process—self-reported mental health and mental-health-related mortality—rather than the organization and division of resources across actors in the production process itself.

The two most closely related studies to our work are Stange (2014) and Traczynski and Udalova (2018). Stange (2014) finds that allowing NPs to prescribe controlled substances with or without physician supervision only leads to modest increases in healthcare utilization, whereas Traczynski and Udalova (2018) find that allowing NPs to both practice and prescribe independently leads to increases in utilization of primary care services. Our paper departs from this previous literature in four important dimensions. First, given well-documented shortages in access to mental health care services in the United States, we focus on the impact of broadening scope of practice legislation on the use of psychotropic medications and mental health outcomes.[6] Second, we use a time

[4]A type of occupational licensing, scope of practice restrictions for NPs are often justified as the state protecting the consumer from receiving substandard care. If consumers are more confident in the services provided as a result of this legal reassurance, restrictive scope of practice legislation will increase demand. However, since restrictive scope of practice legislation limits the number of providers who can perform a given service, these increases in demand may be offset by decreases in supply. While restrictive scope of practice legislation should weakly increase the quality of services, the theoretical effects on quantity are ambiguous.

[5]For example, see Kleiner and Park (2010) and Marier and Wing (2011) for the case of dentists and dental hygienists and Dueker et al. (2005), Kleiner et al. (2016), Stange (2014), and Xue et al. (2016) for the case of physicians and non-physician providers.

[6]Our focus on mental health motivates the law changes that we consider. Since access to a provider who can prescribe psychotropic medications is a significant barrier to mental health care in the United States, we focus on legislation that allows NPs to prescribe medication without the supervision or collaboration of a physician. In contrast to

horizon of 25 years, which allows us to consider the effects of a larger number of law changes than previous papers. Third, we use larger and more representative datasets than previous work; combined with the long time horizon, this gives us the power to look for heterogenous effects of broadened scope of practice legislation.[7] We find that extending independent prescriptive authority to NPs has larger effects among disadvantaged populations, making it a particularly attractive policy instrument for reducing inequality. Finally, given our unique prescription data, we are able to document a "first stage" that helps us understand the mechanisms through which broadened scope of practice legislation affects population mental health.

More broadly, our work contributes to the literature that examines how mental health is affected by policy interventions. Previous studies have focused primarily on policy efforts to improve access to physician-provided care—by increasing access to health insurance, mandating parity in reimbursement for mental health care services, or altering incentives for graduating physicians to enter either psychiatry or primary care—and find mixed results (see, for example, Cunningham, 2009; Finkelstein et al., 2012; Rabinowitz et al., 2008). In contrast to this line of work, we focus on a policy that can increase the accessibility of medical care for disadvantaged populations immediately and at a low cost: there are currently over 234,000 NPs already licensed in the United States who could prescribe independently if legislation permitted them to do so (AANP, 2017).

Taken together, our results demonstrate that relaxing occupational licensing for non-physician providers can help mitigate the negative consequences of limited access to physician-provided health care. In particular, states that are underserved by physicians can grant independent prescriptive authority to NPs to improve the mental health of their residents. The potential for such legislative action remains large: as of January, 2015, only 24 states and the District of Columbia

Stange (2014), we do not separately consider legislation that allows NPs to prescribe controlled substances in addition to unscheduled drugs. Since the majority of antidepressants and antipsychotics are not scheduled, we believe that the relevant legislation is whether NPs can prescribe at least non-controlled substances independently. We note, however, that only one state (Kentucky) allows NPs to prescribe unscheduled drugs but not controlled substances independently (see Footnote 10 for additional information on independent prescriptive authority for controlled substances).

[7]While Traczynski and Udalova (2018) find no evidence of heterogenous effects, they are likely underpowered given both the small sample size of the Medical Expenditure Panel Survey (MEPS) and the more limited time period that they consider. We further note that the MEPS is only representative at the national level, whereas the data we use is either representative at the state level (BRFSS), covers the universe of deaths (U.S. Mortality Files), or covers the universe of prescriptions filled at U.S. retail pharmacies for certain drug classes (IQVIA).

had granted independent prescriptive authority to NPs. Noticeably, no state in the South has yet to allow NPs to independently prescribe.

This paper proceeds as follows. We begin by providing additional background on NPs and scope of practice legislation in Section 2. We then introduce our data in Section 3. In Section 4, we examine how mental-health-related mortality and self-reported mental health respond when independent prescriptive authority is extended to NPs. In Section 5, we examine how the number of prescriptions for antidepressants, antipsychotics, and opioids change when NPs can prescribe independently. Section 6 concludes.

2 Background

The number of NPs in the United States has grown rapidly in recent decades, with the number of licensed NPs more than doubling from 120,000 in 2007 to over 234,000 today (AANP, 2017). To become an NP, registered nurses must complete a master's or doctoral program that provides advanced clinical training beyond their undergraduate nursing education and complete local licensure and national certification requirements. NPs practice in a wide range of settings, including physician practices, hospitals, community health centers, and private NP practices (AANP, 2014).

While the training requirements for NPs are similar across the United States, states have the authority to dictate what NPs are able to do. In states with liberal scope of practice legislation, NPs have the authority to evaluate, diagnose, and treat patients—which includes ordering and interpreting diagnostic tests, initiating and managing treatments, and prescribing medication—under the licensure authority of the state board of nursing. In states with more restrictive scope of practice legislation, NPs are required to undergo career-long supervision, delegation, or team-management by another health provider in order to provide patient care.[8] Such legislation can be very costly

[8] As is common in the literature, we refer to these mandatory professional relationships as "physician supervision or collaboration." The legal requirements for such relationships, both for practice authority and prescriptive authority, differ across states with restrictive scope of practice legislation. For example, NPs in Georgia can only prescribe if a physician delegates the authority pursuant to a written protocol agreement, NPs in Virginia can only prescribe as part of a patient care team, and NPs in South Carolina must maintain a written collaborative agreement with a physician in order to prescribe.

for NPs: anecdotal evidence suggests that NPs often have difficulty finding or affording physicians who are willing to supervise or work in collaboration, and it is not uncommon for NPs to have to move or stop practicing when the physician with whom they contract has moved, retired, or died (Sadeghi, 2017). Broadened scope of practice legislation therefore lowers the cost of practice and may increase access by increasing both the number of providers and the effective labor supply of each provider.

We focus specifically on scope of practice legislation that grants NPs the authority to prescribe medication independently. Given significant disparities in access to providers who can prescribe psychotropic medications (Bishop et al., 2014; Hartley et al., 2004), extending independent prescriptive authority to NPs may be particularly relevant for improving the provision of mental health care in the United States. Broadly speaking, there are two types of treatment for mental illness: psychotherapy and psychotropic medication. A complementarity between the two has been well documented, and in most cases it is recommended that a patient receive a combination of both (SAMHSA, 2015). Despite this ideal of psychotherapy in conjunction with psychotropic medication, it is often much easier to find consistent access to therapy than to medication (Thomas et al., 2009). While all mental health professionals can offer some degree of counseling services, traditionally only psychiatrists and other medical doctors have the legislative authority to prescribe medications independently.

Although some NPs specialize in psychiatric and mental health, these providers make up less than four percent of the total NP workforce (AANP, 2014). Rather, the vast majority of NPs are trained in primary care programs and focus on adult, family, and pediatric health; gerontology; and women's health. Despite their generalist training, most primary care NPs diagnose and treat mental illness on a regular basis. According to a recent survey, 66 (63) percent of general practice NPs treat anxiety (depression) in their practice, with the numbers being even more pronounced among NPs in family practice (76 and 74 percent, respectively) (AANP, 2012). This pattern is similar among physicians: while psychiatrists are the only MDs that specifically focus on mental health, many general practitioners also provide mental health services (Kessler and Stafford, 2008). Therefore,

increased access to NPs in general, rather than just those specializing in psychiatric medicine, may have the potential to improve population mental health.

3 Data

We combine data from seven sources to measure how extending prescriptive authority to NPs affects population mental health. In particular, we merge a new dataset detailing independent prescriptive authority for NPs with administrative data on mental-health-related mortality from the U.S. Mortality Files, survey data on self-reported mental health from the Behavioral Risk Factor Surveillance System survey, and detailed data on prescriptions filled at U.S. retail pharmacies from IQVIA's Xponent database. These data are supplemented with information on the provision of local medical resources and population demographics from the Area Resource Files, the American Community Survey, and the U.S. Census. Each dataset is described in detail below.

3.1 Independent Prescriptive Authority

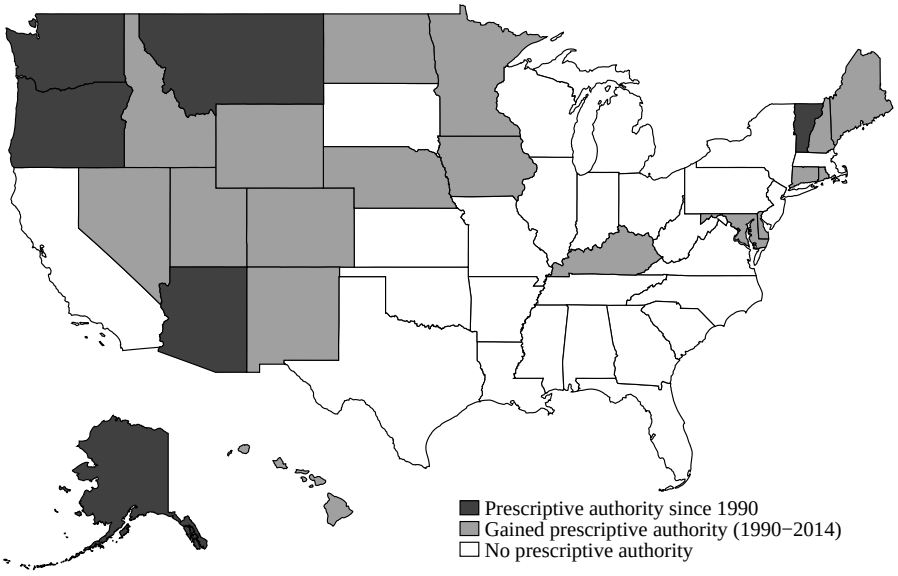
Our first dataset documents whether NPs had the legislative authority to independently prescribe medication in each month from 1990 to 2014 in each state and the District of Columbia. This dataset was constructed by the authors and combines information from the *The Nurse Practitioner's* "Annual Legislative Update," correspondences with state nursing boards, and readings of primary source legislation.[9]

As discussed in Section 2, the language of scope of practice legislation is particular to each state. We define independent prescriptive authority as the ability to prescribe medication with-

[9] *The Nurse Practitioner* is a journal addressing clinical issues relevant to NPs and other primary care providers. Every January since 1989, the journal has published the "Annual Legislative Update" which summarizes both the practice environment and the level of prescriptive authority for NPs in each state. While informative, these overviews do not consistently include dates of legislative action nor comprehensive coverage of the precise changes made to a state's legislation. Therefore, the information provided by the journal alone is not sufficient for a quantitative analysis of independent prescriptive authority.

out physician collaboration or supervision.[10,11] As of January 1st, 1990, six states and the District of Columbia had already granted NPs statutory authority to independently prescribe medication. Between 1990 and 2014, 18 states changed their scope of practice legislation to allow NPs to prescribe without physician involvement. This geographic and temporal variation in scope of practice legislation is displayed in Figure 1; the exact dates of the law changes used in our analysis are provided in Table A.1.

Figure 1: Changes in Independent Prescriptive Authority for NPs: 1990–2014



Notes: We define a state as having independent prescriptive authority if NPs registered in the state have the statutory authority to prescribe medications without physician collaboration or supervision. The exact dates of the law changes used in our analysis are provided in Table A.1.

It is difficult to say how states decide when to grant NPs independent prescriptive authority. If states broaden scope of practice legislation for NPs in response to declining economic condi-

[10]Except for Kentucky, in which NPs are required to have a collaborative practice agreement with a physician in order to prescribe controlled substances, all states that allows NPs to prescribe unscheduled drugs independently also allow NPs to prescribe controlled substances independently. While independent prescriptive authority for both unscheduled drugs and controlled substances is included with licensure in many states with liberal scope of practice legislation, in some states with independent prescriptive authority, such as Connecticut and the District of Columbia, NPs must apply for a controlled substance registration to independently prescribe Schedule II-V drugs.

[11]Eight of the 24 states that allow NPs to prescribe independently require a post-licensure or certification period of supervision or collaboration before an NP is granted independent prescriptive authority. For example, a prescribing mentorship with a physician or another advanced practice nurse is required for the first 1,000 hours of practice in Colorado; in Maine, an NP must be supervised by either a physician or an NP for the first 24 month of the NP's practice. Since these restrictions are temporary, rather than career-long, we consider states that require a preliminary period of supervision or collaboration as having independent prescriptive authority.

tions or worsening health, or at a similar time as other laws that independently impact population mental health, then our results will be subject to omitted variable bias. Pei et al. (forthcoming) demonstrate that balancing regressions—which use candidate controls as dependent, rather than independent, variables—provide a powerful test of orthogonality. In Table A.3, we estimate balancing regressions to examine whether the timing of laws granting NPs independent prescriptive authority are correlated with various individual-level, county-level, and state-level outcomes (e.g., individual health insurance status, county-level provider counts, and state-level unemployment rates). Reassuringly, we find no evidence that the law changes we consider are driven by these measures.[12]

3.2 Health Resources

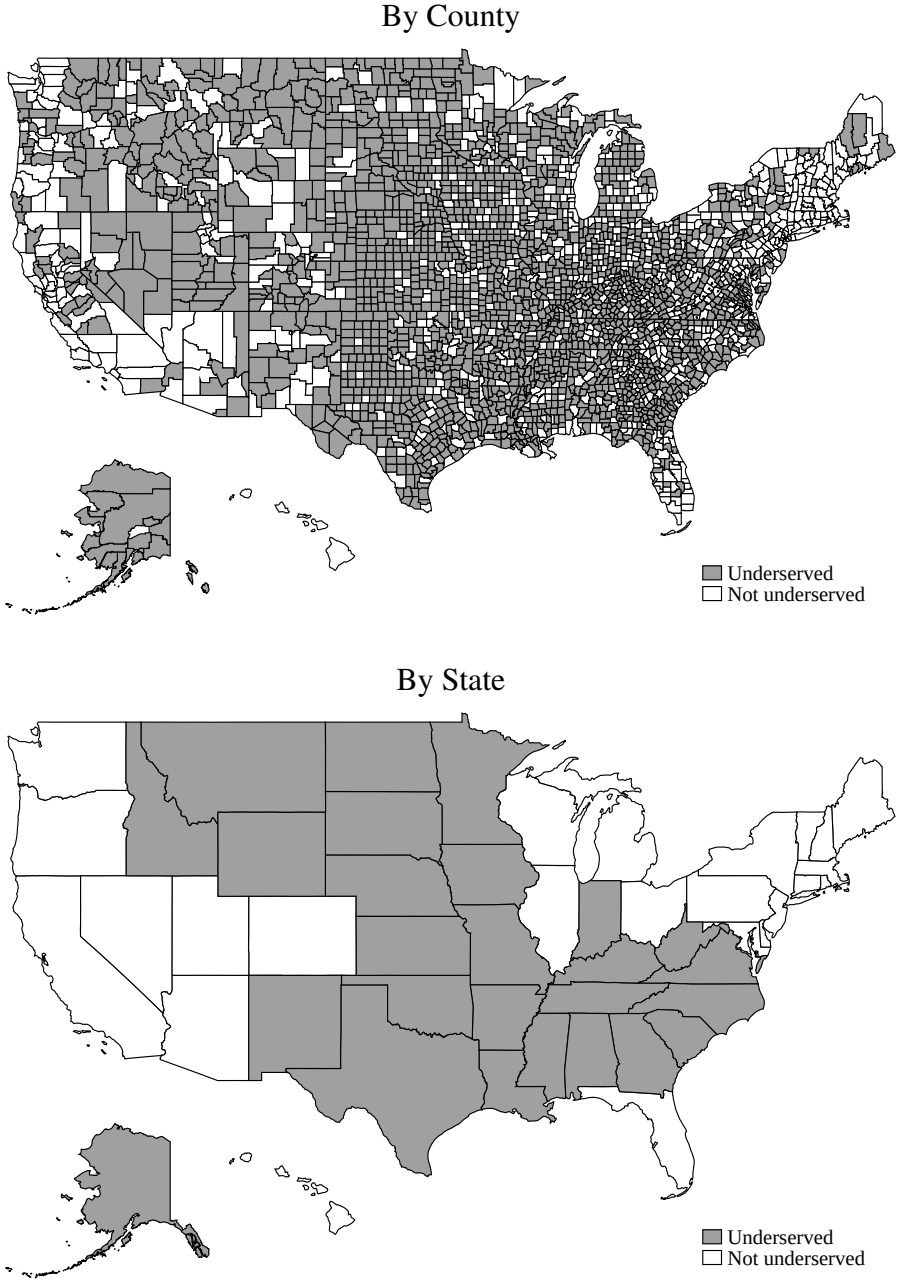
Increasing the supply of providers who can prescribe should have greater impacts in areas with an insufficient supply of such providers. According to the Health Resources and Services Administration (HRSA), an area is "underserved" for mental health care services if there is fewer than one psychiatrist for every 30,000 people. Using this definition, we identify underserved counties by combining county-level psychiatrist counts from the HRSA's Area Resource File in 1990 with county population estimates from the 1990 Census. We use the measure from the beginning of our sample to avoid introducing bias from changes to the supply of medical providers driven by changing scope of practice legislation (Xue et al., 2016).[13] Over our sample period, approximately 20% of the U.S. population lived in counties that were underserved for mental health care services.

The survey data outlined in Section 3.3.2 only provides us with the state, not the county, of

[12]While there is an association between allowing NPs to independently prescribe and Medicaid expansions and the legalization of medical marijuana, this correlation is driven by only a few states at the end of our panel. Notably, Minnesota legalized medical marijuana and extended independent prescriptive authority to NPs in 2014; dropping Minnesota or 2014 eliminates this association. Furthermore, three states (Connecticut, Kentucky, and Minnesota) extended independent prescriptive authority to NPs and expanded Medicaid in 2014; dropping these states or 2014 again eliminates the correlation. Since 2014 is at the tail end of our panel, all of our results are unsurprisingly robust to controlling for these law changes (see Panel B of Tables A.7 and Panel C of Table A.16). Furthermore, as shown in Tables A.11, A.12, A.19, and A.20, our results are robust to individually dropping each state, including those that expanded Medicaid, legalized medical marijuana, and extended independent prescriptive authority in 2014.

[13]Despite this concern, all of our results are robust to instead using a time-varying measure of the provision of mental health care resources (see Tables A.6 and A.15).

Figure 2: Areas Underserved for Mental Health Care Services: 1990



Notes: Following the definition provided by the HRSA, a county is "underserved" for mental health care services if the county has fewer than one psychiatrist per 30,000 people. We identify underserved counties by combining information on the number of psychiatrists per county from the HRSA's 1990 Area Resource File with county population estimates from the 1990 Census. A state is "underserved" for mental health care services if the population-weighted average of binary, underserved categorizations across all counties in that state is less than the median across all states in 1990.

respondents. We therefore also need a measure of how well-equipped each state is for mental health care services. To take into account the geographic distribution of resources within a state, we define a state as being "underserved" for mental health care services if the population-weighted average of binary, underserved categorizations across all counties in the state is less than the median across all states in 1990.[14] Figure 2 shows the geographic variation in underserved counties and states.

