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

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Abstract

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

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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, nearly one third of the U.S. population lives in areas that are underserved by mental health care providers (Bureau of Health Workforce, 2016). As mental health problems tend to develop early in life and persist over the lifecycle, 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). Recent evidence demonstrates that even increases in all-cause mortality for some groups are being driven by mental-health-related deaths (Case and Deaton, 2015), 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 is associated with improved mental health outcomes. Leveraging a novel dataset that documents legislative changes granting NPs independent prescriptive authority over 24 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 health outcomes for 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 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.[1] Critics further note that extending prescriptive authority be-

[1]It has been estimated that NPs could safely provide 70-80% of the care provided by physicians in primary care

yond 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 US, 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 generalized difference-in-difference framework. We use two complementary categories of 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. Our results demonstrate that extending prescriptive authority to NPs is associated with improvements in both self-reported mental health and mental-health-related mortality. On average, granting NPs independent prescriptive authority is associated with a significant reduction in the number of days spent in poor mental health (0.13 days per month, or 4% of the mean). We further find a negative association between prescriptive authority for NPs 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 psychiatrists and among already disadvantaged populations. In particular, areas that are underserved by psychiatrists see 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 an additional reduction of 0.19 days per month in poor mental health (6% of the mean) and underserved counties see an additional reduction of two mental-health-related deaths per quarter (4% of the mean). A back-of-the-envelope calculation suggests that 410 deaths were

(Scheffler et al., 1996). Furthermore, there is no evidence indicating that patients receive substandard care when being treated by NPs. Rather, the 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 (Mundinger et al., 2000; Horrocks et al., 2002; Lenz et al., 2004; Laurant et al., 2008; Naylor and Kurtzman, 2010).

averted in 2014 alone across the 662 underserved counties that allowed NPs to prescribe independently. Populations with low levels of education also see strong improvements in both mental health measures, with the largest benefits 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).[2] Second, psychiatrists are less likely than all other physician specialties to accept insurance, with differences in acceptance rates being greatest among forms of public insurance (Bishop et al., 2014). Therefore, even in areas where there are a sufficient number of psychiatrists, 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; Larson et al., 2003a,b), 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 2006–2014, we find suggestive evidence that extending independent prescriptive authority to NPs is associated with an increase in the number of prescriptions for antidepressants and antipsychotics.[3] Of the 18 states that granted NPs independent prescriptive authority over our entire sample period (1990–2014), 8 changed their legislation between 2006 and 2014. While our statistical power is thus more limited when examining law-induced changes in prescriptions than mental health outcomes, it is reassuring that prescriptions for these classes of psychotropic medications increase when more providers can write them inde-

[2]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 treatments (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. 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.

[3]Note that an increase in prescriptions is not necessary for broadened prescriptive authority to be associated with improvements in mental health. If, for example, NPs spend more time with their patients and patient-provider interaction is critical for mental-health outcomes, we would still expect health outcomes to improve when NPs are allowed to perform more services.

pendently.

In light of rising rates of abuse of prescription pain medication (NSDUH, 2014), another concern with broadening prescriptive authority for NPs is that such legislation could lead to a greater number of opioid analgesics available for misuse. Again using prescription data from 2006–2014, we find suggestive evidence that broadened prescriptive authority is also associated with an increase in the availability of opioids. However, we do not believe that this influences the interpretation of our main findings. We find that allowing NPs to prescribe independently is associated with fewer mental-health-related deaths, a figure that includes overdoses. Therefore, if anything, our main results actually underestimate the effect of only increasing access to non-controlled substances such as antidepressants.

Our work contributes to the 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 most closely related study is Stange (2014), who finds that allowing NPs to prescribe controlled substances is associated with only modest increases in utilization and expenditures.[6] On this dimension our findings diverge substantially, which likely stems from our differing treatment of the law changes. We focus on whether NPs can prescribe any medications independently, whereas Stange (2014) considers whether NPs can prescribe controlled substances with any level of oversight. Given that our results are driven primarily by underserved

[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 be associated with increased demand. However, given that 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 effect on quantity is 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), Stange (2014), and Kleiner et al. (2016) for the case of physicians and non-physician providers.

[6]Focusing primarily on provider supply, Stange (2014) further finds that growth in the number of NPs and physician assistants has a minimal impact on utilization, access, and prices in the primary care market.

areas, where physicians available for either supervision or collaboration are the most scarce, it is not surprising that we find different effects.

More broadly, our work contributes to the literature that examines how mental health outcomes can be affected by policy interventions. Previous studies have focused primarily on policy efforts to improve access to physician-provided care, for example 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 Finkelstein et al. (2012); Cunningham (2009); 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 222,000 NPs already licensed in the US who could prescribe if legislation permitted them to do so (AANP, 2015).

Taken together, our results provide strong evidence 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 psychiatrists 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 had granted independent prescriptive authority to NPs. Noticeably, no state in the South has yet to allow NPs to independently prescribe. Given the limited access to psychiatrists in these states, as well as their record of poor mental health outcomes, our findings are of particular importance for the provision of mental health care services in the southern US.

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

2 Data

We use information from seven sources to document how extending prescriptive authority to NPs affects population mental health. In particular, we combine a new dataset detailing independent prescriptive authority for NPs with mental health outcomes from both the U.S. Mortality Files and the Behavioral Risk Factor Surveillance System survey and prescription data from QuintilesIMS'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 US Census. Each dataset is described in detail below.

2.1 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.[7] While the language of scope of practice legislation is particular to each state, we define independent prescriptive authority as the ability to prescribe medication without physician collaboration or supervision.[8]

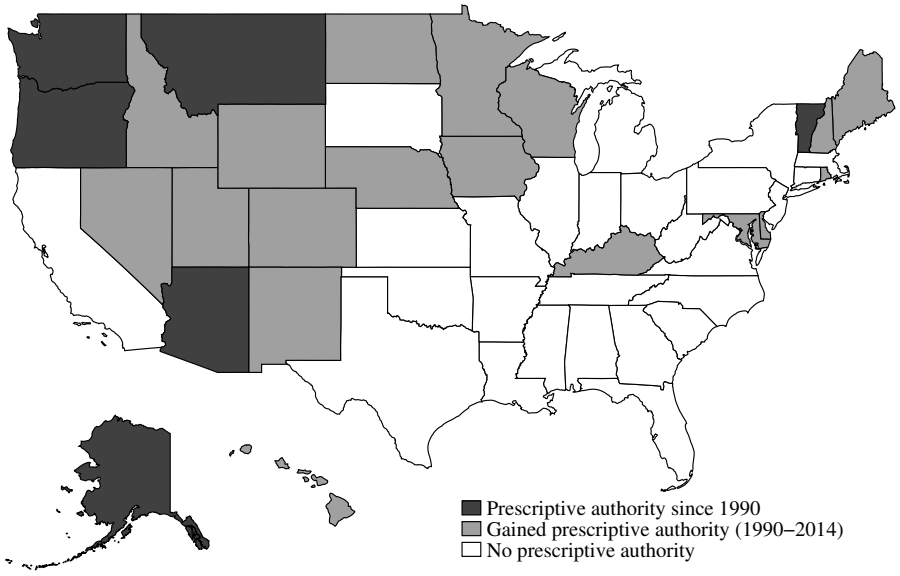
As of January 1st, 1990, six states and the District of Columbia had already granted NPs statutory authority to independently prescribe medication. Between 1990 and 2014, 18 states changed their scope of practice legislation to allow NPs to prescribe without physician involvement. This

[7] *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.