While we define an area as being underserved for mental health care resources by whether they have enough psychiatrists to serve the population, this characterization is an over-simplification of how mental health care is delivered in the United States. Psychiatrists are the only MDs specifically trained to treat mental illness, although in practice many general practitioners also provide treatment for mental illness (Kessler and Stafford, 2008). Despite overlap in the services provided by psychiatrists and general practitioners, we define areas as underserved for mental health care services using psychiatrist-to-population ratios for two reasons. First, the HRSA only defines mental health care shortage areas using the number of psychiatrists, so it is not clear which threshold would be appropriate to use if we were to consider counts of both psychiatrists and general practitioners. Second, in practice, defining shortage areas based on psychiatrist-to-population ratios also captures areas that are underserved by general practitioners; that is, areas defined as underserved by psychiatrists also have fewer general practitioners per capita (see Table 1). Therefore, we identify meaningful variation in the availability of mental health care providers by focusing on areas underserved by psychiatrists.

[14]We could alternatively define underserved at the state-level by applying the HRSA's definition to state-level psychiatrist-to-population ratios. Note that this is mathematically equivalent to applying the HRSA's definition to the population-weighted average of county-level psychiatrist-to-population ratios within a state. However, since cities tend be far from the HRSA's definition of underserved, and since cities have large populations, no state is considered underserved according to this measure. We therefore use the cut-off of above and below median to create a binary measure, although we show in Panel B of Table A.15 that our results are robust to instead using a continuous measure of underserved (population-weighted average of binary, underserved categorizations across all counties in the state; between zero and one).

3.3 Mental Health Outcomes

We identify the impact of independent prescriptive authority for NPs on population mental health using two complementary outcomes: mental-health-related mortality and self-reported days in poor mental health. For each outcome, we consider how extending independent prescriptive authority to NPs impacts both the local population as a whole and disadvantaged subpopulations who may find it particularly difficult to access physician-provided care.

3.3.1 Mental-Health-Related Mortality

Our first outcome is mental-health-related mortality at the county-quarter level from 1990–2014 from the U.S. Mortality Files. Here, we consider both suicides and a broader measure of "mental-health-related deaths," which combines suicides, injuries of undetermined intent, and accidental deaths involving poisonings, drownings, firearms, and trains.[15] The ICD-9 (1990-1999) and ICD-10 codes (2000-2014) we use to identify these causes of death are outlined in Table A.2.

We believe that the broad measure of mental-health-related mortality provides a more accurate picture of mortality caused by poor mental health rather than suicides alone for two reasons. First, geographic variation in reported suicides reflects both differences in true suicides and differences in cause-of-death reporting (Cooper and Milroy, 1995; Jougla et al., 2002; Phillips and Ruth, 1993; Rockett et al., 2010; Tollefsen et al., 2010; Whitt, 2006). When someone dies from an overdose of oxycodone, for example, the local coroner decides whether to label the death as a suicide or an accidental poisoning. Our broad measure of mental-health-related deaths captures both causes of death, whereas "suicides" only captures the former. Second, drug addiction is an increasingly important category of mental illness, and thus we are interested in drug-related deaths even if

[15] A large literature documents that injuries of undetermined intent and accidental deaths commonly obscure true suicide rates (see, for example, Bjorkenstam et al., 2014; Cooper and Milroy, 1995; Holding and Barraclough, 1977; Jougla et al., 2002; Kelleher et al., 1996; Lindqvist and Gustafsson, 2002; Maniam, 1995; Ohberg and Lonnqvist, 1998; Phillips and Ruth, 1993; Platt et al., 1988; Rockett and Smith, 1993; Rockett et al., 2006; Rockett et al., 2010; Rockett et al., 2010). On average over our sample period, 53.4% of mental-health-related deaths were suicides; 31.9% were accidental poisonings; 6.6% were injuries of undetermined intent; and 5.8%, 1.4%, and 1.1% were accidental deaths involving drownings, firearms, and trains, respectively.

suicide was not the individual's intent.[16]

The mortality files contain demographic information for the deceased individual. In particular, the deceased's county of residence, sex, race, age, and level of education are recorded. We use this information to determine both the total number of deaths at the county level as well as the number of deaths among subpopulations of interest. As the mortality files contain no information on the deceased's income, we use education as a proxy for socioeconomic status.

While the mortality files tell us the number of people who died, they provide us with no information on the size of the population base. When one area reports having more deaths than another, we cannot determine from the mortality files alone whether this is because the population is larger and the death rates are the same, or whether the location experienced a disproportionate number of deaths. To take into account the size of the relevant population, we combine the number of deaths at the county-quarter level with county-year population counts from the Census and the American Community Survey (ACS). For each year between 2007 and 2014, we take county-level population counts from the five-year pooled ACS surrounding that year (for example, we use the 2005-2009 ACS for county-level population counts in 2007). For 1990 to 2006, we linearly interpolate county-level population counts between the 1990 Census, the 2000 Census, and the 2005-2009 ACS.[17]

As shown in Table 1, counties in states that allow NPs to prescribe independently at some point during our sample period tend to be less densely populated and less racially diverse. However, both groups of counties have very similar unemployment rates and age profiles. Perhaps unsurprisingly, underserved counties are on average less densely populated, less educated, and more white than

[16]There is an extensive body of literature in medicine discussing the feedback between substance abuse disorders and other types of mental illness. Most prominently, the self-medication hypothesis posits that substance use disorders themselves can be driven by a desire to relieve the symptoms of other mental health problems, including anxiety disorders, depression, and post-traumatic stress disorder (Barkus and Murray, 2010; Khantzian, 1985, 1997; Nock et al., 2010; Regier et al., 1990).

[17]The Census only provides intercensal county-level population estimates across age, sex, race, and ethnic groups, while our analysis requires county-level population estimates for all of the subgroups that we consider. For example, we consider mental-health-related mortality among individuals with a high school degree or less, and the Census does not provide intercensal population estimates by education. We have compared our linearly interpolated estimates to the intercensal estimates from the Census where available, and the numbers are nearly identical. Our results are therefore robust to using the intercensal estimates when possible.

Table 1: Summary Statistics: County-Level Mortality and Controls, 1990–2014

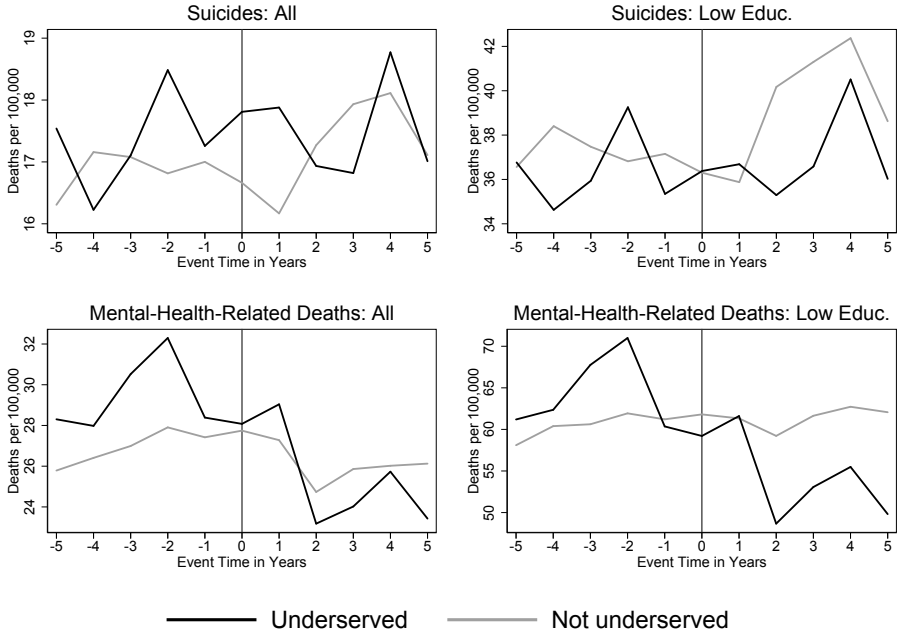
	All	Never Indep. Rx			Ever Indep. Rx		
		All	Not Underserved	Underserved	All	Not Underserved	Underserved
Deaths per 100,000:							
Suicides: total	3.32	3.11	2.98	3.54	4.13	4.11	4.17
Suicides: low educ.	6.56	6.03	5.88	6.41	8.48	8.94	8.59
Mental-health-related deaths: total	5.54	5.33	5.19	5.76	6.35	6.34	6.38
Mental-health-related deaths: low educ.	11.48	10.87	10.92	10.72	14.12	14.36	13.44
Indep. prescriptive authority	0.12	0.00	0.00	0.00	0.56	0.57	0.52
Underserved	0.23	0.23	0.00	1.00	0.23	0.00	1.00
Population	1,044,604	1,164,548	1,487,352	103,819	587,731	737,514	75,335
Population density (per mile^2)	2,104	2,463	3,148	212	735	916	114
Percent male	0.49	0.49	0.49	0.49	0.49	0.49	0.50
Percent white	0.75	0.73	0.71	0.83	0.81	0.78	0.88
Percent black	0.12	0.14	0.15	0.11	0.07	0.08	0.03
Percent age 18 and under	0.25	0.25	0.25	0.25	0.25	0.25	0.26
Percent age 65+	0.13	0.13	0.12	0.14	0.12	0.12	0.14
Percent high school or less	0.47	0.48	0.45	0.57	0.43	0.40	0.50
Median household income	54,032	53,644	55,952	46,063	55,509	57,135	49,947
Percent in poverty	0.28	0.29	0.29	0.29	0.27	0.27	0.27
Percent unemployed	0.06	0.06	0.06	0.06	0.06	0.06	0.05
Psychiatrists per 100,000	11.88	11.92	14.77	2.56	11.72	14.35	2.72
Primary care MDs/DOs per 100,000	96.02	96.22	108.69	55.38	95.24	105.30	60.92
Observations	313,372	221,880	65,800	156,080	91,492	26,300	65,192

Notes: Observations are at the county-quarter level. Statistics are weighted by population. "Mental-health-related deaths" include suicides, injuries of undetermined intent, and accidental deaths involving poisonings, drownings, firearms, and trains. "Ever (Never) Indep. Rx" includes counties that had independent prescriptive authority for NPs at some point (at no point) during our sample. "(Not) Underserved" reflects whether a county was underserved for mental health care services in 1990. "Low educ." is defined as having a high school degree or less. Mortality statistics come from the U.S. Mortality Files, provider counts come from the HRSA's Area Resource Files, and all other variables come from the Census and the five-year pooled American Community Surveys (ACS). Census and ACS variables are linearly interpolated at the county-year level for years not available.

counties with adequate mental health care resources.

Before proceeding to a formal difference-in-difference analysis, we first examine mortality patterns in the raw data. Figure 3 shows unadjusted mental-health-related mortality rates at the county-year level in event time around the year in which states grant NPs independent prescriptive authority. We plot death rates separately for counties that are and are not underserved for mental heath care services and separately for the whole population and among individuals with a high school degree or less. Suicide rates are fairly noisy, likely due both to low incidence and to differences in how suspected suicides are reported across counties and over time (Cooper and Milroy, 1995; Phillips and Ruth, 1993; Rockett et al., 2010; Whitt, 2006). However, there is a clear pattern of decreased mental-health-related deaths after states allow NPs to prescribe independently. These decreases are more pronounced in underserved counties and are the largest among individuals with a high school degree or less who live in these underserved areas. Furthermore, there is no evidence of pre-trends in mortality before the law changes.

Figure 3: Raw Data: Independent Prescriptive Authority and Mental-Health-Related Mortality



Notes: Observations are at the county-year level and are population weighted. "Mental-Health-Related Deaths" includes suicides, injuries of undetermined intent, and accidental deaths involving poisonings, drownings, firearms, and trains. A county is "underserved" if it had fewer than one psychiatrist per 30,000 people in 1990. "Low educ." is defined as having a high school degree or less.

3.3.2 Self-Reported Mental Health

Our second outcome is the number of days in the past month that a person reports being in poor mental health. This measure comes from the Behavioral Risk Factor Surveillance System survey (BRFSS)—a large, annual phone survey that collects information on health-related risk behaviors, chronic health conditions, and use of preventive services in the United States. The BRFSS is representative at the state-year level. Starting in 1993 and in most state-years during our sample period, respondents were asked the following question:[18]

> "Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?"

This question is not designed to draw a particular mental health diagnosis, but rather to indicate whether a respondent experiences any symptoms associated with a wide range of mental health conditions. Importantly, responses are elicited from those with both diagnosed and undiagnosed mental illnesses, as respondents are not asked whether they have ever been diagnosed with a mental illness by a doctor.

We consider as outcome variables both the number of days reported in poor mental health and an indicator for whether the respondent reported having spent at least 21 of the past 30 days in poor mental health. According to the Diagnostic and Statistical Manual of Mental Disorders, 5th Edition (DSM-5), to be diagnosed with a major depressive episode a patient must have either "a depressed mood most of the day, nearly every day" or "a markedly diminished interest or pleasure in all, or almost all, activities most of the day, nearly every day" for two consecutive weeks. In addition to major depressive disorder, the diagnostic criteria for many mental health conditions include

[18]The BRFSS did not ask this question in Wyoming in 1993, Rhode Island in 1994, Washington D.C. in 1995, 29 states in 2002 (Alabama, Arkansas, Arizona, Colorado, Connecticut, Washington D.C., Delaware, Florida, Georgia, Indiana, Louisiana, Massachusetts, Maryland, Maine, Michigan, Mississippi, Montana, North Dakota, Nebraska, New Hampshire, Nevada, Ohio, Oklahoma, Pennsylvania, South Dakota, Tennessee, Vermont, Wisconsin, West Virginia), and Hawaii in 2004. These missing state-years correspond to 3.08% of state-year observations representing 2.26% of the population. The missing state-years do not correspond to the year before, the year of, or the year after a relevant law change for any state, and thus our identification is not directly affected.

Table 2: Summary Statistics: Self-Reported Mental Health and Controls, 1993–2015

	All	Never Indep. Rx			Ever Indep. Rx		
		All	Not Underserved	Underserved	All	Not Underserved	Underserved
Days in poor mental health:							
All: average	3.36	3.39	3.39	3.40	3.26	3.25	3.27
All: percent 0	0.66	0.67	0.66	0.69	0.66	0.66	0.67
All: percent ≥ 21	0.06	0.06	0.06	0.06	0.05	0.05	0.06
Low educ: average	3.91	3.93	3.90	3.99	3.82	3.83	3.81
Low educ: percent 0	0.67	0.66	0.66	0.68	0.67	0.66	0.69
Low educ: percent ≥ 21	0.07	0.07	0.07	0.08	0.07	0.07	0.08
Indep. prescriptive authority	0.13	0.00	0.00	0.00	0.61	0.66	0.52
Underserved	0.38	0.40	0.14	1.00	0.33	0.00	1.00
Male	0.48	0.48	0.48	0.48	0.49	0.49	0.49
White	0.70	0.68	0.66	0.74	0.78	0.74	0.86
Black	0.10	0.11	0.09	0.17	0.05	0.07	0.03
Hispanic	0.13	0.14	0.18	0.04	0.09	0.10	0.07
Health insurance	0.85	0.84	0.84	0.84	0.86	0.86	0.87
Married	0.58	0.57	0.56	0.59	0.59	0.58	0.62
Age: 18 to 34	0.31	0.31	0.31	0.32	0.31	0.31	0.31
Age: 35 to 44	0.20	0.20	0.20	0.20	0.20	0.20	0.19
Age: 45 to 54	0.18	0.18	0.18	0.18	0.18	0.18	0.18
Age: 55 to 64	0.13	0.13	0.13	0.14	0.14	0.14	0.14
Age: 65+	0.17	0.17	0.17	0.17	0.17	0.17	0.18
Education: high school or less	0.43	0.44	0.43	0.47	0.39	0.38	0.43
Education: college or more	0.29	0.29	0.30	0.26	0.31	0.32	0.27
Income: 1st quintile	0.20	0.21	0.21	0.20	0.17	0.16	0.19
Income: 2nd quintile	0.18	0.18	0.17	0.19	0.17	0.17	0.18
Income: 3rd quintile	0.17	0.17	0.17	0.17	0.18	0.17	0.18
Income: 4th quintile	0.18	0.18	0.19	0.17	0.19	0.20	0.19
Income: 5th quintile	0.14	0.13	0.14	0.12	0.15	0.16	0.13
Employment: for wages	0.52	0.52	0.51	0.52	0.53	0.53	0.53
Employment: self-employed	0.08	0.08	0.08	0.08	0.09	0.09	0.09
Employment: out of work	0.10	0.11	0.10	0.11	0.09	0.09	0.09
Employment: homemaker	0.08	0.08	0.08	0.07	0.07	0.07	0.07
Employment: student	0.05	0.05	0.05	0.04	0.05	0.05	0.05
Employment: retired	0.16	0.16	0.16	0.17	0.17	0.17	0.17
Observations	6,545,759	3,567,713	1,775,802	1,791,911	2,978,046	1,774,188	1,203,858

Notes: Observations are at the individual level. Statistics are weighted using BRFSS sample weights. "Ever (Never) Indep. Rx" includes respondents living in states that had independent prescriptive authority for NPs at some point (at no point) during our sample period. "(Not) Underserved" reflects whether respondents are living in states that were underserved for mental health care services in 1990. "Low educ." is defined as having a high school degree or less. Some categorical variables do not sum to one; the difference reflects the percentage of missings.

extended time periods over which symptoms must be experienced in order for the diagnosis to apply. Thus, a binary variable denoting individuals who experienced prolonged symptoms allows us to identify people who may be suffering from a more severe mental illness.

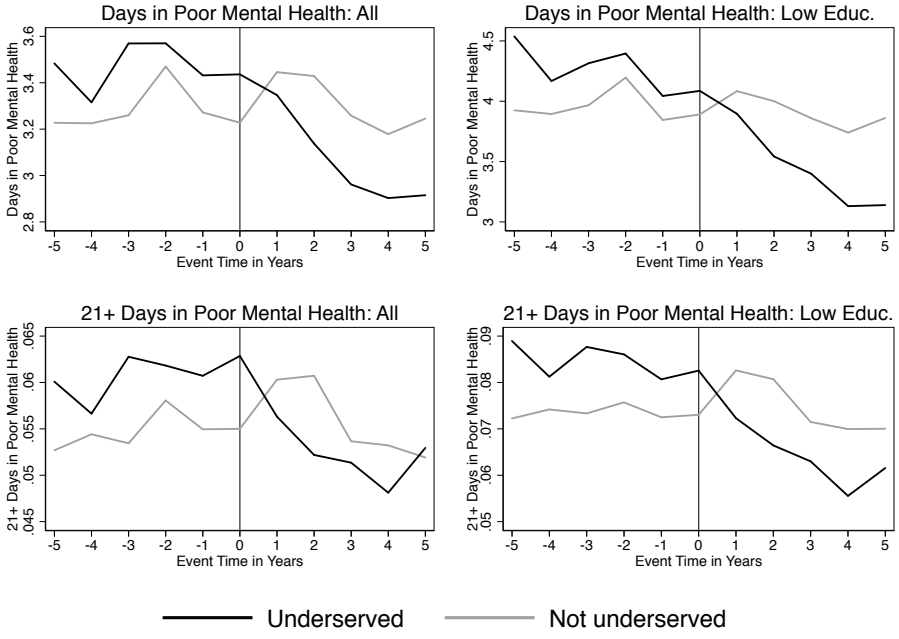
In addition to self-reported mental health, the BRFSS includes information on each respondent's sex, race, ethnicity, age, education, income, and employment and health insurance status. These variables allow us to separately consider disadvantaged populations and to control for underlying differences across respondents in our analysis.

As shown in Table 2, BRFSS respondents report spending an average of 3.36 days in the past month in poor mental health, with 66% of respondents reporting no days in poor mental health and 6% of respondents reporting at least 21 days in poor mental health. Similar to the pattern observed in Table 1, survey respondents in states that ever had independent prescriptive authority during our sample have similar age and employment profiles, although states that grant independent prescriptive authority over our sample period are less racially diverse, more educated, and have higher income profiles. As with counties, states that are underserved for mental health care services are more white and less educated than states with a sufficient provision of mental health care resources.

As in Section 3.3.1, we examine trends in self-reported health in the raw data before proceeding to a formal difference-in-difference analysis. Figure 4 shows unadjusted self-reported mental health at the individual level in event time around the year in which states grant NPs independent prescriptive authority. We plot self-reported mental health separately for states that are and are not underserved for mental heath care services and separately for the whole population and among individuals with a high school degree or less. The figures suggest that self-reported mental health improves when states grant NPs independent prescriptive authority. The patterns in these improvements follow those observed for mental-health-related mortality in Figure 3: across both measures of self-reported mental health, those living in underserved states report both higher initial levels of poor mental health and larger decreases following broadened scope of practice legislation. Notably, individuals with low levels of education have worse average baseline mental health and

experience the largest improvements when independent prescriptive authority is extended to NPs.

Figure 4: Raw Data: Independent Prescriptive Authority and Self-Reported Mental Health



Notes: Observations are at the individual level and are weighted using the BRFSS sample weights. A state is "underserved" if the population-weighted average of binary, underserved categorizations across all counties in the state is less than the median across all states in 1990. "Low educ." is defined as having a high school degree or less.

3.4 Prescription Data

Finally, to examine how extending independent prescriptive authority to NPs influences the number of prescriptions, we use the IQVIA Xponent database. Our version of the database contains the near universe of antidepressant, antipsychotic, and opioid prescriptions filled at U.S. retail pharmacies between 2006 and 2014 and allows us to construct prescription measures at the county-year level. The database further contains information on how a patient paid for their prescription, allowing us to stratify by payment type: Medicaid, third party, and cash. This is particularly important given that the predicted impacts of expanded scope of practice legislation are largest for populations that traditionally find it difficult to access physician-provided care, such as Medicaid beneficiaries (Buerhaus et al., 2015; Everett et al., 2009; Grumbach et al., 2003).

While rich, this data requires us to use a restricted time span: in contrast to the outcome mea-

sures introduced in Sections 3.3 that are available from either 1990 or 1993 onward, we only have the prescription data from 2006. However, nine states granted independent prescriptive authority to NPs during this time frame—Colorado, Connecticut, Hawaii, Kentucky, Maryland, Minnesota, Nevada, North Dakota, and Rhode Island—so there is limited but nonetheless meaningful variation that we can exploit (see Table A.1).

While the IQVIA data tells us the number of prescriptions filled within each county, it does not include information on the size of the relevant population base. To account for local population from 2007-2014, we again take county-level population counts from the five-year pooled ACS surrounding each year; county-level population counts for 2006 are linearly interpolated between the 2000 Census and the 2005-2009 five-year pooled ACS. When considering annual prescriptions paid for by Medicaid within a county, we apply an analogous methodology to estimates of county-level Medicaid eligibles from the ARF.

We focus on antidepressants and antipsychotics as two representative classes of pharmaceuticals used to treat mental illness.[19] These medications are widely used: as shown in Table 3, 0.67 antidepressants and 0.12 antipsychotics per capita were filled on average in each year between 2006 and 2014.[20] These medications are also commonly prescribed by NPs, with 8% of antidepressant and 10% of antipsychotic prescriptions being written by NPs.

In addition to antidepressants and antipsychotics, we further examine whether extending independent prescriptive authority to NPs leads to increases in the number of opioid prescriptions—a class of drugs with a high potential for abuse and addiction (SAMHSA, 2014). We note, however, that the market for opioids experienced many changes between 2006 and 2014, including a range

[19] Antidepressants have a wide range of indications, including depressive, anxiety, and panic disorders (Wong et al., 2017). Antipsychotics are used primarily to manage psychosis and are most frequently used for schizophrenia and bipolar disorder. While antipsychotics are much less commonly prescribed than antidepressants, they are relatively more important for low-income populations (23% of antipsychotics are covered by Medicaid compared to just 7% of antidepressants; see Table 3).

[20] Antidepressants are one of the most commonly prescribed classes of pharmaceuticals, and the largest class used to treat mental illness. While it has been argued that medications such as antidepressants are overprescribed (see, for example, Frances, 2011), this does not preclude the possibility that they are underprescribed for populations with limited access to providers. Furthermore, if extending independent prescriptive authority to NPs increases rates of overprescription, and overprescription leads to worse health outcomes among affected populations, our estimates will include these potentially offsetting effects of the policy.

of state-level policies aimed at limiting prescribing and curbing abuse (Meara et al., 2016). As these changes may coincide with the changes in scope of practice legislation that we consider, we interpret the results involving opioids with caution.[21]

While the data is sufficiently detailed to allow us to examine the number of prescriptions written by physicians and NPs separately, we believe that the total number of prescriptions most accurately reflects changes in prescription patterns associated with expanded prescriptive authority for two reasons. First, we want to capture the net effect of broadened scope of practice legislation on prescription patterns. If people switch from a physician to an NP when NPs are granted independent prescriptive authority but still receive the same prescription, we would not want to claim that the law change resulted in improved access to pharmaceuticals. Second, there are technical issues that arise when attributing prescriptions to different types of providers. When NPs have a collaborative or supervisory relationship with a physician, the prescription pad used by the NP may bear either the NP's name and national provider identifier (NPI) or a combination of the affiliated physician and NP's information.[22] If NPs obtain their own prescription pads when they gain independent prescriptive authority, we would observe a mechanical shift in the number of prescriptions from MDs to NPs in the absence of any true change in the providers writing prescriptions.

Figure 5 shows unadjusted prescriptions per capita for antidepressants, antipsychotics, and opioids at the county-year level in event time around the year in which states grant NPs independent prescriptive authority. This analysis is done separately for counties that are and are not underserved for mental heath care services and separately for all prescriptions and those paid for by Medicaid. The top panel of Figure 5 suggests that there are no noticeable changes in prescriptions

[21] Using data on state-level implementation of prescription drug monitoring programs (PDMPs) from Doleac and Mukherjee (2018), we verify that there is no association between PDMP implementation and laws extending independent prescriptive authority to NPs between 2006 and 2014 (see Table A.3).

[22] In states that require NPs to maintain collaborative or supervisory agreements in order to prescribe, legislation dictating whose information must be on prescription orders and labels differs from state to state. For example, while NPs in Florida are required to maintain a written collaborative agreement for prescriptive authority, prescribing NPs must use their own prescription pad and their name must appear on the prescription label. In contrast, while Kansas requires NPs to maintain a written protocol authorized by a physician in order to prescribe, both the name of NP and the name of the collaborating physician must appear on both the prescription pad and the prescription label. Skillman et al. (2012) estimate that only 76% of NPs had an NPI in 2010, providing an upper bound for the percent of NPs who could have a prescription pad bearing only their name.

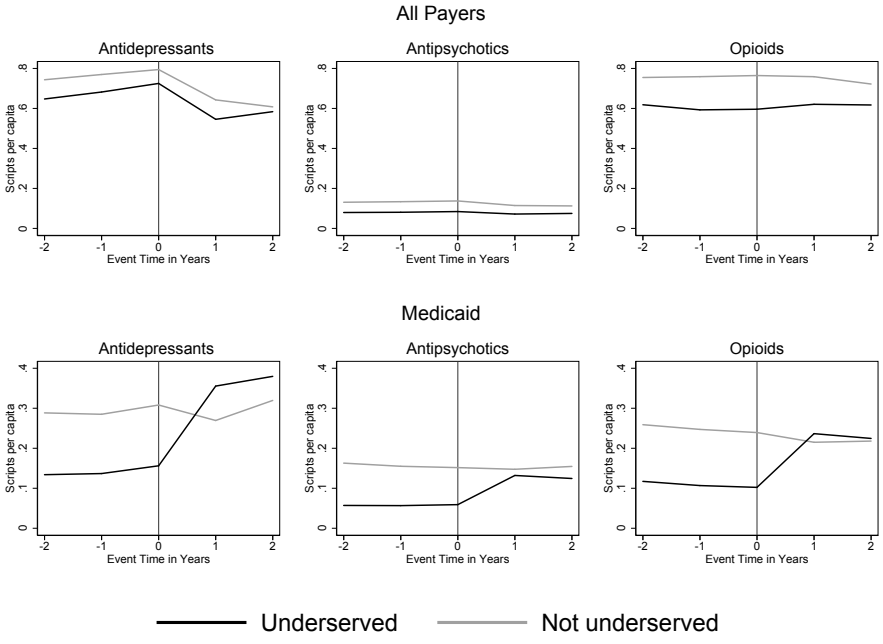
Table 3: Summary Statistics: County-Level Prescriptions, 2006–2014

	All	Never Indep. Rx			Ever Indep. Rx		
		All	Not Underserved	Underserved	All	Not Underserved	Underserved
Antidepressants							
Annual Rx (100,000s)	5.99	6.31	7.76	0.67	4.78	5.77	0.73
Rx per capita	0.67	0.65	0.70	0.50	0.73	0.77	0.55
Percent from MDs	0.88	0.90	0.92	0.86	0.80	0.82	0.75
Percent from NPs	0.08	0.06	0.06	0.09	0.13	0.13	0.15
Medicaid							
Percent of total	0.07	0.07	0.07	0.09	0.08	0.08	0.09
Percent from MDs	0.85	0.88	0.88	0.84	0.74	0.75	0.72
Percent from NPs	0.11	0.09	0.08	0.11	0.19	0.19	0.18
Commercial							
Percent of total	0.86	0.86	0.87	0.83	0.85	0.85	0.82
Percent from MDs	0.89	0.91	0.92	0.87	0.81	0.82	0.76
Percent from NPs	0.07	0.06	0.05	0.09	0.12	0.12	0.14
Antipsychotics							
Annual Rx (100,000s)	1.20	1.31	1.62	0.10	0.80	0.96	0.13
Rx per capita	0.12	0.12	0.13	0.07	0.11	0.12	0.08
Percent from MDs	0.88	0.90	0.91	0.88	0.77	0.78	0.74
Percent from NPs	0.10	0.08	0.07	0.09	0.19	0.19	0.19
Medicaid							
Percent of total	0.23	0.23	0.23	0.24	0.22	0.22	0.23
Percent from MDs	0.86	0.89	0.90	0.86	0.75	0.75	0.73
Percent from NPs	0.11	0.09	0.08	0.10	0.21	0.21	0.20
Commercial							
Percent of total	0.73	0.73	0.73	0.72	0.73	0.74	0.72
Percent from MDs	0.88	0.91	0.92	0.88	0.78	0.79	0.75
Percent from NPs	0.09	0.07	0.07	0.08	0.18	0.18	0.18
Opioids							
Annual Rx (100,000s)	6.54	6.88	8.44	0.80	5.29	6.38	0.86
Rx per capita	0.74	0.74	0.78	0.59	0.74	0.78	0.59
Percent from MDs	0.80	0.81	0.82	0.80	0.74	0.74	0.73
Percent from NPs	0.05	0.04	0.03	0.05	0.07	0.07	0.08
Medicaid							
Percent of total	0.07	0.07	0.07	0.09	0.07	0.07	0.08
Percent from MDs	0.78	0.80	0.80	0.79	0.72	0.71	0.72
Percent from NPs	0.06	0.05	0.04	0.06	0.09	0.08	0.09
Commercial							
Percent of total	0.81	0.81	0.82	0.77	0.82	0.83	0.79
Percent from MDs	0.81	0.82	0.83	0.81	0.75	0.75	0.74
Percent from NPs	0.04	0.04	0.03	0.05	0.07	0.07	0.08

Notes: Observations are at the county-year level. Statistics are weighted by population. "Ever (Never) Indep. Rx" includes counties that had independent prescriptive authority for NPs at some point (at no point) during our sample. "(Not) Underserved" reflects whether a county was underserved for mental health care services in 2000. The percentage of prescriptions written by physicians and NPs does not sum to one; the remaining prescriptions are written by other providers such as dentists and physician assistants.

per capita when NPs gain independent prescriptive authority. However, this null effect across all payers masks increases among Medicaid beneficiaries: as shown in the second panel of Figure 5, prescriptions per capita covered by Medicaid increase when independent prescriptive authority is extended to NPs. In line with the patterns observed for mental health outcomes in Figures 3 and 4, increases in prescriptions covered by Medicaid are larger in counties that are underserved for mental health care resources. Notably, underserved areas have lower baseline prescriptions across all three drug classes. If there are decreasing marginal returns to prescriptions, these level differences will result in the marginal patient who receives a prescription in an underserved county to experience larger health benefits than the marginal patient who receives a prescription in a county with a sufficient provision of mental health care resources.

Figure 5: Raw Data: Independent Prescriptive Authority and Prescriptions per Capita



Notes: Observations are at the county-year level and are population weighted. "All payers" scripts per capita are total prescriptions divided by total population; "Medicaid" scripts per capita are prescriptions paid for by Medicaid divided by Medicaid eligibles. A county is "underserved" if it had fewer than one psychiatrist per 30,000 people in 2000.

4 Prescriptive Authority and Mental Health Outcomes

To identify whether extending independent prescriptive authority to NPs improves population mental health, we exploit time-series variation in state-level scope of practice legislation and mental health outcomes using a difference-in-difference framework. As described in Section 3.3, we consider two categories of mental health outcomes: mental-health-related mortality and self-reported days in poor mental health. The impact of independent prescriptive authority on each category of outcomes is considered in turn below.

4.1 Mental-Health-Related Mortality

Does the prevalence of suicides and other mental-health-related deaths change when NPs are allowed to independently prescribe? Letting $Deaths_{cqy}$ denote either of these outcomes in county c in quarter q of year y, we estimate the following equation:

$$Deaths_{cqy} = \beta_0 + \beta_1 Indep.\, Rx_{sqy} + \beta_2 Pop_{cy} + \beta_3 X_{cy} + \gamma_c + \gamma_q + \gamma_y + \epsilon_{cqy} \tag{1}$$

where $Indep.Rx_{sqy}$ is an indicator denoting whether NPs had independent prescriptive authority in state s in quarter q of year y; Pop_{cy} is the population of county c in year y; X_{cy} is a vector of other county-year controls;[23] and λ_c, λ_q, and λ_y are county, quarter, and year fixed effects, respectively. In all of our analyses in this section, standard errors are clustered by state and observations are weighted by population.[24]

To avoid introducing measurement error into the outcome, our preferred specification uses the number of deaths in a county-quarter as the dependent variable and includes a control for the corresponding population estimate on the right-hand side. While one could use county-level death rates as the dependent variable, death rates are very sensitive to population counts, and precise

[23] County-year controls include population density, percent male, percent black, percent age 18 and under, percent age 65 and over, percent with a high school degree or less, a quadratic in median income, percent in poverty, percent unemployed, and the number of practicing psychiatrists and primary care physicians per 100,000. See Table A.7 for results from a specification that excludes controls.

[24] Refer to Table A.8 for results from unweighted specifications.

county-level population estimates are only available every ten years.[25]

Increasing the supply of providers who can prescribe medication should impact mental-health-related mortality most for populations living in areas with an insufficient supply of prescribing providers and for populations who find it more difficult to access physician-provided care. To allow the impact of changing scope of practice legislation to differentially influence mental health in counties with an under-provision of mental health care services, we estimate the following equation:

$$\begin{aligned} Deaths_{cqy} = \beta_0 + \beta_1 Indep.\ Rx_{sqy} + \beta_2 Indep.\ Rx_{sqy} \cdot Underserved_c \\ + \beta_3 Pop_{cy} + \beta_4 X_{cy} + \gamma_c + \gamma_q + \gamma_y + \epsilon_{cqy} \end{aligned} \tag{2}$$

where $Underserved_c$ is an indicator that equals one if county c was underserved for mental health care services in 1990 and zero otherwise, and all other variables are defined as in Equation (1). To look specifically at disadvantaged populations, we further estimate Equation (2) separately for different demographic groups. Results for individuals with low levels of education are provided with the main results below; refer to Table A.5 for results for additional subpopulations.

Estimates from Equations (1) and (2) are provided in Table 4. As shown in Columns (1) and (4), on average there is no statistically significant effect of granting independent prescriptive authority to NPs on mental-health-related mortality across all counties. However, counties that are underserved for mental health care services experience larger and more precisely estimated decreases in mortality when NPs can prescribe independently. As shown in Column (5), underserved counties experience a reduction of 5.83 mental-health-related deaths per quarter, or 11% of the mean, when independent prescriptive authority is extended to NPs. While underserved counties also experience reductions in suicides relative to counties with an adequate provision of mental health care resources (Column (2)), suicides are—as expected—noisier than our broader measure of mental-health-related deaths.

[25] Refer to Table A.9 for results using mortality rates per 100,000 as the dependent variable.

Table 4: Independent Prescriptive Authority and Mental-Health-Related Mortality

	Suicides			Mental-Health-Related Deaths		
	(1)	(2)	(3)	(4)	(5)	(6)
	Full Sample	Full Sample	Low Educ.	Full Sample	Full Sample	Low Educ.
Indep. prescriptive authority	0.122	0.561	0.784*	-1.697	-0.438	0.182
	(0.983)	(1.019)	(0.421)	(1.880)	(1.985)	(1.058)
Indep. Rx * underserved		-1.877*	-1.415***		-5.387***	-3.403***
		(0.965)	(0.391)		(1.923)	(1.217)
Observations	313,372	313,372	313,372	313,372	313,372	313,372
R^2	0.969	0.969	0.950	0.971	0.971	0.957
Mean dependent variable	28.59	28.59	14.89	51.48	51.48	29.05
$\beta_1 + \beta_2$		-1.316	-0.630		-5.825**	-3.221***
P-value (F-test: $\beta_1 + \beta_2 = 0$)		0.300	0.170		0.013	0.006

Notes: Observations are at the county-quarter level and are population weighted. Standard errors are clustered by state. All regressions include county, quarter, and year fixed effects; additional controls include total population (or subgroup population), population density, percent male, percent black, percent age 18 and under, percent age 65 and over, percent with a high school degree or less, a quadratic in median income, percent in poverty, percent unemployed, and the number of practicing psychiatrists and primary care physicians per 100,000. A county is "underserved" if it had fewer than one psychiatrist per 30,000 people in 1990. "Low educ." is defined as having a high school degree or less. Refer to Table A.4 for the full regression results.