[8] In many states, NPs have the statutory authority to prescribe only under the direct supervision of a physician or with a collaborative practice agreement. While such laws should also increase access to treatment over a regime in which NPs have no statutory authority to prescribe, we expect their impacts to be more limited than granting NPs full independent prescriptive authority. Anecdotal evidence suggests that many NPs have difficulty finding or affording physicians who are willing to supervise or work in collaboration, especially in areas with few physicians.

geographic and temporal variation in scope of practice legislation is displayed in Figure 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.

While it is difficult to say why states decide to grant NPs independent prescriptive authority, we believe that the timing of state-level changes in scope of practice legislation are exogenous to population mental health. Anecdotal evidence from those involved in the process suggests that changes in scope of practice legislation are driven largely by idiosyncrasies of local politics. Furthermore, we find no evidence that the law changes are driven by measures of local economic conditions or the availability of medical providers (see Table A.1). Therefore, we believe that these law changes are exogenous to baseline levels and trends of mental health.

2.2 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 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.

2.2.1 Mental-Health-Related Mortality

Our first outcome is mental-health-related mortality from the U.S. Mortality Files at the county-quarter level from 1990–2014. Here, we consider both suicides and a broader measure of "mental-health-related deaths," which combines suicides, deaths of unknown intent, and accidental death categories that are closely related to mental health: those involving firearms, trains, drownings, and poisonings.

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 may reflect both systematic differences in true suicides as well as systematic differences in cause-of-death reporting (Björkenstam et al., 2014; Hilkevitch, 2005; Rockett et al., 2006). When someone dies from an overdose of oxycodone, for example, the local coroner decides whether to label the death as a suicide or as an accidental poisoning. Our broad measure of mental-health-related deaths captures both causes of death, whereas "suicides" only captures the former. Second, drug and alcohol addiction is an increasingly important category of mental illness, and thus we are interested in drug-related deaths even if suicide was not the individual's intent.[9]

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 about the size of the population base. When one area reports having more deaths than

[9]There is an extensive body of literature in medicine and psychiatry discussing the feedback between substance abuse disorders and other types of mental illness. Most prominently, the self-medication hypothesis posits that substance abuse is often related to other underlying mental illness via self-medication (Khantzian, 1985; Regier et al., 1990; Khantzian, 1997; Barkus and Murray, 2010; Nock et al., 2010).

another, for example, 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 linearly interpolated county-year population estimates from the 1990, 2000, and 2010 Decennial Censuses.

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

	All	Never Indep. Rx Authority	Ever Indep. Rx Authority
Deaths per 100,000:			
Suicides	3.32	3.10	4.15
Mental-Health-Related Deaths	5.54	5.32	6.34
Independent Prescriptive Authority	0.13	0	0.62
Low Psychiatrist-to-Pop. Ratio	0.21	0.20	0.21
Total Population	1,039,119	1,172,967	549,985
Population Density (Per Sq. Mile)	2,209	2,246	728
Percent Male	0.49	0.49	0.49
Percent 18 and Under	0.25	0.25	0.25
Percent Middle Age	0.13	0.13	0.13
Percent Black	0.12	0.14	0.06
Percent HS or Less	0.47	0.25	0.26
Percent College or More	0.25	0.48	0.43
Percent Unemployed	0.06	0.06	0.06
Median Household Income	54,015	53,882	54,504
Psychiatrists per 100,000	11.88	12.15	10.91
Primary Care MDs/DOs per 100,000	96.02	96.6	93.9
Observations	313,400	215,500	97,900

Notes: Observations are at the county-quarter level. Statistics are weighted by population. "Mental-Health-Related Deaths" include suicides, deaths of unknown intent, and accidental deaths involving firearms, trains, and poisonings. "Ever (Never) Independent Rx Authority" includes counties that had independent prescriptive authority for NPs at some point (at no point) during our sample. "Independent Prescriptive Authority" and "Low Psychiatrist-to-Pop. Ratio" reflect whether counties allowed NPs independent prescriptive authority or were underserved for mental health services in a given year, respectively. 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 1990, 2000, and 2010 Decennial Censuses and the 5-year pooled (2008–2012) American Community Survey (ACS). Census and ACS variables are linearly interpolated at the county-year level.

In addition to population estimates, we also use county-level demographics from both the census and the American Community Survey (ACS) to control for underlying differences across counties and to identify disadvantaged subpopulations. As with total population, we linearly interpolate subpopulation estimates at the county-year level between the 1990 census, the 2000 census, and

either the 2010 census or the 5-year pooled (2008–2012) ACS. 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 employment, education, and age profiles.

2.2.2 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 US. The BRFSS is representative at the state-year level. Starting in 1993 and in most state-years during our sample frame, respondents were asked the following question:

> "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 either diagnosed or 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 extended time periods over which symptoms must be experienced in order for the diagnosis to apply. Thus, we believe creating a binary variable focusing on those experiencing prolonged symptoms will help identify people suffering from more severe forms of mental illness.

The BRFSS also 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.

Table 2: Summary Statistics: Self-Reported Mental Health and Controls, 1993–2013

	All	Never Indep. Rx Authority	Ever Indep. Rx Authority
Days in Poor Mental Health:			
Average	3.33	3.36	3.16
Percent 0	0.67	0.67	0.66
Percent >= 21	0.06	0.06	0.05
Independent Prescriptive Authority	0.14	0	0.75
Low Psychiatrist-to-Population Ratio	0.37	0.39	0.26
Male	0.48	0.48	0.49
White	0.71	0.70	0.78
Black	0.10	0.11	0.05
Hispanic	0.12	0.13	0.09
Employed	0.52	0.52	0.54
Health Insurance	0.84	0.84	0.86
Age: 18 to 34	0.31	0.31	0.32
Age: 35 to 44	0.20	0.20	0.20
Age: 45 to 54	0.18	0.18	0.18
Age: 55 to 64	0.13	0.13	0.13
Age: 65 and Over	0.17	0.17	0.17
Education: HS or Less	0.43	0.44	0.39
Education: Some College or More	0.57	0.56	0.60
Income: 1st Quintile	0.20	0.20	0.17
Income: 2nd Quintile	0.17	0.17	0.18
Income: 3rd Quintile	0.17	0.17	0.18
Income: 4th Quintile	0.18	0.18	0.19
Income: 5th Quintile	0.14	0.14	0.15
Observations	5,670,468	3,399,048	2,271,420

Notes: Observations are at the individual level. Statistics are weighted using BRFSS sample weights. "Ever (Never) Independent Rx Authority" includes respondents living in states that had independent prescriptive authority for NPs at some point (at no point) during our sample. "Independent Prescriptive Authority" and "Low Psychiatrist-to-Pop. Ratio" reflect the fraction of respondents living in a state with independent prescriptive authority or that was underserved for mental health services in the year that he/she responded, respectively. Some categorical variables do not sum to one; the difference reflects the percentage of missings.

As shown in Table 2, BRFSS respondents report spending 3.33 days in the past month in poor mental health on average, with 67% 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, education, and income profiles to control states, although states that grant independent prescriptive authority over our sample period are less racially diverse.

The question on days in poor mental health was not asked in some state-years during our sample frame.[10] 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 with 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.

2.3 Health Resources

Increasing the supply of providers who can prescribe medication should have greater impacts among populations living 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-year psychiatrist counts from the HRSA's Area Resource Files with county-year population estimates from the census. As before, we linearly interpolate county-level populations between the 1990, 2000, and 2010 Decennial Censuses. Refer to A.1 for a map of underserved counties in 2002.

As the survey data outlined in Section 2.2.2 is at the state level, we 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

[10] In particular, the BRFSS did not this question in Wyoming in 1993, Rhode Island in 1994, Washington D.C. in 1995, 29 states in 2002, and Hawaii in 2004. The states missing in 2002 are: 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.

services in a given year if the population-weighted average of binary, underserved categorizations across all counties in the state is less than the median across all states in that year. Refer to A.2 for a map of underserved states in 2002.

Over our sample period, approximately 20% of the U.S. population lived in counties that were underserved for mental health care (see Figure A.3). Despite yearly fluctuations, this fraction remains fairly stable over our sample period. Perhaps unsurprisingly, underserved counties are on average less densely populated, less educated, and are more white than counties with adequate mental health resources (see Tables A.3 and A.2).

While we define an area as being underserved for mental health care by whether they have enough psychiatrists to serve the population, this characterization is an over-simplification of how mental health care is actually delivered in the US. Psychiatrists are the only MDs specifically trained to treat mental illness, although many general practitioners also provide treatment for mental illness in practice (Kessler and Stafford, 2008). Despite this overlap in the services provided by psychiatrists and general practitioners, we define areas as underserved for mental health care using the psychiatrist-to-population ratio for two reasons. First, the HRSA only defines mental health care shortage areas using the number of psychiatrists, so logistically it is not clear what threshold would be appropriate to define a county as underserved for mental health care resources using 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. Therefore, we believe that we are identifying the relevant variation in the availability of mental health care providers by focusing on areas underserved by psychiatrists.

2.4 Prescription Data

Finally, to examine how extending independent prescriptive authority to NPs influences the number of prescriptions being written, we use the Xponent database from QuintilesIMS. This dataset contains the number of prescriptions filled for antipsychotics, antidepressants, and opioids at the

provider-month level from 2006 to 2014. Importantly, the data contains both the county and the month of each prescription. These variables allow us to identify whether NPs had independent prescriptive authority when and where the prescription was filled.[11] Unfortunately, we only have prescription data from 2006 onward. However, eight states granted independent prescriptive authority to NPs during this time frame: Colorado, Hawaii, Maryland, Nevada, North Dakota, Rhode Island, Kentucky, and Minnesota.

While the data is sufficiently detailed to allow us to examine the number of prescriptions written by either physicians or NPs separately, we believe that the total number of prescriptions more accurately reflects changes in prescription patterns associated with the law changes. When NPs have a supervisory or collaborative relationship with a physician, the prescription pad used by the NP may bear either the affiliated physician's name and national provider identifier (NPI) or the NP's name and NPI.[12] 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. As we cannot precisely attribute any changes in the number of prescriptions that occur when NPs gain independent prescriptive authority to either MDs or NPs, we instead consider the total number of prescriptions filled within a county.

3 Prescriptive Authority and Mental Health Outcomes

In order to identify whether extending independent prescriptive authority to NPs improves mental health outcomes, we exploit time-series variation in state-level scope of practice legislation and mental health outcomes using a generalized difference-in-difference framework. As described in Section 2.2, we consider two categories of mental health outcomes: mental-health-related mortality and self-reported days in poor mental health. The impact of prescriptive authority on each category

[11] QuintilesIMS constructs the database by collecting prescription scripts directly from 86% of U.S. retail pharmacies and estimating the remaining 14% using their patented projection methodology.

[12] 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 their name.

of outcomes is considered in turn below.

3.1 Mental-Health-Related Mortality

When NPs are allowed to independently prescribe, do we see reductions in the prevalence of suicides and other mental-health-related deaths? 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; and λ_c, λ_q, and λ_y are county, quarter, and year fixed effects, respectively.[13]

To avoid introducing measurement error into the outcome, our preferred specification uses the number of deaths in a county-quarter as the outcome 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 outcome variable, death rates are very sensitive to population counts, and precise county-level population estimates are only available every ten years. Whereas measurement error from population estimates on the right-hand side will attenuate the estimated coefficient on population, it will not affect the precision of our estimated coefficients of interest. On the other hand, measurement error in the outcome would serve to attenuate all estimated coefficients, including those of key policy relevance.

Increasing the supply of providers should impact mental health outcomes most for populations living in areas with an insufficient supply of providers and for populations who find it more difficult to access psychiatrist-provided care. We therefore allow the impact of changing scope of practice legislation to differentially influence mental health in counties with an underprovision

[13] Since we include county fixed effects, we do not control for county demographics that are nearly constant over time. However, we do control for time-varying county-year demographics: population, population density, percent unemployed, percent with a high school diploma or less, percent with a college degree or more, a quadratic in median income, and the number of practicing psychiatrists and primary care physicians. Results are robust to including a wider range of county-level demographics.

of mental health care services and for populations who are traditionally disadvantaged. Letting $Underserved_{cy}$ be a dummy which equals one if county c in year y is underserved for mental health care services and zero otherwise, we estimate the following equation:

$$\begin{aligned} Deaths_{cqy} &= \beta_0 + \beta_1 Indep.\ Rx_{sqy} + \beta_2 Underserved_{cy} + \\ &\quad \beta_3 Indep.\ Rx_{sqy} \cdot Underserved_{cy} + \beta_4 Pop_{cy} + \\ &\quad \beta_5 X_{cy} + \gamma_c + \gamma_q + \gamma_y + \epsilon_{cqy} \end{aligned} \tag{2}$$

where 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 Tables A.5 and A.6 for results for additional subpopulations.