Columns (3) and (6) consider the effects of allowing NPs to prescribe independently on mental-health-related mortality among individuals with a high school degree or less. As in the general population, the effects are concentrated among residents of underserved counties. Looking to Column (6), we see that allowing NPs to prescribe independently leads to 3.2 fewer mental-health-related deaths per quarter, or 11% of the mean, among individuals with low levels of education residing in underserved counties. The results are again noisier when considering suicides in isolation, although Column (3) provides suggestive evidence that suicides decline among the most disadvantaged populations when NPs can prescribe independently. Given that suicides and mental-health-related deaths are quite rare, there is likely more noise when we restrict our sample to individuals with low education. It is therefore notable that we identify effects of comparable magnitudes despite these measurement concerns.

The results presented in Table 4 are robust to a wide range of alternative specifications and variable definitions. While a county is considered underserved in Table 4 if it had fewer than one

psychiatrist per 100,000 in 1990, Table A.6 demonstrates that our results are robust to using a time-varying measure of underserved. Panel A of Table A.7 provides results from a specification that excludes county-year controls; as we include county fixed effects, and many county-level characteristics do not change over time, our results are robust to altering the set of controls included. Panel B of A.7 demonstrates that our results are robust to controlling for state unemployment rates, state beer taxes, and indicators denoting whether the state requires universal background checks and waiting periods for handgun and firearm purchases, expanded Medicaid, allows medical marijuana, allows recreational marijuana, implemented a prescription drug monitoring program (PDMP), and implemented a "must-access" PDMP. Furthermore, while all regressions are weighted by population in Table 4, Table A.8 reports results from unweighted specifications. As the law changes have the largest impacts in less populous counties, the effects of extending prescriptive authority to NPs are more precisely estimated in the unweighted regressions. Table A.9 shows that the results are attenuated and less precise but qualitatively robust to using mortality rates per 100,000 as the dependent variable in unweighted regressions,[26] and Table A.10 shows that the results are robust to the inclusion of state-level linear time trends. Finally, the results presented in Table 4 are not driven by any one particular state. Tables A.11 and A.12 show that the estimates are robust to separately dropping each state that extended independent prescriptive authority to NPs over our sample period.

To verify the parallel trends assumption and to examine the time path of effects, we estimate event study specifications. In particular, we estimate a version of Equation (1) that includes indicators denoting each of the three years before, the year of, and each of five years after a law change in place of the post indicator. Letting $Deaths_{cy}$ denote the number of deaths in county c in year y, we estimate the following equation:

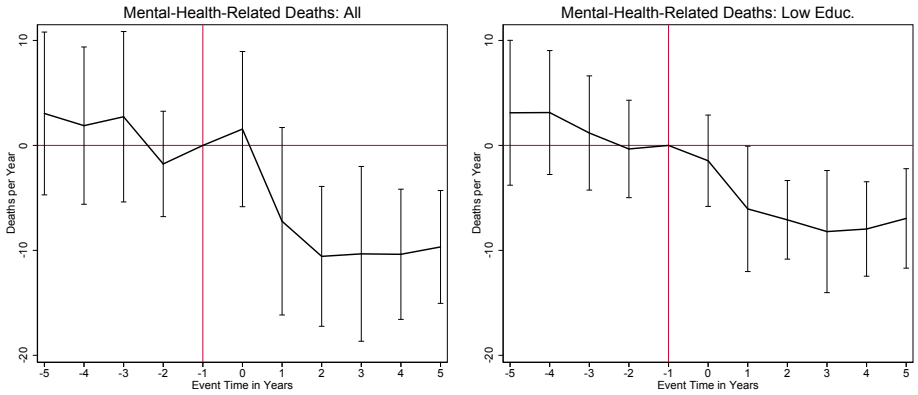
$$Deaths_{cy} = \beta_0 + \sum_{n \in \{-3,5\} \setminus -1} \alpha_n \mathbb{1}\left\{y_s^* + n = y\right\} + \beta_1 Pop_{cy} + \beta_2 X_{cy} + \gamma_c + \gamma_y + \epsilon_{cy} \quad (3)$$

[26] Weighting by population has a greater effect on the estimates when the outcome variable is in rates than in levels. We note, however, that the pattern of effects is very comparable across the unweighted specifications in Table A.8 (mortality levels) and Table A.9 (mortality rates per 100,000).

where y_s^* denotes the year of the law change extending independent prescriptive authority to NPs in state s, $\mathbb{1}\{y_s^* + n = y\}$ is an indicator denoting whether an observation is n years from the law change, and all other variables are defined as in Equation (1).

Figure 6 presents the α coefficients and 95% confidence intervals from estimation of Equation (3) with mental-health-related mortality as the dependent variable. The left panel includes mental-health-related mortality among the entire population, while the right panel focusses only on individuals with low levels of education. In both panels, we see that there is no statistically significant difference in mental-health-related mortality in the years before independent prescriptive authority is granted to NPs. Following the law change, however, we see that mental-health-related mortality significantly decreases. These effects appear in the first year that is fully treated (the first year following the law change) and persist over time.

Figure 6: Event Time: Independent Prescriptive Authority and Mental-Health-Related Mortality



Notes: Observations are at the county-year level and are population weighted. Standard errors are clustered by state. All regressions include county and year fixed effects; additional controls include total population (or subgroup population), population density, percent male, percent black, percent age 18 and under, percent age 65 and over, percent with a high school degree or less, a quadratic in median income, percent in poverty, percent unemployed, and the number of practicing psychiatrists and primary care physicians per 100,000. "Low educ." is defined as having a high school degree or less. The panel is unbalanced, years before and after the event time window are included using separate indicators, and zero denotes the year of the law change.

4.2 Self-Reported Mental Health

In Section 4.1 we found that allowing NPs to prescribe independently leads to significant reductions in mental-health-related mortality. As mortality is an extreme outcome, we next ask whether

extending independent prescriptive authority to NPs leads to improvements in the mental health of individuals on a day-to-day basis. As described in Section 3.3.2, we consider both the number of days in the past month individuals report being in poor mental health as well as a binary variable which equals one if the individual reports having spent at least three weeks in poor mental health and zero otherwise. Letting $Poor\,Mental\,Health_{isy}$ denote either of these outcomes for individual i in state s in year y, we estimate the following equation:

$$Poor\ Mental\ Health_{isy} = \beta_0 + \beta_1 Indep.\ Rx_{sy} + \beta_2 X_{isy} + \gamma_s + \gamma_y + \epsilon_{isy} \tag{4}$$

where $Indep.\ Rx_{sy}$ is an indicator denoting whether NPs had independent prescriptive authority in state s in year y; X_{isy} is a vector of individual-level controls;[27] and γ_s and γ_y are state and year fixed effects, respectively. We define a state as having independent prescriptive authority in a given year if NPs had the legislative authority to prescribe independently at any point within the year; all of our results are robust to alternative timing assumptions. In all of our analyses in this section, standard errors are clustered by state and observations are weighted using the BRFSS sample weights.[28]

As before, we examine whether extending independent prescriptive authority to NPs has differential impacts on the mental health of individuals living in states with an under-provision of mental health care services and among disadvantaged populations. Letting $Underserved_s$ be an indicator that equals one if state s was less equipped for mental health care services in 1990 and zero otherwise, we estimate the following equation:

$$\begin{aligned} Poor\ Mental\ Health_{isy} = \beta_0 + \beta_1 Indep.\ Rx_{sy} + \beta_2 Indep.\ Rx_{sy} \cdot Underserved_s \\ + \beta_3 X_{isy} + \gamma_s + \gamma_y + \epsilon_{isy} \end{aligned} \tag{5}$$

[27] Individual-level controls include indicators for age groups, education groups, income quintiles, and employment status and indicators denoting whether the respondent is male, white, black, Hispanic, married, and has health insurance. See Table A.16 for results from specifications that include alternative sets of controls.

[28] Refer to Table A.17 for results using BRFSS sample weights that have been adjusted to account for the 2011 redesign of the survey (Simon et al., 2017).

where all other variables are defined as in Equation (4). To look specifically at disadvantaged populations, we further estimate Equation (5) separately for different subpopulations of interest. Results for individuals with low levels of education are provided with the main results below; refer to Table A.14 for results for other subpopulations.

Table 5 presents estimates from Equations (4) and (5). Looking first to Column (1), we see that respondents report having spent 0.17 fewer days in poor mental health when NPs are allowed to prescribe—a reduction of 5% relative to the mean. As with mental-health-related mortality, Column (2) demonstrates that the benefits are concentrated among respondents in areas that are less equipped for mental health care services. For respondents in underserved states, allowing NPs to prescribe independently leads to an overall reduction of 0.29 days in poor mental health, or an additional reduction of 0.17 fewer days in poor mental health relative to states with adequate mental health care resources. Finally, we find that the most disadvantaged populations—individuals with low levels of education living in areas underserved by psychiatrists—see the greatest reductions in poor mental health on a day-to-day basis. As seen in Column (3), independent prescriptive authority leads to a reduction of 0.41 days in poor mental health, or over 10% relative to the mean, among respondents with a high school degree or less in underserved states.

Allowing NPs to independently prescribe further leads to reductions in the likelihood that individuals spend at least three weeks in poor mental health. As shown in Columns (4) and (5) of Table 5, independent prescriptive authority leads to a 5% reduction in this measure of more severe mental illness among the population as a whole and a reduction of 15% among individuals in underserved states. As before, the effects are larger among the most vulnerable populations: we see in Column (6) that individuals who are both living in underserved states and have low levels of education experience a 20% reduction in the probability of reporting 21+ days in poor mental health when NPs can prescribe independently.

Table 5: Independent Prescriptive Authority and Self-Reported Mental Health

	Days in Poor Mental Health			21+ Days in Poor Mental Health		
	(1)	(2)	(3)	(4)	(5)	(6)
	Full Sample	Full Sample	Low Educ.	Full Sample	Full Sample	Low Educ.
Indep. prescriptive authority	-0.169**	-0.116	-0.135	-0.005**	-0.003**	-0.002
	(0.066)	(0.072)	(0.130)	(0.002)	(0.001)	(0.004)
Indep. Rx * underserved		-0.171*	-0.274**		-0.006	-0.012*
		(0.090)	(0.133)		(0.004)	(0.006)
Observations	6,540,521	6,540,521	2,606,231	6,540,521	6,540,521	2,606,231
R^2	0.083	0.083	0.083	0.052	0.052	0.052
Mean dependent variable	3.36	3.36	3.91	0.06	0.06	0.07
$\beta_1 + \beta_2$		-0.287***	-0.409***		-0.009**	-0.014**
P-value (F-test: $\beta_1 + \beta_2 = 0$)		0.001	0.000		0.045	0.013

Notes: Observations are at the individual level with BRFSS sample weights. Standard errors are clustered by state. All regressions include state and year fixed effects; additional controls include indicators for age groups, education groups, income quintiles, and employment status and indicators denoting whether the respondent is male, white, black, Hispanic, married, and has health insurance. A state is "underserved" if the population-weighted average of binary, underserved categorizations across all counties in the state is less than the median across all states in 1990. "Low educ." is defined as having a high school degree or less. Refer to Table A.13 for the full regression results.

Taken together, the results in Table 5 indicate that individuals with both minor and more severe mental illnesses benefit from the expansion of prescriptive authority. As with our mortality results, we provide a variety of additional analyses to probe the robustness of these results. While a state is considered underserved in Table 5 if the population-weighted average of binary, underserved categorizations across all counties in the state is less than the median across all states in 1990, Table A.15 demonstrates that our results are robust to using a time-varying measure of underserved and to using a continuous measure of underserved (population-weighted average of binary, underserved categorizations across all counties in the state in 1990; between zero and one). Our results are further robust to excluding all individual-level controls (Table A.16, Panel A); only controlling for age, sex, race, and ethnicity (Table A.16, Panel B); and to controlling for state unemployment rates, state beer taxes, and indicators denoting whether the state requires universal background checks and waiting periods for handgun and firearm purchases, expanded Medicaid, allows medical marijuana, allows recreational marijuana, implemented a PDMP, and implemented a "must-access"

PDMP (Table A.16, Panel C). Table A.17 shows that our results are robust to adjusting the BRFSS sample weights to account for the 2011 redesign of the survey.[29] Furthermore, Tables A.19 and A.20 demonstrates that our results are not driven by any one state: as with our mortality results, the estimates are very stable when we separately drop each state that extends independent prescriptive authority to NPs over our sample period.

Unlike the mortality results, however, Table A.18 shows that the self-reported mental health results are not robust to adding state-level linear time trends. As all of the variation we are able to exploit in the BRFSS is at the state-year level, adding state-level linear time trends in conjunction with state and year fixed effects leaves little residual variation, so the null result is not surprising.[30] Finally, as our estimates are limited in precision, we do not have the power to estimate individual event-time coefficients from an augmented version of Equation (4). Recall that the BRFSS is a survey of a subsample of the U.S. population, while the mortality and prescription data cover the universe of outcomes in the United States, so we have less statistical power when examining self-reported mental health.

5 Prescriptive Authority and the Number of Prescriptions

We found in the previous section that extending prescriptive authority to NPs leads to improvements in population mental health. Allowing NPs to prescribe medication without physician oversight could affect population mental health in two ways. The first and most direct route is that removing restrictions on NP's ability to prescribe may allow more people to access medication that affects their mental health. A second and less direct route is that granting NPs independent prescriptive authority may attract more individuals to the profession or redirect already licensed NPs to areas with more liberal scope of practice legislation, thereby expanding access to health

[29] We follow Simon et al. (2017) and reconstruct each individual's sample weight as the fraction of their assigned BRFSS sample weight over the sum of all individuals' sample weights for that year.

[30] It is less of a concern to add state-level linear time trends to the mortality regressions, as the outcome there varies at the county-quarter level. Additionally, there is within-year variation in law changes and within-state variation in health resources.

care services more broadly (Xue et al., 2016). If increased access to health care leads to improved well-being, then extending prescriptive authority to NPs could improve population mental health independently of the number of prescriptions written.

Using prescription data from 2006-2014, we examine whether there is evidence of increased use of prescription medications when NPs are allowed to prescribe independently. Letting $Prescriptions_{cy}$ denote antidepressant, antipsychotic, or opioid prescriptions per capita in county c in year y, we estimate the following equation:

$$Prescriptions_{cy} = \beta_0 + \beta_1 Indep.\ Rx_{sy} + \beta_2 X_{cy} + \gamma_c + \gamma_y + \epsilon_{cy} \tag{6}$$

where all other variables are defined as in Equation (1). As in Section 4.1, standard errors are clustered by state and observations are weighted by population. In contrast to the analysis in Section 4.1, however, we define the dependent variable in rates in this analysis: since the ACS provides county-level population counts for each year between 2007 and 2014, we are less concerned about measurement error in yearly population estimates between 2006 and 2014 (the sample window here) than between 1990 and 2014 (the sample window in Section 4.1).

As before, we expect that extending prescriptive authority to NPs will lead to larger increases in prescriptions in counties with an under-provision of mental health care services and among populations who are traditionally disadvantaged. Letting $Underserved_c$ be an indicator that equals one if county c was less equipped for mental health care services in 2000 and zero otherwise, we estimate the following equation:

$$\begin{aligned} Prescriptions_{cy} = \beta_0 + \beta_1 Indep.\ Rx_{sy} + \beta_2 Indep.\ Rx_{sy} \cdot Underserved_c \\ + \beta_3 X_{cy} + \gamma_c + \gamma_y + \epsilon_{cy} \end{aligned} \tag{7}$$

where all other variables are defined as in Equation (6). To look specifically at disadvantaged populations, we further estimate Equation (7) separately for prescriptions paid for by Medicaid.[31]

[31] 19 states expanded their Medicaid programs in 2014 to include coverage for low-income adults without children. To ensure that our results are not confounded by the 2014 Medicaid expansion, we verified that our prescription

Table 6: Independent Prescriptive Authority and Prescriptions per Capita

A. All Payers	Antidepressants		Antipsychotics		Opioids	
	(1)	(2)	(3)	(4)	(5)	(6)
Indep. prescriptive authority	-0.015	-0.020	0.001	-0.001	0.028*	0.027
	(0.013)	(0.013)	(0.002)	(0.002)	(0.017)	(0.016)
Indep. Rx * underserved		0.032**		0.012**		0.008
		(0.013)		(0.005)		(0.008)
Observations	28,179	28,179	28,179	28,179	28,179	28,179
R^2	0.972	0.972	0.941	0.941	0.967	0.967
Mean dependent variable	0.67	0.67	0.12	0.12	0.74	0.74
$\beta_1 + \beta_2$		0.012		0.010*		0.035*
P-value (F-test: $\beta_1 + \beta_2 = 0$)		0.515		0.074		0.075
B. Medicaid	Antidepressants		Antipsychotics		Opioids	
	(1)	(2)	(3)	(4)	(5)	(6)
Indep. prescriptive authority	0.129***	0.121***	0.015	0.009	0.098	0.109*
	(0.036)	(0.035)	(0.014)	(0.015)	(0.059)	(0.058)
Indep. Rx * underserved		0.035		0.030***		-0.045**
		(0.021)		(0.010)		(0.022)
Observations	28,162	28,162	28,162	28,162	28,162	28,162
R^2	0.825	0.825	0.810	0.810	0.826	0.826
Mean dependent variable	0.22	0.22	0.12	0.12	0.24	0.24
$\beta_1 + \beta_2$		0.156***		0.038**		0.063
P-value (F-test: $\beta_1 + \beta_2 = 0$)		0.000		0.016		0.303

Notes: Observations are at the county-year level and are weighted by population (Panel A) or Medicaid eligibles (Panel B). In Panel A, the dependent variables are county-level prescriptions per capita; in Panel B, the dependent variables are county-level prescriptions paid for by Medicaid per Medicaid eligible. Standard errors are clustered by state. All regressions include county and year fixed effects; additional controls include population density, percent male, percent black, percent age 18 and under, percent age 65 and over, percent with a high school degree or less, a quadratic in median income, percent in poverty, percent unemployed, and the number of practicing psychiatrists and primary care physicians per 100,000. A county is "underserved" if it had fewer than one psychiatrist per 30,000 people in 2000.

Estimates from Equations (6) and (7) are provided in Table 6. As shown in Columns (1) and (3) of Panel A, we see no evidence that per capita prescriptions for antidepressants or antipsychotics increase on average across counties when independent prescriptive authority is extended to NPs.

results are robust to excluding 2014. Furthermore, while Connecticut, Kentucky, and Minnesota extended independent prescriptive authority to NPs in 2014, only Kentucky expanded Medicaid in the same year (Connecticut and Minnesota expanded their Medicaid programs before 2014; see Leung and Mas, 2018).

However, mirroring the patterns observed in Sections 4.1 and 4.2, counties that are underserved for mental health care resources see increases in the use of antidepressants and antipsychotics relative to counties with adequate mental health care resources when NPs can prescribe independently. Notably, these increases are larger among Medicaid beneficiaries: as shown in Columns (1) and (2) of Panel B, antidepressant use among Medicaid beneficiaries increases by over 50% when NPs are allowed to prescribe independently, with Medicaid beneficiaries living in underserved counties experiencing the largest increases. Looking to Column (4) of Panel B, we see that antipsychotic use among Medicaid beneficiaries living in underserved counties increases by 0.04 prescriptions per capita, or 33% relative to the mean, when independent prescriptive authority is extended to NPs.