As shown in Columns (1) and (4) of Table 3, on average there is no statistically significant effect of granting independent prescriptive authority to NPs on deaths across all counties. However, as expected, counties that are underserved by psychiatrists experience larger and more precisely estimated decreases in mortality when NPs can prescribe independently. Relative to the average county with sufficient resources, underserved counties experience a reduction of 0.76 suicides per quarter, or 2.5% of the mean (Column (2)). Column (5) paints a similar picture: relative to counties with more resources, who experience a negative but imprecisely estimated reduction in mental-health-related deaths when NPs can prescribe, underserved counties see additional decreases in mental-health-related mortality of two deaths per quarter (4% of the mean).

Table 3: Independent Prescriptive Authority and Mental-Health-Related Mortality

	Suicides			Mental-Health-Related Deaths		
	(1) Full Sample	(2) Full Sample	(3) Low Educ.	(4) Full Sample	(5) Full Sample	(6) Low Educ.
Indep. Prescriptive Authority	0.711	0.872	0.170	-1.602	-1.172	-1.443*
	(0.641)	(0.602)	(0.468)	(1.407)	(1.408)	(0.858)
Low Psychiatrist-to-Pop. Ratio		0.493	0.487**		0.835	0.898***
		(0.309)	(0.198)		(0.510)	(0.281)
Interaction		-0.758**	-0.528**		-2.029***	-1.365**
		(0.329)	(0.238)		(0.746)	(0.579)
Observations	313,400	313,400	313,388	313,400	313,400	313,388
R^2	0.969	0.969	0.951	0.971	0.971	0.957
Mean Dependent Variable	28.52	28.52	15.70	51.34	51.34	30.68

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 unemployed, percent with a high school diploma or less, percent with a college degree or more, a quadratic in median income, and the number of practicing psychiatrists and primary care physicians. "Low Educ" is defined as having a high school degree or less. Refer to Table A.4 for full regression results.

Individuals with low levels of education see even greater reductions in percentage terms in both the prevalence of suicides and mental-health-related deaths when NPs are granted independent prescriptive authority (Columns (3) and (6)). Allowing NPs to prescribe independently is associated with 4.7% fewer mental-health-related deaths (1.4 fewer deaths per quarter) among those with low education, even for those living in counties that are not underserved. For those with low levels of education and who reside in underserved counties, the impacts are the greatest: suicides and mental-health-related deaths are reduced by an additional 3.4% and 4.7%, respectively (0.53 fewer suicides and 1.37 fewer mental-health-related deaths per county-quarter). Given that suicides and mental-health-related deaths are quite rare, there is likely more noise when we restrict our sample to individuals with a high school degree or less. As measurement issues will serve to attenuate our estimates, it is notable that we still identify effects of comparable, if not larger, magnitudes.

Finally, the results presented in Table 3 are robust to alternative specifications. While all regressions are weighted by population in Table 3, Table A.7 reports the analogous results of unweighted specifications. If anything, the effects of extending prescriptive authority to NPs are more pre-

cisely estimated in the unweighted regressions, as the law changes have the largest impacts in less populous counties. Furthermore, Table A.8 shows that the results are robust to the inclusion of state-level linear time trends. Finally, the results presented in Table 3 are not driven by any one particular state. Tables A.9 and A.10 show that the point estimates are very stable when we separately drop each state that takes up treatment during our sample period.

3.2 Self-Reported Mental Health

When prescriptive authority is extended to NPs, do we see improvements in the mental health of individuals on a day-to-day basis that track the decreases in mental-health-related deaths? As described in Section 2.2.2, we consider both the number of days in the past month respondents report being in poor mental health as well as a binary variable which equals one if the respondent 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:

$$Poor\ Mental\ Health_{isy} = \beta_0 + \beta_1 Indep.\ Rx_{sy} + \beta_2 X_{isy} + \gamma_s + \gamma_y + \epsilon_{isy} \tag{3}$$

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; and γ_s and γ_y are state and year fixed effects, respectively.[14] Here, we define a state as having independent prescriptive authority in a given year if NPs had the legislative authority to prescribe medications independently at any point within the year, although all results are robust to alternative timing assumptions.

As before, we examine whether extending prescriptive authority to NPs impacts mental health more for populations living in states with an underprovision of mental health care services and among populations who are traditionally disadvantaged. Letting $Underserved_{sy}$ be a dummy which equals one if state s in year y is less equipped for mental health care services and zero

[14]Individual-level controls include sex, age, education, income quintile dummies, and indicators for race (white, black, and missing), Hispanic, employment status, and insurance status.

otherwise, we estimate the following equation:

$$\begin{aligned} Poor\ Mental\ Health_{isy} \quad = \quad & \beta_0 + \beta_1 Indep.\ Rx_{sy} + \beta_2 Underserved_{sy} + \\ & + \beta_3 Indep.\ Rx_{sy} \cdot Underserved_{sy} + \beta_4 X_{isy} + \gamma_s + \gamma_y + \epsilon_{isy} \end{aligned} \tag{4}$$

where all other variables are defined as in Equation (3). To look specifically at disadvantaged populations, we further estimate the coefficients in Equation (4) separately for different subpopulations of interest. Results for individuals with low levels of education are provided with the main results below; refer to Tables A.12 and A.13 for results for other subpopulations.

As shown in Table 4, independent prescriptive authority for NPs is associated with significant reductions in the number of poor mental health days reported by survey respondents. Looking first to Column (1), we see that respondents report on average having spent 0.13 fewer days in poor mental health when NPs are allowed to prescribe—a reduction of 4% of the mean. Adhering to the expectation that areas with an insufficient supply of providers should experience greater improvements, Column (2) demonstrates that the benefits are again concentrated among respondents in areas that are less equipped for mental health care. For respondents in underserved states, allowing NPs to prescribe independently is associated with 0.19 fewer days in poor mental health relative to other states. The overall effect of the law change on those in underserved states (0.28 fewer days in poor mental health) is over twice the improvement observed for the population on average. Finally, consistent with the mortality results, 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 is associated with 0.36 fewer poor mental health days for low education respondents who live in underserved states.

Table 4: Independent Prescriptive Authority and Self-Reported Mental Health

	Days in Poor Mental Health			21+ Days in Poor Mental Health		
	(1) Full Sample	(2) Full Sample	(3) Low Educ.	(4) Full Sample	(5) Full Sample	(6) Low Educ.
Indep. Prescriptive Authority	-0.134*	-0.093	-0.095	-0.003	-0.002	-0.002
	(0.072)	(0.083)	(0.136)	(0.002)	(0.002)	(0.004)
Low Psychiatrist-to-Pop. Ratio		0.113	0.157		0.002**	0.004*
		(0.075)	(0.124)		(0.001)	(0.002)
Interaction		-0.186*	-0.267*		-0.003	-0.005**
		(0.109)	(0.140)		(0.002)	(0.002)
Observations	5,670,468	5,670,468	2,296,282	5,670,468	5,670,468	2,296,282
R^2	0.044	0.044	0.044	0.024	0.024	0.025
Mean Dependent Variable	3.33	3.33	3.86	0.06	0.06	0.07

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 dummies for whether the respondent is male, white, black, Hispanic, employed, and has health insurance. Dummies for age groups, education groups, and income quintiles are also included. "Low Educ" is defined as having a high school degree, less than a high school degree, or missing education information. Refer to Table A.11 for the full regression results.

Allowing NPs to prescribe medication without physician supervision is further associated with a decrease in the likelihood of spending at least three weeks in poor mental health for the most disadvantaged groups. While Columns (4) and (5) of Table 4 show that independent prescriptive authority has no statistically significant impact on this measure of more severe mental illness for the population as a whole, we see in Column (6) that individuals who are both living in underserved states and have low levels of education experience a 10% reduction in the probability of reporting 21+ days in poor mental health when NPs can prescribe.

Taken together, the results in Table 4 indict that individuals with minor mental illnesses and individuals with more severe mental illnesses who have difficulty accessing psychiatrist-provided care benefit the most from the expansion of prescriptive authority. These patterns suggest that available psychiatrists focus their efforts on those who have more severe mental illnesses in the absence of independent prescriptive authority for NPs.

As with our mortality results, we provide a variety of robustness checks for these self-reported mental health results in the appendix. Tables A.14 and A.15 show that our results are not driven by any one state: the point estimates are very stable when we separately drop each state that takes

up treatment during our sample period. Unlike the mortality results, however, Table A.16 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 exploiting here is at the state-year level, adding state-level linear time trends in conjunction with state and year fixed effects is asking a lot of the data, so the null result is not surprising.[15]

4 Prescriptive Authority and Prescribing Patterns

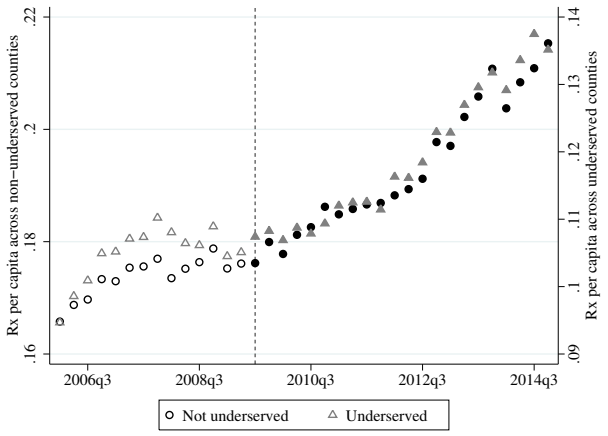
The positive impacts of extending independent prescriptive authority to NPs on mental health documented above suggest that access to psychotropic medications increases when NPs can prescribe. However, it is possible that such legislation is not associated with improvements in access, as patients may simply switch from physicians to NPs when NPs have the statutory ability to prescribe independently. To examine this empirically, we exploit within-county variation in both prescriptive authority and the number of prescriptions filled for antidepressants and antipsychotics in each quarter between 2006–2014 to see whether the number of prescriptions for these classes of psychotropic medications changes when independent prescriptive authority is granted to NPs.[16]

We begin with a case study of Colorado, a state that extended independent prescriptive authority to NPs in the third quarter of 2009. Colorado is unique in that we have nearly four years of prescription data before and after prescriptive authority was extended to NPs. Figure 2 displays population-weighted averages of the number of prescriptions filled for antidepressants and antipsychotics per capita across counties in Colorado in each quarter between Q1 2006 and Q4

[15]This is less of a concern when we add state-level linear time trends to the mortality regressions. In Section 3.1, the outcome varies at the county-quarter level. Additionally, there is within-year variation in law changes and within-state variation in health resources.

[16]Even if independent prescriptive authority for NPs is not associated with a net increase in the number of antidepressants or antipsychotics, one could still see improvements in mental health outcomes for two reasons. First, it is possible that access to other medications not measured here may be important for mental health. Second, it is possible that differences in the provision of care across NPs and MDs lead to improvements in mental health outcomes when NPs can prescribe. For example, since NPs have been shown to spend more time with each patient than MDs (Naylor and Kurtzman, 2010; Laurant et al., 2008; Horrocks et al., 2002), it is possible that patients are more likely to be treated with both therapy and psychotropic medication when seen by an NP. Since a combination of medication and therapy is recommended in most situations, substitution between NPs and MDs could lead to improved health outcomes due not to increased pharmaceutical use but rather to a more balanced mix of treatment approaches.

Figure 2: Prescriptive Authority and Antidepressants and Antipsychotics: Colorado



Notes: The above plot displays the population-weighted average of antidepressants and antipsychotics per capita at the county-quarter level in Colorado. The vertical line denotes the quarter in which NPs in Colorado were granted independent prescriptive authority.

2014. There are two main takeaways from Figure 2. First, the number of prescriptions for antidepressants and antipsychotics was fairly stable before the law change and increased steadily after NPs were allowed to prescribe independently. This trend break occurred both in underserved and non-underserved counties. Second, the number of prescriptions written for these medication classes per capita is significantly lower in underserved versus non-underserved counties. If there are decreasing marginal returns to prescriptions within a county, these level differences suggest that the marginal person gaining a prescription in an underserved county will experience larger health benefits. Therefore, while allowing NPs to prescribe independently in Colorado increased the number of prescriptions on average across all counties, the health impacts should be larger in underserved areas.