Compared to the mortality effects documented in Section 4.1, these estimates imply elasticities of mental-health-related deaths with respect to antidepressant and antipsychotic use among disadvantaged populations of -0.16 and -0.34, respectively. Although there is general consensus in the medical literature that antidepressant and antipsychotic use is associated with suicide prevention (Zalsman et al., 2016), the magnitude of these effects is not well understood: while a study comparing the relationship between antidepressant use and suicides in Sweden found an elasticity of around -0.10 (Carlsten et al., 2001), work in the United States found an elasticity among adolescents of -3.5 (Olfson et al., 2003). We note that the intervention we study will increase the prescribing of different classes of medication simultaneously. If multiple types of drugs contribute to the reductions in mental-health-related mortality that we find, then our implied elasticities per drug class will be biased upwards.

The final two columns of Table 6 examine how independent prescriptive authority for NPs affects per capita opioid prescriptions. Columns (5) and (6) of Panel A suggest that opioid use among the general population and among those living in underserved counties increases by 4% and 5%, respectively, when independent prescriptive authority is extended to NPs. While the point estimates are again larger among Medicaid beneficiaries (Panel B), the effects of extending independent prescriptive authority to NPs on opioid prescriptions paid for by Medicaid are imprecisely

estimated.

As the scope of practice legislation we consider is not limited to psychotropic medications, it is not surprising that prescriptions for opioids also increase when NPs can prescribe independently.[32] Given that rates of opioid abuse in the United States have reached epidemic levels, however, any policy that increases the provision of opioids could be troublesome (SAMHSA, 2014). Despite the strong association between opioid prescriptions per capita and deaths involving drugs within counties over time (Schnell and Currie, 2018), we found in Section 4.1 that extending independent prescriptive authority to NPs leads to decreases in mental-health-related mortality, a measure that includes overdose deaths. Given the concurrent rise in opioid prescriptions, it is noteworthy that we find significant reductions in mental-health-related mortality when NPs are allowed to prescribe independently.

As in our mortality analysis, we use an event study specification to verify the parallel trends assumption and to examine the time path of effects. In particular, we estimate a version of Equation (6) in which we include indicators denoting each of the two years before, the year of, and each of two years after a law change in place of a post indicator. Again letting $Prescriptions_{cy}$ denote antidepressant, antipsychotic, or opioid prescriptions per capita in county c in year y, we estimate the following equation:

$$Prescriptions_{cy} = \beta_0 + \sum_{n \in \{-2,2\} \setminus -1} \alpha_n \mathbb{1}\left\{y_s^* + n = y\right\} + \beta_1 X_{cy} + \gamma_c + \gamma_y + \epsilon_{cy} \tag{8}$$

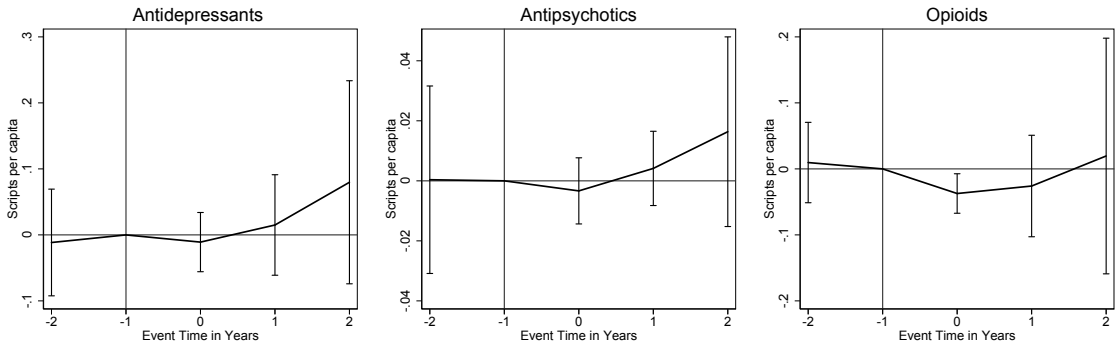
where all other variables are defined as in Equation (3).

Figure 7 presents the α coefficients and 95% confidence intervals from estimation of Equation (8) with per capita prescriptions to Medicaid beneficiaries as the outcome variable. While our statistical power is limited, the event studies suggest that antidepressant and antipsychotic use among Medicaid beneficiaries increases when independent prescriptive authority is extended to NPs. The effects appear to grow over time, although the short sample window limits the post-

[32] As detailed in Footnote 10, 23 of the 24 states that allow NPs to prescribe controlled substances independently.

period that we are able to consider.

Figure 7: Event Time: Independent Prescriptive Authority and Medicaid Prescriptions per Capita



Notes: Observations are at the county-year level and are weighted by Medicaid eligibles. The dependent variables are county-level prescriptions paid for by Medicaid per Medicaid eligible. Standard errors are clustered by state. All regressions include county and year fixed effects; additional controls include population density, percent male, percent black, percent age 18 and under, percent age 65 and over, percent with a high school degree or less, a quadratic in median income, percent in poverty, percent unemployed, and the number of practicing psychiatrists and primary care physicians per 100,000. The panel is unbalanced, years before and after the event time window are included using separate indicators, and zero denotes the year of the law change.

6 Conclusion

Taken together, our results indicate that granting independent prescriptive authority to NPs is an important policy tool that can be used to improve population mental health. Policies that increase the number of providers who can prescribe medication may be particularly important in the United States, where the supply of physicians has not kept pace with rising demand for health care services. Although the discussions surrounding independent prescriptive authority for NPs focus primarily on shortages of primary care providers who can prescribe medication, we show that these laws also have important implications for mental health. In particular, states that grant independent prescriptive authority to NPs see improvements in self-reported mental health and reductions in the prevalence of mental-health-related deaths. Improvements are greatest for individuals who live in areas that are underserved by psychiatrists and among populations who have been shown to have more difficulty accessing physician-provided care.

A back-of-the-envelope calculation suggests that 1,596 mental-health-related deaths were averted

in underserved counties in 2014 alone by states allowing NPs to prescribe independently. If all states granted NPs independent prescriptive authority, the number of deaths averted yearly in underserved counties would rise to over 5,000. In addition, many more lives would be saved among disadvantaged populations who live in counties with adequate mental health resources but who have difficulty accessing physician-provided care. Furthermore, any estimate of deaths averted underestimates the full effect of the policy: for every person who commits suicide, there are over a thousand struggling with mental illness (Bureau of Health Workforce, 2016).

The effects of granting NPs independent prescriptive authority are similar in magnitude to the effects of gaining health insurance. For example, when Medicaid was extended to low-income adults using a lottery in Oregon, those who gained insurance reported spending 11% fewer days per month in poor mental health and were 10% less likely to screen positive for depression (Finkelstein et al., 2012). Furthermore, use of medication to treat depression increased by 33% relative to the control mean (Baicker et al., 2013). Our results demonstrate that the benefits of having health insurance will be mediated by the availability of providers who are able to fully treat patients.

It is noteworthy that we observe a consistent pattern of effects across two very different measures of mental health. Self-reported "days in poor mental health" allows us to examine whether populations suffering from mental illnesses of varying severity, including minor mental illness, notice improvements when NPs are allowed to prescribe. On the other hand, mental-health-related mortality allows us to examine whether populations suffering from very severe mental illnesses—that is, mental illness that may result in death—see improvements when independent prescriptive authority is extended beyond physicians. Even if extending prescriptive authority to NPs impacts one of these outcomes, it is not clear ex ante that prescriptive authority should also impact the other. In particular, since suicides and other deaths caused by poor mental health are relatively rare, it is possible that population mental health could improve without measurable effects on such extreme outcomes. The consistency of our results across these two categories of outcome measures indicates that prescriptive authority for NPs is associated with improved mental health across a spectrum of severity.

When independent prescriptive authority is extended to NPs, all NPs, not just those who specialize in mental health, have the statutory authority to prescribe. Just like physicians, however, some NPs specialize in psychiatric medicine. Psychiatric NPs with prescriptive authority traditionally provide psychotherapy in addition to psychotropic treatment, in contrast to the current movement among psychiatrists to only prescribe medications. It is therefore possible that the improvements in mental health that we observe are at least partly driven by an increase in "full-service" mental health providers—that is, specialists that provide both psychotherapy and psychotropic treatment. However, it is also possible that our results are driven by an increase in the overall supply of general practitioners who can prescribe. It remains an open question whether extending independent prescriptive authority to NPs results in improved mental health because such laws increase the number of general health care providers who can prescribe psychotropic treatment or because they increase the number of providers who provide psychotherapy in conjunction with psychotropic treatment. Answering this question is a promising area for future research.

References

American Association of Nurse Practitioners (2012). 2012 aanp sample survey: Report on np services. Technical report.

American Association of Nurse Practitioners (2014). 2012 national aanp sample survey: An overview. Technical report.

American Association of Nurse Practitioners (2017). More than 234,000 licensed nurse practitioners in the united states. Technical report.

American Medical Association (2010, October 5). AMA Responds to IOM Report on Future of Nursing. Press Release.

Baicker, K., S. Taubman, H. Allen, M. Bernstein, J. Gruber, J. Newhouse, E. Schneider, B. Wright, A. Zaslavsky, and A. Finkelstein (2013). The Oregon Experiment – Effects of Medicaid on Clinical Outcomes. *New England Journal of Medicine 363*(18), 1713–1722.

Barkus, E. and R. Murray (2010). Substance Use in Adolescence and Psychosis: Clarifying the Relationship. *Annual Review of Clinical Psychology 6*, 365–389.

Bishop, T., M. Press, S. Keyhani, and H. Pincus (2014). Acceptance of Insurance by Psychiatrists and the Implications for Access to Mental Health Care. *JAMA Psychiatry 71*(2), 176–181.

Bjorkenstam, C., L. Johansson, P. Nordstrom, I. Thiblin, A. Fugelstad, J. Hallqvist, and R. Ljung (2014). Suicide or Undetermined Intent? A Register Based Study of Signs of Misclassification. *Population Health Metrics 12*(11), 1–11.

Buerhaus, P., C. DesRoches, R. Dittus, and K. Donelan (2015). Practice Characteristics of Primary Care Nurse Practitioners and Physicians. *Nursing Outlook 63*(2), 144–153.

Bureau of Health Workforce (2016). Designated Health Professional Shortage Areas Statistics. Technical report, U.S. Department of Health and Human Services.

Carlsten, A., M. Waern, A. Ekedahl, and J. Ranstam (2001). Antidepressant Medication and Suicide in Sweden. *Pharmacoepidemiology and Drug Safety 10*(6), 525–530.

Case, A. and A. Deaton (2015). Rising Morbidity and Mortality in Midlife Among White Non-Hispanic Americans in the 21st Century. *Proceedings of the National Academy of Sciences of the United States of America 112*(49), 15078–15083.

Case, A. and A. Deaton (2017). Mortality and Morbidity in the 21st Century. *Brookings Papers on Economic Activity*, 397–476.

Cooper, P. and C. Milroy (1995). The Coroner's System and Under-Reporting of Suicide. *Medicine, Science, and Law 35*, 319–326.

Cunningham, P. (2009). Beyond Parity: Primary Care Physicians' Perspectives on Access to Mental Health Care. *Health Affairs 28*(3), 490–501.

Currie, J. and M. Stabile (2006). Child Mental Health and Human Capital Accumulation: The Case of ADHD. *Journal of Health Economics 25*(6), 1094–1118.

Doleac, J. and A. Mukherjee (2018). The moral hazard of lifesaving innovations: Naloxone access, opioid abuse, and crime. Technical report, Working Paper.

Dueker, M., A. Jacox, D. Kalist, and S. Spurr (2005). The Practice Boundaries of Advanced Practice Nurses: An Economic and Legal Analysis. *Journal of Regulatory Economics 27*(3), 309–329.

Ettner, S., R. Frank, and R. Kessler (1997). The Impact of Psychiatric Disorders on Labor Market Outcomes. *Industrial and Labor Relations Review 51*(1), 64–81.

Everett, C., J. Shumacher, A. Wright, and M. Smith (2009). Physician Assistants and Nurse Practitioners as Usual Source of Care. *Journal of Rural Health 25*(4), 407–414.

Finkelstein, A., S. Taubman, B. Wright, M. Bernstein, J. Gruber, J. Newhouse, H. Allen, and K. Baicker (2012). The Oregon Health Insurance Experiment: Evidence from the First Year. *Quarterly Journal of Economics 127*(3), 1057–1106.

Frances, A. (2011). Antidepressant Use Has Gone Crazy: Bad News From the cdc. *Psychiatric Times*.

Greenberg, G. and R. Rosenheck (2008). Jail Incarceration, Homelessness, and Mental Health: A National Study. *Psychiatric Services 59*(2), 170–177.

Grumbach, K., L. Hart, E. Mertz, J. Coffman, and L. Palazzo (2003). Who is Caring for the Underserved? A Comparison of Primary Care Physicians and Non-Physician Clinicians in California and Washington. *Annals of Family Medicine 1*(2), 97–104.

Hartley, D., V. Hart, N. Hanrahan, and S. Loux (2004). Are Advanced Practice Psychiatric Nurses a Solution to Rural Mental Health Workforce Shortage? Technical report, Maine Rural Health Research Center, Working Paper 31.

Holding, T. and B. Barraclough (1977). Psychiatric Morbidity in a Sample of Accidents. *British Journal of Psychiatry 130*, 224–252.

Horrocks, S., E. Anderson, and C. Salisbury (2002). Systematic Review of Whether Nurse Practitioners Working in Primary Care can Provide Equivalent Care to Doctors. *British Medical Journal 324*(7341), 819–823.

Institute of Medicine (2011). The Future of Nursing: Leading Change, Advancing Health.

Jougla, E., F. Pequignot, J. Chappert, F. Rossollin, A. Le Toullec, and G. Pavillon (2002). Quality of Suicide Mortality Data. *Revue d'Epidemiologie et de Sante Publique 50*, 49–52.

Kelleher, M., P. Corcoran, H. Keeley, J. Dennehy, and I. O'Donnell (1996). Improving Procedures for Recording Suicide Statistics. *Irish Medical Journal 81*, 14–15.

Kessler, R., S. Heeringa, M. Lakoma, M. Petukhova, A. Rupp, M. Schoenbaum, P. Wang, and A. Zaslavsky (2008). Individual and Societal Effects of Mental Disorders on Earning in the United States: Results from the National Comorbidity Survey Replication. *American Journal of Psychiatry 165*(6), 703–711.

Kessler, R. and D. Stafford (2008). *Primary Care Is the De Facto Mental Health System*, pp. 9–21. New York, NY: Springer New York.

Khantzian, E. (1985). The Self-Medication Hypothesis of Addictive Disorders: Focus on Heroin and Cocaine Dependence. *American Journal of Psychiatry 142*, 1259–1264.

Khantzian, E. (1997). The Self-Medication Hypothesis of Substance Use Disorders: A Reconsideration and Recent Applications. *Harvard Review of Psychiatry 4*, 231–244.

Kleiner, M., A. Allison Marier, K. Park, and C. Wing (2016). Relaxing Occupational Licensing Requirements: Analyzing Wages and Prices for a Medical Service. *Journal of Law and Economics 59*(2), 261–291.

Kleiner, M. and K. Park (2010). Battles Among Licensed Occupations: Analyzing Government Regulations on Labor Market Outcomes for Dentists and Hygienists. *NBER Working Paper 16560*.

Larson, E., L. Palazzo, B. Berkowitz, M. Pirani, and L. Hart (2003). The Contribution of Nurse Practitioners and Physician Assistants to Generalist Care in Washington State. *Health Service Research 38*(4).

Laurant, M., R. Hermens, J. Braspenning, R. Akkermans, B. Sibbald, and R. Grol (2008). An Overview of Patients' Preferences for, and Satisfaction with, Care Provided by General Practitioners and Nurse Practitioners. *Journal of Clinical Nursing 17*(20), 2690–2698.

Lenz, E., M. Mundinger, R. Kane, S. Hopkins, and S. Lin (2004). Primary Care Outcomes in

Patients Treated by Nurse Practitioners or Physicians: Two-Year Follow-Up. *Medical Care Research and Review 61*(3), 332–351.

Leung, P. and A. Mas (2018). Employment Effects of the Affordable Care Act Medicaid Expansions. *Industrial Relations 57*(2), 206–234.

Lindqvist, P. and L. Gustafsson (2002). Suicide Classification–Clues and Their Use. A Study of 122 Cases of Suicide and Undetermined Manner of Death. *Forensic Science International 128*, 136–140.

Maniam, T. (1995). Suicide and Undetermined Violent Deaths in Malaysia, 1966-1990: Evidence for the Misclassification of Suicide Statistics. *Asia Pacific Journal of Public Health 8*, 181–185.

Marier, A. and C. Wing (2011). Do Occupational Regulations Make Dental Services More Expensive? Evidence from Dental Insurance Claims. *Syracuse University, Working Paper*.

Meara, E., J. Horwitz, W. Powell, L. McClelland, W. Zhou, J. O'Malley, and N. Morden (2016). State Legal Restrictions and Prescription-Opioid Use among Disabled Adults. *New England Journal of Medicine*.

Meinhofer, A. (2018). Prescription Drug Monitoring Programs: The Role of Asymmetric Information on Drug Availability and Abuse. *American Journal of Health Economics 4*(4), 504–526.

Merikangas, K., J. He, M. Burstein, S. Swanson, S. Avenevoli, L. Cui, C. Benjet, K. Georgiades, and J. Swendsen (2010). Lifetime prevalence of mental disorders in u.s. adolescents: Results from the national comorbidity survey replication–adolescent supplement (ncs-a). *Journal of the American Academy of Child and Adolescent Psychiatry 49*(10), 980–989.

Mundinger, M., R. Kane, E. Lenz, A. Totten, W. Tsai, P. Cleary, W. Friedewald, A. Siu, and M. Shelanski (2000). Primary Care Outcomes in Patients Treated by Nurse Practitioners or Physicians: A Randomized Trial. *JAMA 283*(1), 59–68.

Naylor, M. and E. Kurtzman (2010). The Role of Nurse Practitioners in Reinventing Primary Care. *Health Affairs 29*(5), 893–899.

Nock, M., I. Hwang, N. Sampson, and R. Kessler (2010). Mental Disorders, Comorbidity and Suicidal Behavior: Results from the National Comorbidity Survey Replication. *Molecular Psychiatry 15*, 868–876.

Ohberg, A. and J. Lonnqvist (1998). Suicides Hidden among Undetermined Deaths. *Acta Psychiatrica Scandinavica 98*, 214–218.

Olfson, M., D. Shaffer, S. Marcus, and T. Greenberg (2003). Relationship Between Antidepressant Medication Treatment and Suicide in Adolescents. *Archives of General Psychiatry 60*(10), 978–982.

Pei, Z., J. Pischke, and H. Schwandt (Forthcoming). Poorly Measured Confounders are More Useful on the Left than on the Right. *Journal of Business and Economic Statistics*.

Phillips, D. and T. Ruth (1993). Adequacy of Official Suicide Statistics for Scientific Research and Public Policy. *Suicide and Life-Threatening Behavior 23*, 307–319.