While eight states granted NPs independent prescriptive authority between 2006 and 2014, the variation we are able to exploit when examining the impact of prescriptive authority on prescriptions is more limited than the variation we use when examining the impact on mental health outcomes (where our panel extends from 1990–2014). Given this limited variation, we use an event study specification to visually examine whether there is any evidence of changes in the number of prescriptions when nurses can prescribe. That is, letting $Prescriptions_{cqy}$ denote the number of antidepressant and antipsychotic prescriptions in county c in quarter q of year y, we estimate the

following equation:

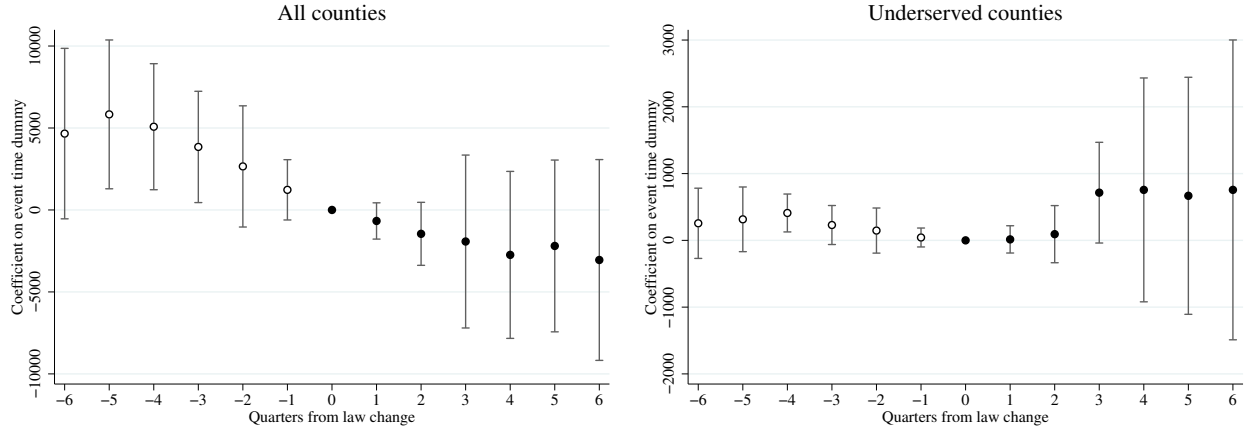
$$Prescriptions_{cqy} = \beta_0 + \sum_{t=-7}^{-1} \beta_t Indep.Rx_{s,qy+t} + \sum_{t=1}^{7} \beta_t Indep.Rx_{s,qy+t} + \delta X_{cy} + \gamma_c + \gamma_q + \gamma_y + \epsilon_{cqy} \tag{5}$$

where $Indep.\ Rx_{s,qy\pm t}$ for $t \in [-6, 6]$ are dummies which equal one in quarter q of year y if NPs were granted independent prescriptive authority exactly t quarters before or after and zero otherwise; $Indep.\ Rx_{s,qy\pm t}$ for $t \in \{-7, 7\}$ are dummies which equal one in quarter q of year y if NPs were granted independent prescriptive authority $7+$ quarters before or after and zero otherwise; X_{cy} is a vector of county-year controls; and γ_c, γ_q, and γ_y are county, quarter, and year fixed effects, respectively.[17] Note that the quarter of the the law change is the omitted category. In order to allow the effect to vary with the provision of local health care resources, we estimate Equation (5) both for all counties and separately for counties that are underserved by psychiatrists.

Figure 3 plots the estimated coefficients on the event time dummies from the specification presented in Equation (5). Looking first at the results across all counties, we see that prescriptions for antidepressants and antipsychotics were actually trending smoothly downwards on average once we control for time trends, time-varying county characteristics, and county fixed effects. There is no noticeable break in the downward trend when NPs are allowed to prescribe independently. In contrast, the right subplot provides suggestive evidence that there was a change in the trend of prescriptions for antidepressants and antipsychotics when independent prescriptive authority was extended to NPs in underserved counties. In counties less equipped for physician-provided mental health care, the number of prescriptions for antidepressants and antipsychotics begins trending upwards in the quarters following the legislation change. Unfortunately, many of the states that broadened their scope of practice during this time period did so towards the end of our sample, and thus our estimates for more than one year after the law change are extremely imprecise. Nev-

[17] States that never granted NPs independent prescriptive authority were assigned an event time dummy of -7 in all quarters. States that always allowed NPs to prescribe independently over this period were assigned an event time dummy of 7 in all quarters.

Figure 3: Prescriptive Authority and Antidepressants and Antipsychotics: Event Study

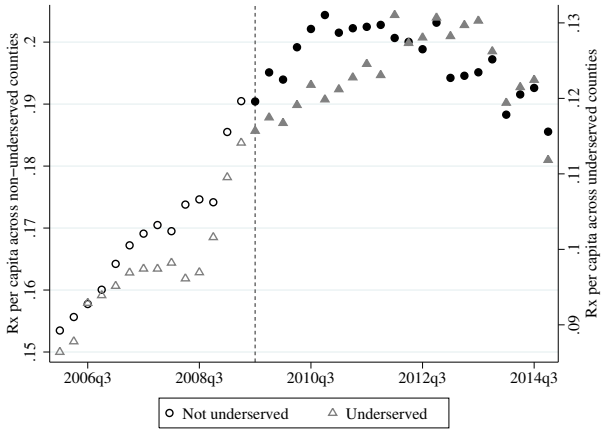


Notes: The above plots display the coefficient estimates from a regression of the number of prescriptions for antidepressants and antipsychotics at the county-quarter level on event time dummies for the six quarters before and the six quarters after independent prescriptive authority is granted to NPs. All regressions include county, quarter, and year fixed effects. Additional controls include total population, population density, percent unemployed, percent with a high school diploma or less, percent with a college degree or more, a quadratic in median income, and the number of practicing psychiatrists and primary care physicians. Population weights are used. Quarter "0" corresponds to the quarter in which independent prescriptive authority was extended to NPs.

ertheless, we take Figures 2 and 3 as suggestive evidence that the number of prescriptions for antidepressants and antipsychotics increase when states extend independent prescriptive authority to NPs, especially in areas with fewer existing mental health care resources.

Given recent evidence highlighting rising rates of abuse of prescription pain medication (NSDUH, 2014), extending prescriptive authority to NPs could lead to a greater number of opioid analgesics available for misuse. Looking again to the case of Colorado in Figure 4, we see no evidence of a trend break or level shift in opioids per capita when NPs can independently prescribe. However, when looking across all eight states that extended prescriptive authority over our sample period, there is imprecise but suggestive evidence that opioid prescriptions do increase when NPs can prescribe independently (see Figure A.4). We do not believe that this affects the interpretation of our main results for two reasons. First, any increase in opioid abuse associated with expanding unrestricted independent prescriptive authority to NPs will bias our mortality results towards zero, since our measure of mental-health-related mortality includes overdose deaths. Second, if states are worried about increasing opioid use, they can exclude opioids from the medications that NPs

Figure 4: Independent Prescriptive Authority and Opioids: Colorado



Notes: The above plot displays the population-weighted average of opioids per capita at the county-quarter level in Colorado. The vertical line denotes the quarter in which NPs in Colorado were granted independent prescriptive authority.

are allowed to prescribe independently.[18]

5 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. In particular, areas with an underprovision of psychiatrists or with populations who find it difficult to access psychiatrist-provided care can grant independent prescriptive authority to NPs to help mitigate the negative consequences of physician shortages and extend care to disadvantaged populations.