Platt, S., S. Backett, and N. Kreitman (1988). Social Construction or Causal Ascription: Distinguishing Suicide from Undetermined Deaths. *Social Psychiatry and Psychiatric Epidemiology 23*, 217–221.

Rabinowitz, H., J. Diamond, F. Markham, and J. Wortman (2008). Medical School Programs to Increase the Rural Physician Supply: A Systematic Review and Projected Impact of Widespread Replication. *Academic Medicine 83*(3), 235–243.

Regier, D., M. Farmer, D. Rae, B. Locke, S. Keith, L. Judd, and F. Goodwin (1990). Comorbidity of Mental Disorders with Alcohol and Other Drugs: Results from the Epidemiologic Catchment Area (ECA) Study. *JAMA 264*(19), 2511–2518.

Rockett, I., G. Hobbs, D. De Leo, S. Stack, J. Frost, A. Ducatman, N. Kapusta, and R. Walker (2010). Suicide or Unintentional Poisoning Mortality Trends in the United States, 1987-2006: Two Unrelated Phenomena? *BMC Public Health 10*(705).

Rockett, I., J. Samora, and J. Coben (2006). The Black-White Suicide Paradox: Possible Effects of Misclassification. *Social Science and Medicine 63*, 2165–2175.

Rockett, I. and G. Smith (1993). Covert Suicide among Elderly Japanese Females: Questioning Unintentional Drownings. *Social Science and Medicine 36*, 1467–1472.

Rockett, I., S. Wang, S. Stack, D. De Leo, J. Frost, A. Ducatman, R. Walker, and N. Kapusta (2010). Race/Ethnicity and Potential Suicide Misclassification: Window on a Minority Suicide Paradox? *BMC Psyschiatry 10*.

Sadeghi, C. (2017). Nurse Practitioners ask Lawmakers to Loosen Law on Practice. *KHOU*.

Scheffler, R., N. Waitzman, and J. Hillman (1996). The Productivity of Physician Assistants and Nurse Practitioners and Health Workforce Policy in the Era of Managed Health Care. *Journal of Allied Health 25*(3), 207–217.

Schnell, M. and J. Currie (2018). Addressing the Opioid Epidemic: Is There a Role for Physician Education? *American Journal of Health Economics 4*(3), 383–410.

Simon, K., A. Soni, and J. Cawley (2017). The Impact of Health Insurance on Preventive Care and Health Behaviors: Evidence from the First Two Years of the ACA Medicaid Expansions. *Journal of Policy Analysis and Management 36*(2), 390–417.

Skillman, S., L. Kaplan, M. Fordyce, P. McMenamin, and M. Doescher (2012). Understanding Advance Practice Registered Nurse Distribution in Urban and Rural Areas of the US Using National Provider Identifier Data. Technical report.

Stange, K. (2014). How Does Provider Supply and Regulation Influence Health Care Markets?

Evidence from Nurse Practitioners and Physician Assistants. *Journal of Health Economics 33*, 1–27.

Substance Abuse and Mental Health Services Administration (2014). Results from the 2013 National Survey on Drug Use and Health: Summary of National Findings. *NSDUH Series H-48, HHS Publication No. (SMA) 14-4863*.

Substance Abuse and Mental Health Services Administration (2015). Treatments for Mental Disorders. Technical report.

Substance Abuse and Mental Health Services Administration (2017). Key Substance Use and Mental Health Indicators in the United States: Results from the 2016 National Survey on Drug Use and Health. *NSDUH Series H-52, HHS Publication No. (SMA) 17-5044*.

Thomas, K., A. Ellis, T. Konrad, C. Holzer, and J. Morrissey (2009). County-Level Estimates of Mental Health Professional Shortages in the United States. *Psychiatric Services 60*(10).

Tollefsen, I., E. Hem, and O. Ekeberg (2010). The reliability of suicide statistics: A systematic review. *BMC Psychiatry 12*(9).

Traczynski, J. and V. Udalova (2018). Nurse Practitioner Independence, Health Care Utilization, and Health Outcomes. *Journal of Health Economics 58*, 90–109.

Whitt, H. (2006). Where Did the Bodies Go? The Social Construction of Suicide Data, New York City, 1976-1992. *Sociological Inquiry 76*, 166–187.

Wong, J., A. Motulsky, M. Abrahamowicz, T. Eguale, D. Buckeridge, and R. Tamblyn (2017). Off-Label Indications for Antidepressants in Primary Care: Descriptive Study of Prescriptions from an Indication Based Electronic Prescribing System. *British Medical Journal*.

Xue, Y., Z. Ye, C. Brewer, and J. Spetz (2016). Impact of State Nurse Practitioner Scope-of-Practice Regulation on Health Care Delivery: Systematic Review. *Nursing Outlook 64*, 71–85.

Zalsman, G., K. Hawton, D. Wasserman, K. van Heeringen, and E. Arensman (2016). Suicide Prevention Strategies Revisited: 10-Year Systematic Review. *The Lancet Psychiatry 3*(7), 646–659.

For Online Publication

A Supplementary Tables and Figures

Table A.1: Dates of Law Changes Granting NPs Independent Prescriptive Authority

Before 1990	
Alaska	Oregon
Arizona	Vermont
District of Columbia	Washington
Montana	
1990-2014	*Month granted*
Wyoming	February 1991
Iowa	June 1991
New Hampshire	June 1991
Utah	March 1992
New Mexico	March 1993
Delaware	July 1994
Maine	June 1995
Nebraska	April 1996
Idaho	March 2004
Colorado	June 2009
Hawaii	April 2010
Maryland	April 2010
North Dakota	April 2011
Nevada	June 2013
Rhode Island	June 2013
Kentucky	February 2014
Connecticut	May 2014
Minnesota	May 2014

Notes: As outlined in Section 3.1, the law changes in this table are derived from information from the *The Nurse Practitioner's* "Annual Legislative Update," correspondences with state nursing boards, and readings of primary source legislation. We define "independent prescriptive authority" as the ability to prescribe medication without physician collaboration or supervision. More information on the relevant bills and legislative processes are available from the authors by request.

Table A.2: ICD-9 and ICD-10 Codes Included in Mental-Health-Related Mortality

Suicides
ICD-9 codes:
E950-E959
ICD-10: [Recode 358]
424: Intentional self-harm (suicide) (*U03,X60-X84,Y87.0)
Or if manner of death is noted as suicide or self-inflicted

Injuries of undetermined intent
ICD-9: [Recode 282]
35200: Injury undetermined whether accidentally or purposely inflicted (E980-E989)
ICD-10: [Recode 113]
131: Events of undetermined intent (Y10-Y34,Y87.2,Y89.9)

Accidental deaths
Poisonings
ICD-9: [Recode 282]
31600: Accidental poisoning (E850-E869)
ICD-10: [Recode 113]
122: Accidental poisoning and exposure to noxious substances (X40-X49)

Drownings
ICD-9: [Recode 282]
32800: Accidental drowning and submersion (E910)
ICD-10: [Recode 113]
120: Accidental drowning and submersion (W65-W74)

Firearms
ICD-9: [Recode 282]
33000: Accident caused by handgun (E922.0)
33100: Accidents caused by all other and unspecified firearms (E922.1-E922.9)
ICD-10: [Recode 113]
119: Accidental discharge of firearms (W32-W34)

Trains
ICD-9: [Recode 282]
30200: Railway accidents (E800-E807)
30500: Motor vehicle traffice acccidents involving collision with train (E810)
ICD-10: [Recode 358]
384: Railway accidents (V05,V15,V80.6,V81.2-V81.9)
389: Motor vehicle accident involving collision with railway train (V25,V35,V45,V55,V65,V75,V81.0-V81.1,V87.6,V88.6)

Notes: ICD-9 codes in use through 1999; ICD-10 codes in use starting in 2000. On average over our sample period, 53.4% of mental-health-related deaths were suicides; 31.9% were accidental poisonings; 6.6% were injuries of undetermined intent; and 5.8%, 1.4%, and 1.1% were accidental deaths involving drownings, firearms, and trains, respectively.

Table A.3: Correlates of Law Changes Granting Independent Prescriptive Authority

A. Ind. & County-Level Outcomes	General Health		Insured		No. Psychiatrists		No. Prim. Care MD/DOs	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Indep. prescriptive authority	0.000	-0.003	0.006	0.007	-1.772	-1.817	-3.789	3.808
	(0.005)	(0.006)	(0.006)	(0.005)	(4.460)	(5.045)	(20.759)	(24.368)
Indep. Rx * underserved		0.009		-0.004		0.192		-32.503
		(0.007)		(0.014)		(3.032)		(27.077)
Observations	6,519,963	6,519,963	6,540,521	6,540,521	313,372	313,372	313,372	313,372
R^2	0.216	0.216	0.195	0.195	0.997	0.997	0.995	0.995
Mean dependent variable	2.44	2.44	0.85	0.85	158.90	158.90	1,115.98	1,115.98
$\beta_1 + \beta_2$		0.007		0.003		-1.625		-28.695
P-value (F-test: $\beta_1 + \beta_2 = 0$)		0.305		0.855		0.582		0.160

B. State-Level Outcomes	Unemployment Rates		Medicaid Expansion		Beer Taxes		Gun Control	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Indep. prescriptive authority	0.005	-0.043	0.107**	0.111***	-0.008	-0.008	0.063	0.075
	(0.222)	(0.217)	(0.041)	(0.038)	(0.014)	(0.014)	(0.069)	(0.071)
Indep. Rx * underserved		0.208		-0.017		0.002		-0.049
		(0.214)		(0.031)		(0.006)		(0.030)
Observations	313,372	313,372	313,372	313,372	313,372	313,372	313,372	313,372
R^2	0.837	0.837	0.556	0.556	0.955	0.955	0.955	0.955
Mean dependent variable	6.19	6.19	0.02	0.02	0.25	0.25	0.18	0.18
$\beta_1 + \beta_2$		0.164		0.094*		-0.007		0.026
P-value (F-test: $\beta_1 + \beta_2 = 0$)		0.589		0.098		0.676		0.690

C. State-Level Outcomes (cont.)	PDMP Implemented		Must-Access PDMP		Medical Marijuana		Recreational Marijuana	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Indep. prescriptive authority	0.174	0.174	0.001	-0.004	0.128*	0.147**	0.067	0.070
	(0.123)	(0.128)	(0.053)	(0.050)	(0.073)	(0.072)	(0.069)	(0.071)
Indep. Rx * underserved		0.000		0.022		-0.081		-0.014
		(0.053)		(0.039)		(0.057)		(0.016)
Observations	313,372	313,372	313,372	313,372	313,372	313,372	313,372	313,372
R^2	0.755	0.755	0.249	0.249	0.684	0.684	0.157	0.157
Mean dependent variable	0.59	0.59	0.02	0.02	0.17	0.17	0.00	0.00
$\beta_1 + \beta_2$		0.174		0.019		0.065		0.056
P-value (F-test: $\beta_1 + \beta_2 = 0$)		0.147		0.790		0.459		0.370

Notes: Observations in Columns (1)-(4) of Panel A are at the individual level and are weighted using BRFSS sample weights; corresponding regressions include the same controls as in Table 5. Observations in Columns (5)-(8) of Panel A and all columns in Panels B and C are at the county-quarter level and are population weighted; corresponding regressions include the same controls as in Table 4. Standard errors are clustered by state in all regressions. Individual-level outcomes are from the BRFSS, and county-level provider counts are from the HRSA's Area Resource Files. State-level unemployment rates are from the Bureau of Labor Statistics, data on state-level beer taxes comes from the Urban-Brookings Tax Policy Center, data on gun control legislation (waiting periods or background checks for handgun and firearm purchases) comes from the State Firearm Laws project and the RAND State Firearm Law Database, Medicaid expansion dates come from the Kaiser Family Foundation, dates of medical and recreational marijuana legalization come from ProCon.org, and dates of state-level implementation of prescription drug monitoring programs (PDMPs) and "must-access" PDMP laws are taken from Meinhofer (2018).

A.1 Mental-Health-Related Mortality

Table A.4: Mental-Health-Related Mortality: Full Regression Results

	Suicides			Mental-Health-Related Deaths		
	(1)	(2)	(3)	(4)	(5)	(6)
	Full Sample	Full Sample	Low Educ.	Full Sample	Full Sample	Low Educ.
Indep. prescriptive authority	0.122	0.561	0.784*	-1.697	-0.438	0.182
	(0.983)	(1.019)	(0.421)	(1.880)	(1.985)	(1.058)
Indep. Rx * underserved		-1.877*	-1.415***		-5.387***	-3.403***
		(0.965)	(0.391)		(1.923)	(1.217)
Population density (per mile^2)	-0.001*	-0.001*	0.002***	-0.003***	-0.003***	0.003***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)
Percent male	43.466	43.298	59.008**	-29.115	-29.597	3.114
	(46.660)	(46.698)	(29.278)	(100.041)	(100.116)	(50.645)
Percent black	63.023**	63.034**	34.073*	77.357	77.389	43.228
	(26.897)	(26.850)	(18.984)	(56.318)	(56.222)	(37.188)
Percent age 18 and under	24.373	23.697	51.826	-36.633	-38.573	86.862
	(37.542)	(37.518)	(37.323)	(70.184)	(70.040)	(55.730)
Percent age 65+	50.406	50.496	39.144	-182.712**	-182.452**	-113.002***
	(40.709)	(40.759)	(27.578)	(84.352)	(84.501)	(34.745)
Percent high school or less	3.438	2.999	-18.503	10.393	9.135	16.662
	(30.403)	(30.285)	(15.072)	(44.501)	(44.269)	(19.765)
Median household income	0.001**	0.001**	0.001**	0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
Median household income^2	-0.000***	-0.000***	-0.000***	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Percent in poverty	-18.894**	-18.903**	-6.648	-39.736**	-39.761**	-8.980
	(8.747)	(8.741)	(4.014)	(17.090)	(17.060)	(10.268)
Percent unemployed	1.065**	1.067**	0.498*	2.023*	2.029*	1.141
	(0.519)	(0.519)	(0.254)	(1.031)	(1.031)	(0.684)
Psychiatrists per 100,000	0.124***	0.124***	0.096***	0.130	0.130	0.141***
	(0.045)	(0.045)	(0.027)	(0.084)	(0.084)	(0.039)
PC MDs/DOs per 100,000	-0.017**	-0.017**	-0.014***	-0.023**	-0.023**	-0.015*
	(0.007)	(0.006)	(0.004)	(0.011)	(0.011)	(0.008)
Observations	313,372	313,372	313,372	313,372	313,372	313,372
R^2	0.969	0.969	0.950	0.971	0.971	0.957
Mean dependent variable	28.59	28.59	14.89	51.48	51.48	29.05
$\beta_1 + \beta_2$		-1.316	-0.630		-5.825**	-3.221***
P-value (F-test: $\beta_1 + \beta_2 = 0$)		0.300	0.170		0.013	0.006

Notes: Observations are at the county-quarter level and are population weighted. Standard errors are clustered by state. All regressions include county, quarter, and year fixed effects and county-level population. "Low educ." is defined as having a high school degree or less.

Table A.5: Mental-Health-Related Mortality: Subgroup Analysis

A. Suicides	(1) All	(2) Black	(3) Age 45-55	(4) Under 18	(5) Low Educ.	(6) Male	(7) Female
Indep. prescriptive authority	0.561	-3.097**	0.252	0.075	0.784*	0.268	0.230
	(1.019)	(1.380)	(0.201)	(0.056)	(0.421)	(0.797)	(0.206)
Indep. Rx * underserved	-1.877*	2.162**	-0.610*	-0.041	-1.415***	-1.315*	-0.587**
	(0.965)	(0.909)	(0.305)	(0.033)	(0.391)	(0.724)	(0.280)
Observations	313,372	310,148	313,400	313,376	313,372	313,400	313,400
R^2	0.969	0.858	0.928	0.695	0.950	0.968	0.915
Mean dependent variable	28.59	5.24	7.53	0.99	14.89	21.88	6.65
$\beta_1 + \beta_2$	-1.316	-0.935	-0.358	0.034	-0.630	-1.047	-0.358
P-value (F-test: $\beta_1 + \beta_2 = 0$)	0.300	0.151	0.239	0.453	0.170	0.281	0.224

B. Mental-Health-Related	(1) All	(2) Black	(3) Age 45-55	(4) Under 18	(5) Low Educ.	(6) Male	(7) Female
Indep. prescriptive authority	-0.438	-2.342**	0.380	0.196**	0.182	-0.639	-0.026
	(1.985)	(1.162)	(0.472)	(0.093)	(1.058)	(1.348)	(0.527)
Indep. Rx * underserved	-5.387***	2.032*	-1.302**	-0.178	-3.403***	-3.678***	-1.727***
	(1.923)	(1.029)	(0.583)	(0.115)	(1.217)	(1.349)	(0.558)
Observations	313,372	310,148	313,400	313,376	313,372	313,400	313,400
R^2	0.971	0.926	0.950	0.805	0.957	0.970	0.944
Mean dependent variable	51.48	12.80	14.89	2.14	29.05	38.32	13.02
$\beta_1 + \beta_2$	-5.825**	-0.310	-0.923	0.018	-3.221***	-4.318**	-1.753***
P-value (F-test: $\beta_1 + \beta_2 = 0$)	0.013	0.555	0.154	0.893	0.006	0.015	0.007

Notes: Observations are at the county-quarter level and are population weighted. Standard errors are clustered by state. All regressions include county, quarter, and year fixed effects; additional controls include total population (or subgroup population), population density, percent male, percent black, percent age 18 and under, percent age 65 and over, percent with a high school degree or less, a quadratic in median income, percent in poverty, percent unemployed, and the number of practicing psychiatrists and primary care physicians per 100,000. A county is "underserved" if it had fewer than one psychiatrist per 30,000 people in 1990. "Low educ." is defined as having a high school degree or less.

Table A.6: Mental-Health-Related Mortality: Time-Varying Underserved Measure

	Suicides			Mental-Health-Related Deaths		
	(1)	(2)	(3)	(4)	(5)	(6)
	Full Sample	Full Sample	Low Educ.	Full Sample	Full Sample	Low Educ.
Indep. prescriptive authority	0.122	0.238	0.542	-1.697	-1.155	-0.244
	(0.983)	(0.949)	(0.375)	(1.880)	(1.881)	(0.972)
Underserved		0.385	0.421**		0.815	0.730**
		(0.308)	(0.193)		(0.532)	(0.349)
Indep. Rx * underserved		-0.601	-0.597**		-2.812***	-2.106***
		(0.518)	(0.273)		(0.917)	(0.672)
Observations	313,372	313,372	313,372	313,372	313,372	313,372
R^2	0.969	0.969	0.950	0.971	0.971	0.957
Mean dependent variable	28.59	28.59	14.89	51.48	51.48	29.05

Notes: Observations are at the county-quarter level and are population weighted. Standard errors are clustered by state. All regressions include county, quarter, and year fixed effects; additional controls include total population (or subgroup population), population density, percent male, percent black, percent age 18 and under, percent age 65 and over, percent with a high school degree or less, a quadratic in median income, percent in poverty, percent unemployed, and the number of practicing psychiatrists and primary care physicians per 100,000. A county is "underserved" if it had fewer than one psychiatrist per 30,000 people in a given year. "Low educ." is defined as having a high school degree or less.

Table A.7: Mental-Health-Related Mortality: Alternative Controls

A. No Controls	Suicides			Mental-Health-Related Deaths		
	(1)	(2)	(3)	(4)	(5)	(6)
	Full Sample	Full Sample	Low Educ.	Full Sample	Full Sample	Low Educ.
Indep. prescriptive authority	1.244	1.366	1.020	-1.473	-0.381	-0.260
	(0.822)	(0.975)	(1.048)	(1.694)	(1.971)	(1.602)
Indep. Rx * underserved		-0.515	0.296		-4.635**	-3.793***
		(1.252)	(0.704)		(2.040)	(1.286)
Observations	313,372	313,372	313,372	313,372	313,372	313,372
R^2	0.964	0.964	0.935	0.968	0.968	0.951
Mean dependent variable	28.59	28.59	14.89	51.48	51.48	29.05
$\beta_1 + \beta_2$		0.850	1.315		-5.016***	-4.053*
P-value (F-test: $\beta_1 + \beta_2 = 0$)		0.400	0.392		0.006	0.052

B. Additional State-Level Controls	Suicides			Mental-Health-Related Deaths		
	(1)	(2)	(3)	(4)	(5)	(6)
	Full Sample	Full Sample	Low Educ.	Full Sample	Full Sample	Low Educ.
Indep. prescriptive authority	-0.813	-0.431	0.350	-2.649	-1.408	-0.047
	(1.097)	(1.200)	(0.658)	(1.901)	(2.218)	(1.203)
Indep. Rx * underserved		-1.643	-1.130**		-5.342**	-3.697**
		(1.132)	(0.536)		(2.432)	(1.566)
Observations	300,836	300,836	300,836	300,836	300,836	300,836
R^2	0.970	0.970	0.952	0.972	0.972	0.958
Mean dependent variable	28.59	28.59	14.89	51.48	51.48	29.05
$\beta_1 + \beta_2$		-2.074	-0.780		-6.749***	-3.744***
P-value (F-test: $\beta_1 + \beta_2 = 0$)		0.106	0.147		0.001	0.003

Notes: Observations are at the county-quarter level and are population weighted. Standard errors are clustered by state. Regressions in Panel A include county, quarter, and year fixed effects and control for population. Regressions in Panel B include all of the controls from our main specification in addition to state unemployment rates, state beer taxes, and indicators denoting whether the state requires universal background checks and waiting periods for handgun and firearm purchases, expanded Medicaid, allows medical marijuana, allows recreational marijuana, implemented a prescription drug monitoring program (PDMP), and implemented a "must-access" PDMP. Data sources for these additional state-level controls are listed in the notes for Table A.3. A county is "underserved" if it had fewer than one psychiatrist per 30,000 people in 1990. "Low educ." is defined as having a high school degree or less.

Table A.8: Mental-Health-Related Mortality: Unweighted Regressions

	Suicides			Mental-Health-Related Deaths		
	(1)	(2)	(3)	(4)	(5)	(6)
	Full Sample	Full Sample	Low Educ.	Full Sample	Full Sample	Low Educ.
Indep. prescriptive authority	0.047	0.491**	0.210*	-0.250	0.749*	0.355
	(0.099)	(0.229)	(0.122)	(0.244)	(0.443)	(0.273)
Indep. Rx * underserved		-0.605**	-0.333***		-1.361***	-0.860***
		(0.261)	(0.124)		(0.486)	(0.286)
Observations	313,372	313,372	313,372	313,372	313,372	313,372
R^2	0.939	0.939	0.891	0.947	0.948	0.917
Mean dependent variable	3.01	3.01	1.81	5.01	5.01	3.18
$\beta_1 + \beta_2$		-0.114	-0.123**		-0.612***	-0.505***
P-value (F-test: $\beta_1 + \beta_2 = 0$)		0.183	0.039		0.008	0.003

Notes: Observations are at the county-quarter level and are not population weighted. Standard errors are clustered by state. All regressions include county, quarter, and year fixed effects; additional controls include population density, percent male, percent black, percent age 18 and under, percent age 65 and over, percent with a high school degree or less, a quadratic in median income, percent in poverty, percent unemployed, and the number of practicing psychiatrists and primary care physicians per 100,000. A county is "underserved" if it had fewer than one psychiatrist per 30,000 people in 1990. "Low educ." is defined as having a high school degree or less.

Table A.9: Mental-Health-Related Mortality: Deaths per 100,000

A. Weighted	Suicide Rate			Mental-Health-Related Death Rate		
	(1)	(2)	(3)	(4)	(5)	(6)
	Full Sample	Full Sample	Low Educ.	Full Sample	Full Sample	Low Educ.
Indep. prescriptive authority	0.052	-0.014	0.116	-0.023	-0.008	0.192
	(0.095)	(0.107)	(0.261)	(0.237)	(0.269)	(0.646)
Indep. Rx * underserved		0.279*	0.256		-0.063	-0.789
		(0.156)	(0.348)		(0.282)	(0.640)
Observations	313,372	313,372	313,372	313,372	313,372	313,372
R^2	0.217	0.217	0.211	0.334	0.334	0.323
Mean dependent variable	3.32	3.32	6.56	5.54	5.54	11.48
$\beta_1 + \beta_2$		0.266*	0.372		-0.071	-0.596
P-value (F-test: $\beta_1 + \beta_2 = 0$)		0.060	0.331		0.777	0.379

B. Unweighted	Suicide Death Rate			Mental-Health-Related Death Rate		
	(1)	(2)	(3)	(4)	(5)	(6)
	Full Sample	Full Sample	Low Educ.	Full Sample	Full Sample	Low Educ.
Indep. prescriptive authority	0.032	0.088	0.144	-0.187	0.062	0.261
	(0.079)	(0.112)	(0.391)	(0.230)	(0.217)	(0.494)
Indep. Rx * underserved		-0.076	-0.400		-0.339**	-1.218***
		(0.112)	(0.399)		(0.164)	(0.363)
Observations	313,372	313,372	313,372	313,372	313,372	313,372
R^2	0.052	0.052	0.058	0.090	0.090	0.097
Mean dependent variable	3.91	3.91	7.23	6.04	6.04	11.45
$\beta_1 + \beta_2$		0.012	-0.256		-0.277	-0.957
P-value (F-test: $\beta_1 + \beta_2 = 0$)		0.887	0.459		0.248	0.103

Notes: Observations are at the county-quarter level; observations in Panel A (B) are weighted (not weighted) by population. Standard errors are clustered by state. All regressions include county, quarter, and year fixed effects; additional controls include population density, percent male, percent black, percent age 18 and under, percent age 65 and over, percent with a high school degree or less, a quadratic in median income, percent in poverty, percent unemployed, and the number of practicing psychiatrists and primary care physicians per 100,000. A county is "underserved" if it had fewer than one psychiatrist per 30,000 people in 1990. "Low educ." is defined as having a high school degree or less.

Table A.10: Mental-Health-Related Mortality: State-Specific Linear Time Trends

	Suicides			Mental-Health-Related Deaths		
	(1)	(2)	(3)	(4)	(5)	(6)
	Full Sample	Full Sample	Low Educ.	Full Sample	Full Sample	Low Educ.
Indep. prescriptive authority	-1.883	-1.587	-1.765	-2.320	-1.503	-1.849
	(1.695)	(1.841)	(1.725)	(1.550)	(1.717)	(1.315)
Indep. Rx * underserved		-1.248	-0.471		-3.435*	-1.516
		(1.105)	(0.615)		(1.957)	(1.044)
Observations	313,372	313,372	313,372	313,372	313,372	313,372
R^2	0.972	0.972	0.953	0.974	0.974	0.961
Mean dependent variable	28.59	28.59	14.89	51.48	51.48	29.05
$\beta_1 + \beta_2$		-2.835*	-2.236*		-4.939**	-3.365**
P-value (F-test: $\beta_1 + \beta_2 = 0$)		0.074	0.095		0.021	0.014

Notes: Observations are at the county-quarter level and are population weighted. Standard errors are clustered by state. All regressions include county, quarter, and year fixed effects and state-specific linear time trends; additional controls include total population (or subgroup population), population density, percent male, percent black, percent age 18 and under, percent age 65 and over, percent with a high school degree or less, a quadratic in median income, percent in poverty, percent unemployed, and the number of practicing psychiatrists and primary care physicians per 100,000. A county is "underserved" if it had fewer than one psychiatrist per 30,000 people in 1990. "Low educ." is defined as having a high school degree or less.

Table A.11: Suicides: "Leave Out" Robustness

	(1) ID	(2) NV	(3) UT	(4) CO	(5) WY	(6) NE	(7) NM	(8) ND	(9) MN
Indep. prescriptive authority	0.433	0.374	0.181	0.437	0.548	0.657	0.380	0.610	0.616
	(1.073)	(1.113)	(0.947)	(1.215)	(1.025)	(1.074)	(1.035)	(1.037)	(1.059)
Indep. Rx * underserved	-2.107**	-1.701*	-1.509	-1.444	-1.902*	-1.878*	-1.924*	-1.882*	-1.916*
	(1.016)	(0.869)	(0.930)	(0.925)	(0.968)	(0.947)	(1.003)	(0.989)	(1.015)
Observations	308,972	311,672	310,472	307,072	311,072	304,072	310,072	308,072	304,672
R^2	0.969	0.969	0.970	0.970	0.969	0.969	0.969	0.969	0.969
Mean dependent variable	28.69	28.34	28.57	28.77	28.63	28.72	28.69	28.65	28.89
$\beta_1 + \beta_2$	-1.674	-1.327	-1.328	-1.007	-1.354	-1.220	-1.545	-1.272	-1.300
P-value (F-test: $\beta_1 + \beta_2 = 0$)	0.210	0.313	0.306	0.420	0.290	0.346	0.237	0.331	0.336

	(10) IA	(11) NH	(12) KY	(13) MD	(14) DE	(15) RI	(16) CT	(17) ME	(18) HI
Indep. prescriptive authority	0.542	0.538	0.570	1.376*	0.547	0.685	0.655	0.406	0.529
	(1.043)	(1.033)	(1.050)	(0.748)	(1.039)	(1.045)	(1.047)	(1.081)	(1.078)
Indep. Rx * underserved	-1.918*	-1.854*	-1.814*	-2.176**	-1.869*	-2.006**	-1.982*	-1.867*	-1.852*
	(0.975)	(0.976)	(1.025)	(0.996)	(0.968)	(0.975)	(0.990)	(0.995)	(1.007)
Observations	303,472	312,372	301,372	310,972	313,072	312,872	312,572	311,772	312,872
R^2	0.969	0.969	0.969	0.970	0.969	0.969	0.970	0.969	0.969
Mean dependent variable	28.85	28.68	28.91	28.63	28.63	28.64	28.73	28.69	28.61
$\beta_1 + \beta_2$	-1.377	-1.316	-1.244	-0.800	-1.322	-1.321	-1.327	-1.460	-1.324
P-value (F-test: $\beta_1 + \beta_2 = 0$)	0.283	0.302	0.361	0.486	0.300	0.301	0.299	0.269	0.299

Notes: Observations are at the county-quarter level and are population weighted. Standard errors are clustered by state. All regressions include county, quarter, and year fixed effects; additional controls include total population (or subgroup population), population density, percent male, percent black, percent age 18 and under, percent age 65 and over, percent with a high school degree or less, a quadratic in median income, percent in poverty, percent unemployed, and the number of practicing psychiatrists and primary care physicians per 100,000. A county is "underserved" if it had fewer than one psychiatrist per 30,000 people in 1990.

Table A.12: Mental-Health-Related Mortality: "Leave Out" Robustness

	(1) ID	(2) NV	(3) UT	(4) CO	(5) WY	(6) NE	(7) NM	(8) ND	(9) MN
Indep. prescriptive authority	-0.286	-1.111	-0.631	-0.698	-0.456	-0.127	-0.913	-0.357	-0.381
	(2.136)	(2.025)	(2.019)	(2.324)	(1.996)	(2.083)	(1.978)	(2.012)	(2.049)
Indep. Rx * underserved	-5.610**	-4.885***	-5.160**	-4.975**	-5.437***	-5.437***	-5.446***	-5.456***	-5.394***
	(2.102)	(1.745)	(1.960)	(1.975)	(1.932)	(1.874)	(1.989)	(1.965)	(2.012)
Observations	308,972	311,672	310,472	307,072	311,072	304,072	310,072	308,072	304,672
R^2	0.971	0.972	0.972	0.972	0.971	0.971	0.972	0.971	0.971
Mean dependent variable	51.68	51.06	51.58	51.87	51.56	51.74	51.65	51.59	52.08
$\beta_1 + \beta_2$	-5.896**	-5.996**	-5.791**	-5.674**	-5.892**	-5.565**	-6.359***	-5.813**	-5.776**
P-value (F-test: $\beta_1 + \beta_2 = 0$)	0.025	0.013	0.015	0.010	0.012	0.015	0.009	0.014	0.018

	(10) IA	(11) NH	(12) KY	(13) MD	(14) DE	(15) RI	(16) CT	(17) ME	(18) HI
Indep. prescriptive authority	-0.401	-0.439	-0.576	1.234	-0.470	-0.485	-0.420	-0.641	-0.692
	(2.039)	(2.016)	(2.013)	(1.375)	(2.027)	(1.999)	(2.023)	(2.131)	(2.051)
Indep. Rx * underserved	-5.495***	-5.378***	-5.261**	-6.740***	-5.427***	-5.361***	-5.444***	-5.471***	-5.168**
	(1.947)	(1.937)	(2.003)	(1.543)	(1.932)	(1.969)	(1.993)	(1.971)	(2.004)
Observations	303,472	312,372	301,372	310,972	313,072	312,872	312,572	311,772	312,872
R^2	0.971	0.971	0.971	0.972	0.971	0.971	0.972	0.971	0.972
Mean dependent variable	51.96	51.65	52.06	51.90	51.56	51.58	51.71	51.68	51.55
$\beta_1 + \beta_2$	-5.896**	-5.816**	-5.837**	-5.507***	-5.897**	-5.847**	-5.864**	-6.112**	-5.861**
P-value (F-test: $\beta_1 + \beta_2 = 0$)	0.012	0.013	0.018	0.009	0.012	0.013	0.012	0.013	0.012

Notes: Observations are at the county-quarter level and are population weighted. Standard errors are clustered by state. All regressions include county, quarter, and year fixed effects; additional controls include total population (or subgroup population), population density, percent male, percent black, percent age 18 and under, percent age 65 and over, percent with a high school degree or less, a quadratic in median income, percent in poverty, percent unemployed, and the number of practicing psychiatrists and primary care physicians per 100,000. A county is "underserved" if it had fewer than one psychiatrist per 30,000 people in 1990.

A.2 Self-Reported Mental Health

Table A.13: Self-Reported Mental Health: Full Regression Results

	Days in Poor Mental Health			21+ Days in Poor Mental Health		
	(1)	(2)	(3)	(4)	(5)	(6)
	Full Sample	Full Sample	Low Educ.	Full Sample	Full Sample	Low Educ.
Indep. prescriptive authority	-0.169**	-0.116	-0.135	-0.005**	-0.003**	-0.002
	(0.066)	(0.072)	(0.130)	(0.002)	(0.001)	(0.004)
Indep. Rx * underserved		-0.171*	-0.274**		-0.006	-0.012*
		(0.090)	(0.133)		(0.004)	(0.006)
Male	-1.004***	-1.004***	-1.060***	-0.014***	-0.014***	-0.016***
	(0.027)	(0.027)	(0.043)	(0.001)	(0.001)	(0.001)
White	0.173**	0.173**	0.047	-0.001	-0.001	-0.003
	(0.074)	(0.074)	(0.138)	(0.002)	(0.002)	(0.003)
Black	-0.443***	-0.443***	-0.796***	-0.014***	-0.014***	-0.024***
	(0.136)	(0.136)	(0.211)	(0.004)	(0.004)	(0.005)
Hispanic	-0.552***	-0.552***	-1.029***	-0.017***	-0.017***	-0.029***
	(0.110)	(0.110)	(0.174)	(0.003)	(0.003)	(0.004)
Health insurance	-0.487***	-0.487***	-0.372***	-0.013***	-0.013***	-0.011***
	(0.040)	(0.040)	(0.050)	(0.001)	(0.001)	(0.001)
Married	-0.750***	-0.750***	-0.702***	-0.015***	-0.015***	-0.015***
	(0.022)	(0.022)	(0.030)	(0.000)	(0.000)	(0.001)
Age: 18 to 34	0.085**	0.085**	-0.011	-0.011***	-0.011***	-0.013***
	(0.039)	(0.039)	(0.072)	(0.001)	(0.001)	(0.002)
Age: 35 to 44	0.220***	0.220***	0.190***	-0.001	-0.001	-0.001
	(0.031)	(0.031)	(0.065)	(0.001)	(0.001)	(0.002)
Age: 55 to 64	-0.775***	-0.775***	-1.015***	-0.015***	-0.015***	-0.023***
	(0.036)	(0.036)	(0.065)	(0.001)	(0.001)	(0.002)
Age: 65+	-1.880***	-1.880***	-2.337***	-0.037***	-0.037***	-0.051***
	(0.044)	(0.044)	(0.069)	(0.001)	(0.001)	(0.002)
Education: high school or less	0.000	0.000		0.002***	0.002***	
	(0.021)	(0.021)		(0.001)	(0.001)	
Education: college or more	-0.595***	-0.595***		-0.014***	-0.014***	
	(0.020)	(0.020)		(0.000)	(0.000)	
Income: 1st quintile	1.311***	1.311***	1.164***	0.027***	0.027***	0.024***
	(0.032)	(0.032)	(0.052)	(0.001)	(0.001)	(0.002)
Income: 2nd quintile	0.635***	0.635***	0.427***	0.009***	0.009***	0.004***
	(0.019)	(0.019)	(0.025)	(0.001)	(0.001)	(0.001)
Income: 3rd quintile	0.308***	0.308***	0.062	0.000	0.000	-0.005***
	(0.032)	(0.032)	(0.040)	(0.001)	(0.001)	(0.001)
Income: 4th quintile	0.018	0.018	-0.202***	-0.006***	-0.006***	-0.011***
	(0.036)	(0.036)	(0.037)	(0.001)	(0.001)	(0.001)
Income: 5th quintile	-0.449***	-0.449***	-0.710***	-0.015***	-0.015***	-0.021***
	(0.046)	(0.046)	(0.073)	(0.001)	(0.001)	(0.002)
Employment: for wages	-0.388***	-0.388***	-0.478***	-0.012***	-0.012***	-0.012**
	(0.084)	(0.084)	(0.110)	(0.004)	(0.004)	(0.006)
Employment: self-employed	-0.276***	-0.276***	-0.302**	-0.008**	-0.008**	-0.006
	(0.095)	(0.095)	(0.142)	(0.004)	(0.004)	(0.006)
Employment: out of work	6.868***	6.868***	6.448***	0.183***	0.183***	0.174***
	(0.131)	(0.131)	(0.168)	(0.005)	(0.005)	(0.007)
Employment: homemaker	-0.215**	-0.215**	-0.079	-0.004	-0.004	0.003
	(0.083)	(0.083)	(0.137)	(0.003)	(0.003)	(0.005)
Employment: student	-0.208**	-0.208**	-0.437***	-0.020***	-0.020***	-0.022***
	(0.103)	(0.103)	(0.130)	(0.004)	(0.004)	(0.006)
Employment: retired	0.049	0.049	0.173	0.003	0.003	0.009*
	(0.075)	(0.075)	(0.115)	(0.003)	(0.003)	(0.005)
Observations	6,540,521	6,540,521	2,606,231	6,540,521	6,540,521	2,606,231
R^2	0.083	0.083	0.083	0.052	0.052	0.052
Mean dependent variable	3.36	3.36	3.91	0.06	0.06	0.07
$\beta_1 + \beta_2$		-0.287***	-0.409***		-0.009**	-0.014**
P-value (F-test: $\beta_1 + \beta_2 = 0$)		0.001	0.000		0.045	0.013

Notes: Observations are at the individual level with BRFSS sample weights. Standard errors are clustered by state. All regressions include state and year fixed effects; indicators denoting missing information for marital status, race, Hispanic, and health insurance are also included. For income, education, and employment, the omitted category is an indicator denoting missing information. "Low Educ." is defined as having a high school degree or less.