Policies that increase the number of providers who can prescribe medication may be particularly important in the US, 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

[18] All eight states that granted independent prescriptive authority to NPs between 2006 and 2014 did so for both legend drugs and controlled substances. However, it is not uncommon for states to have different scope of practice legislation for controlled and non-controlled substances.

and reductions in the prevalence of mental-health-related deaths, including suicides. 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 psychiatrist-provided care.

A back-of-the-envelope calculation suggests that around 410 mental-health-related deaths were averted in underserved counties in 2014 alone by states allowing NPs to prescribe independently (to arrive at this number, we use results from an unweighted regression on only underserved counties). If all states granted NPs independent prescriptive authority, the number of deaths averted yearly in underserved counties would rise to 1,345. 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).

It is noteworthy that we observe a consistent pattern of effects despite using two very different measures of mental health. Self-reported "days in poor mental health" allow 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 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.

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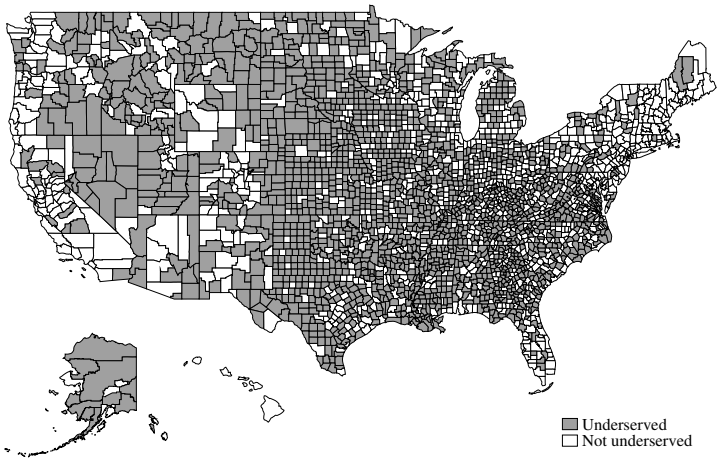
For Online Publication

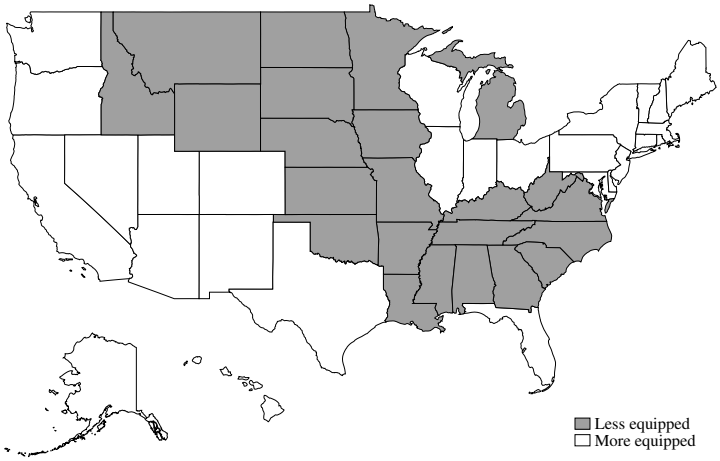
A Supplementary Figures

Figure A.1: Mental Health Services by County: 2002



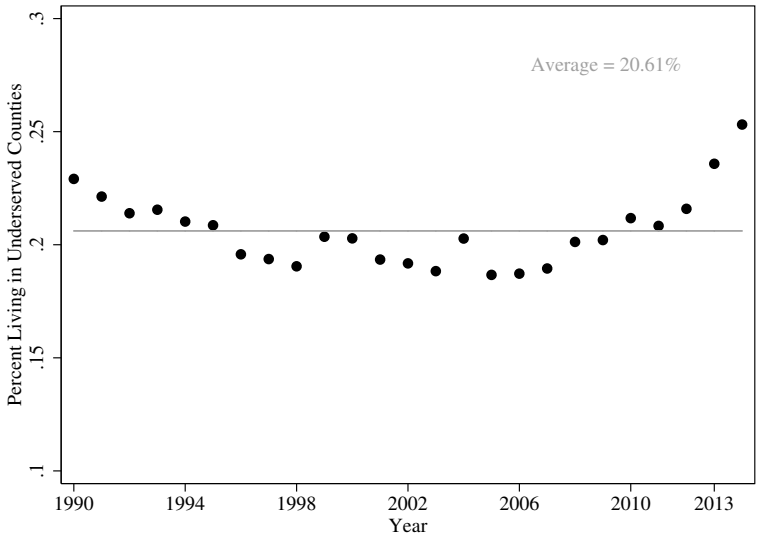
Notes: Following the definition provided by the HRSA, a county is "underserved" for mental health care services in a given year if the county has fewer than one psychiatrist per 30,000 residents. We identify underserved counties by combining county-year information on the number of psychiatrists from the HRSA's Area Resource Files with county-year population estimates linearly interpolated between the 1990, 2000, and 2010 Decennial Censuses.

Figure A.2: Mental Health Services by State: 2002



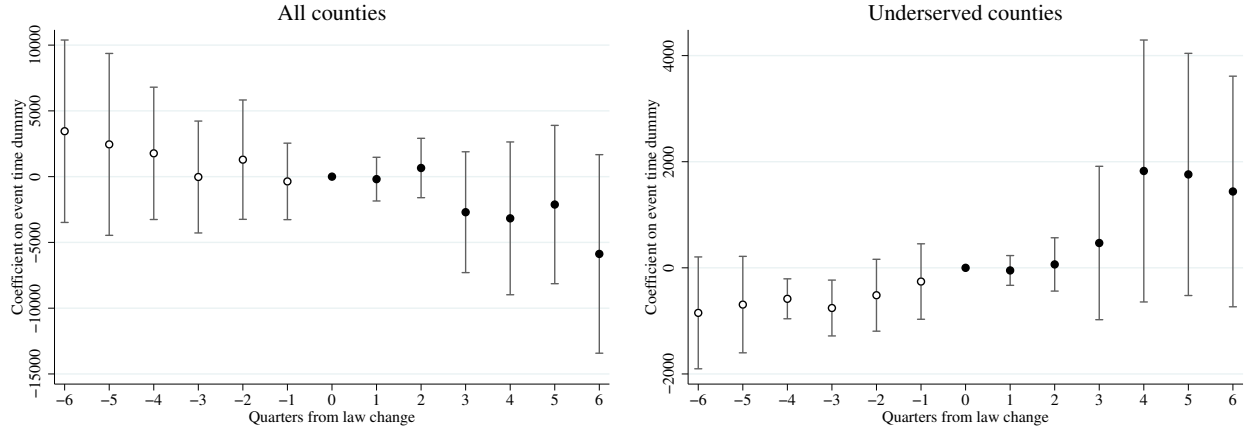
Notes: A state is "less equipped" for mental health services in a given year if the population-weighted average of binary, underserved categorizations across all counties in that state is less than the median across all states in that year. To construct the binary, underserved categorizations at the county level, we use 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 residents. We identify underserved counties by combining county-year information on the number of psychiatrists from the HRSA's Area Resource Files with county-year population estimates linearly interpolated between the 1990, 2000, and 2010 Decennial Censuses.