Table A.14: Days in Poor Mental Health: Subgroup Analysis

A. Days in Poor Mental Health	(1) All	(2) Black	(3) Age 45-54	(4) Low Educ.	(5) Low Inc.	(6) Male	(7) Female
Indep. prescriptive authority	-0.116	0.041	-0.319***	-0.135	-0.240	-0.099	-0.130
	(0.072)	(0.098)	(0.098)	(0.130)	(0.195)	(0.062)	(0.102)
Indep. Rx * underserved	-0.171*	-0.636***	0.036	-0.274**	-0.021	-0.116	-0.228
	(0.090)	(0.106)	(0.100)	(0.133)	(0.193)	(0.073)	(0.148)
Observations	6,540,521	515,582	1,221,434	2,606,231	2,275,392	2,599,150	3,941,371
R^2	0.083	0.068	0.134	0.083	0.097	0.080	0.080
Mean dependent variable	3.36	3.81	3.70	3.91	4.39	2.80	3.89
$\beta_1 + \beta_2$	-0.287***	-0.595***	-0.283***	-0.409***	-0.261*	-0.216***	-0.357***
P-value (F-test: $\beta_1 + \beta_2 = 0$)	0.001	0.000	0.000	0.000	0.064	0.003	0.007

B. 21+ Days in Poor Mental Health	(1) All	(2) Black	(3) Age 45-54	(4) Low Educ.	(5) Low Inc.	(6) Male	(7) Female
Indep. prescriptive authority	-0.003**	0.002	-0.010***	-0.002	-0.005	-0.003**	-0.003
	(0.001)	(0.002)	(0.003)	(0.004)	(0.005)	(0.001)	(0.002)
Indep. Rx * underserved	-0.006	-0.017***	-0.000	-0.012*	-0.003	-0.003	-0.009
	(0.004)	(0.004)	(0.005)	(0.006)	(0.006)	(0.003)	(0.007)
Observations	6,540,521	515,582	1,221,434	2,606,231	2,275,392	2,599,150	3,941,371
R^2	0.052	0.039	0.091	0.052	0.062	0.052	0.051
Mean dependent variable	0.06	0.07	0.07	0.07	0.08	0.05	0.07
$\beta_1 + \beta_2$	-0.009**	-0.016***	-0.010**	-0.014**	-0.008	-0.006**	-0.011*
P-value (F-test: $\beta_1 + \beta_2 = 0$)	0.045	0.000	0.014	0.013	0.105	0.017	0.067

Notes: Observations are at the individual level with BRFSS sample weights. Standard errors are clustered by state. All regressions include state and year fixed effects; additional controls include indicators for age groups, education groups, income quintiles, and employment status and indicators denoting whether the respondent is male, white, black, Hispanic, married, and has health insurance. A state is "underserved" if the population-weighted average of binary, underserved categorizations across all counties in the state is less than the median across all states in 1990. "Low educ." is defined as having a high school degree or less; "Low Inc." is defined as being in the bottom two quintiles of income.

Table A.15: Self-Reported Mental Health: Alternative Underserved Measures

A. Time-varying	Days in Poor Mental Health			21+ Days in Poor Mental Health		
	(1)	(2)	(3)	(4)	(5)	(6)
	Full Sample	Full Sample	Low Educ.	Full Sample	Full Sample	Low Educ.
Indep. prescriptive authority	-0.169**	-0.128*	-0.168	-0.005**	-0.003**	-0.003
	(0.066)	(0.075)	(0.126)	(0.002)	(0.002)	(0.003)
Underserved		0.056	0.106		0.002	0.004
		(0.118)	(0.174)		(0.002)	(0.004)
Indep. Rx * underserved		-0.168*	-0.210		-0.006*	-0.009**
		(0.096)	(0.132)		(0.003)	(0.004)
Observations	6,540,521	6,540,521	2,606,231	6,540,521	6,540,521	2,606,231
R^2	0.083	0.083	0.083	0.052	0.052	0.052
Mean dependent variable	3.36	3.36	3.91	0.06	0.06	0.07
B. Continuous	Days in Poor Mental Health			21+ Days in Poor Mental Health		
	(1)	(2)	(3)	(4)	(5)	(6)
	Full Sample	Full Sample	Low Educ.	Full Sample	Full Sample	Low Educ.
Indep. prescriptive authority	-0.169**	-0.059	-0.062	-0.005**	-0.001	0.002
	(0.066)	(0.085)	(0.150)	(0.002)	(0.002)	(0.005)
Indep. Rx * underserved		-0.483**	-0.700**		-0.018	-0.032**
		(0.232)	(0.325)		(0.012)	(0.016)
Observations	6,540,521	6,540,521	2,606,231	6,540,521	6,540,521	2,606,231
R^2	0.083	0.083	0.083	0.052	0.052	0.052
Mean dependent variable	3.36	3.36	3.91	0.06	0.06	0.07
$\beta_1 + \beta_2$		-0.543***	-0.762***		-0.018*	-0.030**
P-value (F-test: $\beta_1 + \beta_2 = 0$)		0.005	0.002		0.086	0.023

Notes: Observations are at the individual level with BRFSS sample weights. Standard errors are clustered by state. All regressions include state and year fixed effects; additional controls include indicators for age groups, education groups, income quintiles, and employment status and indicators denoting whether the respondent is male, white, black, Hispanic, married, and has health insurance. In Panel A, a state is "underserved" if the population-weighted average of binary, underserved categorizations across all counties in the state is less than the median across all states in a given year (binary). In Panel B, "underserved" is the population-weighted average of binary, underserved categorizations across all counties in the state in 1990 (continuous between zero and one). "Low educ." is defined as having a high school degree or less.

Table A.16: Self-Reported Mental Health: Alternative Controls

A. No Controls	Days in Poor Mental Health			21+ Days in Poor Mental Health		
	(1)	(2)	(3)	(4)	(5)	(6)
	Full Sample	Full Sample	Low Educ.	Full Sample	Full Sample	Low Educ.
Indep. prescriptive authority	-0.240***	-0.195**	-0.224	-0.006***	-0.005**	-0.004
	(0.079)	(0.092)	(0.159)	(0.002)	(0.002)	(0.004)
Indep. Rx * underserved		-0.142	-0.236*		-0.006	-0.011**
		(0.086)	(0.133)		(0.004)	(0.005)
Observations	6,545,759	6,545,759	2,606,851	6,545,759	6,545,759	2,606,851
R^2	0.003	0.003	0.005	0.002	0.002	0.003
Mean dependent variable	3.36	3.36	3.91	0.06	0.06	0.07
$\beta_1 + \beta_2$		-0.338***	-0.460***		-0.010***	-0.015***
P-value (F-test: $\beta_1 + \beta_2 = 0$)		0.000	0.000		0.009	0.001

B. Only Demographic Controls	Days in Poor Mental Health			21+ Days in Poor Mental Health		
	(1)	(2)	(3)	(4)	(5)	(6)
	Full Sample	Full Sample	Low Educ.	Full Sample	Full Sample	Low Educ.
Indep. prescriptive authority	-0.234***	-0.187**	-0.224	-0.006***	-0.004**	-0.004
	(0.079)	(0.091)	(0.159)	(0.002)	(0.002)	(0.004)
Indep. Rx * underserved		-0.149*	-0.252*		-0.006	-0.011**
		(0.083)	(0.132)		(0.004)	(0.005)
Observations	6,545,759	6,545,759	2,606,851	6,545,759	6,545,759	2,606,851
R^2	0.015	0.015	0.020	0.005	0.005	0.009
Mean dependent variable	3.36	3.36	3.91	0.06	0.06	0.07
$\beta_1 + \beta_2$		-0.336***	-0.476***		-0.010***	-0.015***
P-value (F-test: $\beta_1 + \beta_2 = 0$)		0.000	0.000		0.010	0.001

C. Additional State-Level Controls	Days in Poor Mental Health			21+ Days in Poor Mental Health		
	(1)	(2)	(3)	(4)	(5)	(6)
	Full Sample	Full Sample	Low Educ.	Full Sample	Full Sample	Low Educ.
Indep. prescriptive authority	-0.179***	-0.104	-0.100	-0.004**	-0.002*	-0.000
	(0.061)	(0.069)	(0.105)	(0.002)	(0.001)	(0.002)
Indep. Rx * underserved		-0.231**	-0.352**		-0.008	-0.015**
		(0.109)	(0.136)		(0.005)	(0.006)
Observations	6,540,521	6,540,521	2,606,231	6,540,521	6,540,521	2,606,231
R^2	0.083	0.083	0.083	0.052	0.052	0.052
Mean dependent variable	3.36	3.36	3.91	0.06	0.06	0.07
$\beta_1 + \beta_2$		-0.335***	-0.453***		-0.010**	-0.015**
P-value (F-test: $\beta_1 + \beta_2 = 0$)		0.001	0.000		0.046	0.012

Notes: Observations are at the individual level with BRFSS sample weights. Standard errors are clustered by state. All regressions include state and year fixed effects. Regressions in Panel B also include indicators for age groups and indicators denoting whether the respondent is male, white, black, or Hispanic. Regressions in Panel C include all controls from our main specification in addition to state unemployment rates, state beer taxes, and indicators denoting whether the state requires universal background checks and waiting periods for handgun and firearm purchases, expanded Medicaid, allows medical marijuana, allows recreational marijuana, implemented a prescription drug monitoring program (PDMP), and implemented a "must-access" PDMP. Data sources for these additional state-level controls are listed in the notes for Table A.3.

Table A.17: Self-Reported Mental Health: Adjusting Sampling Weights for 2011 Redesign

	Days in Poor Mental Health			21+ Days in Poor Mental Health		
	(1)	(2)	(3)	(4)	(5)	(6)
	Full Sample	Full Sample	Low Educ.	Full Sample	Full Sample	Low Educ.
Indep. prescriptive authority	-0.170**	-0.110	-0.128	-0.005**	-0.003*	-0.001
	(0.071)	(0.079)	(0.138)	(0.002)	(0.001)	(0.004)
Indep. Rx * underserved		-0.189*	-0.292*		-0.007	-0.013*
		(0.103)	(0.149)		(0.005)	(0.006)
Observations	6,540,521	6,540,521	2,606,231	6,540,521	6,540,521	2,606,231
R^2	0.082	0.082	0.081	0.051	0.051	0.051
Mean dependent variable	3.34	3.34	3.87	0.06	0.06	0.07
$\beta_1 + \beta_2$		-0.299***	-0.419***		-0.009**	-0.014**
P-value (F-test: $\beta_1 + \beta_2 = 0$)		0.002	0.001		0.049	0.017

Notes: Observations are at the individual level with adjusted BRFSS sample weights. Following Simon et al. (2017), we reconstruct each individual's sample weight as the fraction of their assigned BRFSS sample weight over the sum of all individuals' sample weights for that year. Standard errors are clustered by state. All regressions include state and year fixed effects; additional controls include indicators for age groups, education groups, income quintiles, and employment status and indicators denoting whether the respondent is male, white, black, Hispanic, married, and has health insurance. A state is "underserved" if the population-weighted average of binary, underserved categorizations across all counties in the state is less than the median across all states in 1990. "Low educ." is defined as having a high school degree or less.

Table A.18: Self-Reported Mental Health: State-Specific Linear Time Trends

	Days in Poor Mental Health			21+ Days in Poor Mental Health		
	(1)	(2)	(3)	(4)	(5)	(6)
	Full Sample	Full Sample	Low Educ.	Full Sample	Full Sample	Low Educ.
Indep. prescriptive authority	-0.006	-0.063	-0.015	0.001	-0.000	0.001
	(0.111)	(0.156)	(0.161)	(0.002)	(0.002)	(0.002)
Indep. Rx * underserved		0.152	0.023		0.002	-0.003
		(0.189)	(0.235)		(0.003)	(0.004)
Observations	6,540,521	6,540,521	2,606,231	6,540,521	6,540,521	2,606,231
R^2	0.084	0.084	0.083	0.053	0.053	0.053
Mean dependent variable	3.36	3.36	3.91	0.06	0.06	0.07
$\beta_1 + \beta_2$		0.089	0.007		0.002	-0.001
P-value (F-test: $\beta_1 + \beta_2 = 0$)		0.419	0.968		0.347	0.732

Notes: Observations are at the individual level with BRFSS sample weights. Standard errors are clustered by state. All regressions include state and year fixed effects and state-specific time trends; additional controls include indicators for age groups, education groups, income quintiles, and employment status and indicators denoting whether the respondent is male, white, black, Hispanic, married, and has health insurance. A state is "underserved" if the population-weighted average of binary, underserved categorizations across all counties in the state is less than the median across all states in 1990. "Low educ." is defined as having a high school degree or less.

Table A.19: Days in Poor Mental Health: "Leave Out" Robustness

	(1) ID	(2) NV	(3) UT	(4) CO	(5) WY	(6) NE	(7) NM	(8) ND	(9) MN
Indep. prescriptive authority	-0.116	-0.077	-0.117	-0.082	-0.116	-0.116	-0.115	-0.116	-0.121
	(0.072)	(0.070)	(0.073)	(0.089)	(0.072)	(0.073)	(0.073)	(0.072)	(0.073)
Indep. Rx * underserved	-0.220**	-0.212**	-0.171*	-0.206**	-0.171*	-0.180*	-0.171*	-0.190**	-0.155
	(0.087)	(0.088)	(0.090)	(0.102)	(0.090)	(0.095)	(0.090)	(0.092)	(0.112)
Observations	6,430,612	6,471,578	6,398,983	6,387,373	6,443,881	6,329,702	6,420,995	6,459,761	6,387,329
R^2	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083
Mean dependent variable	3.36	3.36	3.36	3.37	3.36	3.37	3.36	3.36	3.37
$\beta_1 + \beta_2$	-0.336***	-0.288***	-0.287***	-0.288***	-0.287***	-0.297***	-0.287***	-0.306***	-0.276**
P-value (F-test: $\beta_1 + \beta_2 = 0$)	0.000	0.001	0.001	0.001	0.001	0.002	0.001	0.001	0.012

	(10) IA	(11) NH	(12) KY	(13) MD	(14) DE	(15) RI	(16) CT	(17) ME	(18) HI
Indep. prescriptive authority	-0.116	-0.116	-0.118	-0.141	-0.114	-0.118	-0.129*	-0.147**	-0.114
	(0.073)	(0.073)	(0.073)	(0.091)	(0.073)	(0.074)	(0.073)	(0.067)	(0.077)
Indep. Rx * underserved	-0.171*	-0.171*	-0.105	-0.145	-0.173*	-0.169*	-0.155*	-0.139	-0.172*
	(0.090)	(0.090)	(0.081)	(0.106)	(0.091)	(0.092)	(0.091)	(0.086)	(0.094)
Observations	6,427,817	6,445,001	6,384,413	6,380,399	6,462,560	6,445,858	6,419,326	6,431,572	6,428,946
R^2	0.083	0.083	0.083	0.084	0.083	0.083	0.083	0.083	0.083
Mean dependent variable	3.37	3.36	3.35	3.37	3.36	3.36	3.37	3.36	3.37
$\beta_1 + \beta_2$	-0.287***	-0.287***	-0.222***	-0.285***	-0.287***	-0.287***	-0.284***	-0.286***	-0.286***
P-value (F-test: $\beta_1 + \beta_2 = 0$)	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001

Notes: Observations are at the individual level with BRFSS sample weights. Standard errors are clustered by state. All regressions include state and year fixed effects; additional controls include indicators for age groups, education groups, income quintiles, and employment status and indicators denoting whether the respondent is male, white, black, Hispanic, married, and has health insurance. A state is "underserved" if the population-weighted average of binary, underserved categorizations across all counties in the state is less than the median across all states in 1990.

Table A.20: 21+ Days in Poor Mental Health: "Leave Out" Robustness

	(1) ID	(2) NV	(3) UT	(4) CO	(5) WY	(6) NE	(7) NM	(8) ND	(9) MN
Indep. prescriptive authority	-0.003**	-0.003*	-0.003**	-0.002	-0.003**	-0.003**	-0.003**	-0.003**	-0.003**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Indep. Rx * underserved	-0.008	-0.006	-0.006	-0.007	-0.006	-0.006	-0.006	-0.007	-0.008
	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)	(0.005)	(0.004)	(0.005)	(0.006)
Observations	6,430,612	6,471,578	6,398,983	6,387,373	6,443,881	6,329,702	6,420,995	6,459,761	6,387,329
R^2	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052
Mean dependent variable	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
$\beta_1 + \beta_2$	-0.011**	-0.009**	-0.009**	-0.009**	-0.009**	-0.009*	-0.009**	-0.010**	-0.011*
P-value (F-test: $\beta_1 + \beta_2 = 0$)	0.028	0.045	0.045	0.044	0.046	0.069	0.046	0.044	0.075

	(10) IA	(11) NH	(12) KY	(13) MD	(14) DE	(15) RI	(16) CT	(17) ME	(18) HI
Indep. prescriptive authority	-0.003**	-0.003**	-0.003**	-0.003**	-0.003**	-0.003*	-0.003**	-0.003***	-0.003*
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Indep. Rx * underserved	-0.006	-0.006	-0.001	-0.006	-0.006	-0.006	-0.006	-0.006	-0.006
	(0.004)	(0.004)	(0.002)	(0.005)	(0.004)	(0.004)	(0.005)	(0.004)	(0.005)
Observations	6,427,817	6,445,001	6,384,413	6,380,399	6,462,560	6,445,858	6,419,326	6,431,572	6,428,946
R^2	0.052	0.052	0.051	0.052	0.052	0.052	0.052	0.052	0.052
Mean dependent variable	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
$\beta_1 + \beta_2$	-0.009**	-0.009**	-0.004***	-0.009**	-0.009**	-0.009**	-0.009**	-0.009**	-0.009**
P-value (F-test: $\beta_1 + \beta_2 = 0$)	0.045	0.046	0.009	0.045	0.045	0.046	0.046	0.045	0.046

Notes: Observations are at the individual level with BRFSS sample weights. Standard errors are clustered by state. All regressions include state and year fixed effects; additional controls include indicators for age groups, education groups, income quintiles, and employment status and indicators denoting whether the respondent is male, white, black, Hispanic, married, and has health insurance. A state is "underserved" if the population-weighted average of binary, underserved categorizations across all counties in the state is less than the median across all states in 1990.