Figure A.3: Percent of U.S. Population Living in Underserved Counties: 1990–2014



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 residents. We identify underserved counties by combining county-year information on the number of psychiatrists from the HRSA's Area Resource Files with county-year population estimates linearly interpolated between the 1990, 2000, and 2010 Decennial Censuses.

Figure A.4: Independent Prescriptive Authority and Prescriptions for Opioids: Event Study



Notes: The above plots display the coefficient estimates from a regression of the number of prescriptions for opioids at the county-quarter level on event time dummies for the six quarters before and the six quarters after independent prescriptive authority is granted to NPs. All regressions include county, quarter, and year fixed effects. Additional controls include total population, population density, percent unemployed, percent with a high school diploma or less, percent with a college degree or more, a quadratic in median income, and the number of practicing psychiatrists and primary care physicians. Population weights are used. Quarter "0" corresponds to the quarter in which independent prescriptive authority was extended to NPs.

B Supplementary Tables

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

	Unemployment Rates		No. Psychiatrists		No. Prim. Care MDs/DOs	
	(1)	(2)	(3)	(4)	(5)	(6)
Indep. Prescriptive Authority	-0.000	0.001	0.728	0.049	-4.478	-10.407
	(0.002)	(0.002)	(2.782)	(3.323)	(21.232)	(20.128)
Low Psychiatrist-to-Pop. Ratio		-0.000		-4.447***		-3.477
		(0.000)		(1.147)		(7.598)
Interaction		0.001		0.717		9.702
		(0.001)		(2.055)		(18.509)
Observations	313,400	313,400	313,400	313,400	313,400	313,400
R^2	0.850	0.860	0.996	0.996	0.995	0.995

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, population density, percent unemployed, percent with a high school diploma or less, percent with a college degree or more, a quadratic in median income, and the number of practicing psychiatrists and primary care physicians (exlucing the outcome variable for a given regression).

Table A.2: Summary Statistics: County-Level Mortality and Controls, 1990–2014

		Never Indep. Rx			Ever Indep. Rx		
	All	All	Never underserved	Ever underserved	All	Never underserved	Ever underserved
Deaths per 100,000:							
Suicides	3.32	3.10	2.89	3.50	4.15	4.04	4.31
All Mental-Health-Related Deaths	5.54	5.32	5.08	5.79	6.34	6.29	6.40
Independent Prescriptive Authority	0.13	0	0	0	0.62	0.62	0.61
Low Psychiatrist-to-Pop. Ratio	0.21	0.20	0	0.59	0.21	0	0.51
Total Population	1,039,119	1,172,967	1,699,192	169,244	549,985	838,264	142,453
Population Density (Per Sq. Mile)	2,209	2,246	3,359	332	728	982	369
Percent Male	0.49	0.49	0.49	0.49	0.49	0.49	0.50
Percent 18 and Under	0.25	0.25	0.25	0.25	0.25	0.24	0.26
Percent Middle Age	0.13	0.13	0.13	0.13	0.13	0.13	0.13
Percent Black	0.12	0.14	0.15	0.11	0.06	0.08	0.04
Percent HS or Less	0.47	0.25	0.29	0.18	0.26	0.30	0.21
Percent College or More	0.25	0.48	0.44	0.55	0.43	0.40	0.48
Percent Unemployed	0.06	0.06	0.06	0.06	0.06	0.06	0.05
Median Household Income	54,015	53,882	57,482	47,014	54,504	57,366	50,457
Psychiatrists per 100,000	11.88	12.15	16.57	3.72	10.91	15.25	4.76
Primary Care MDs/DOs per 100,000	96.02	96.6	113,.98	63.44	93.9	111,.97	68.35
Observations	313,400	215,500	35,100	180,400	97,900	15,000	82,900

Notes: Observations are at the county-quarter level. Statistics are weighted by population. "Mental-Health-Related Deaths" include suicides, deaths of unknown intent, and accidental deaths involving firearms, trains, and poisonings. "Ever (Never) Independent Rx Authority" includes counties that had independent prescriptive authority for NPs at some point (at no point) during our sample. "Independent Prescriptive Authority" and "Low Psychiatrist-to-Pop. Ratio" reflect whether counties allowed NPs independent prescriptive authority or were underserved for mental health services in a given year, respectively. 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 1990, 2000, and 2010 Decennial Censuses and the 5-year pooled (2008-2012) American Community Survey (ACS). Census and ACS variables are linearly interpolated at the county-year level.

Table A.3: Summary Statistics: Self-Reported Mental Health and Controls, 1993–2013

		Never Indep. Rx			Ever Indep. Rx		
	All	All	Never underserved	Ever underserved	All	Never underserved	Ever underserved
Days in Poor Mental Health:							
Average	3.33	3.36	3.39	3.34	3.16	3.16	3.17
Percent 0	0.67	0.67	0.65	0.68	0.66	0.67	0.65
Percent >= 21	0.06	0.06	0.06	0.06	0.05	0.05	0.05
Independent Prescriptive Authority	0.14	0	0	0	0.75	0.53	0.94
Low Psychiatrist-to-Population Ratio	0.37	0.39	0	0.69	0.26	0	0.47
Male	0.48	0.48	0.48	0.48	0.49	0.49	0.49
White	0.71	0.70	0.64	0.74	0.78	0.70	0.85
Black	0.10	0.11	0.08	0.13	0.05	0.09	0.02
Hispanic	0.12	0.13	0.19	0.08	0.09	0.12	0.07
Employed	0.52	0.52	0.51	0.53	0.54	0.54	0.53
Health Insurance	0.84	0.84	0.85	0.84	0.86	0.86	0.86
Age: 18 to 34	0.31	0.31	0.31	0.32	0.32	0.31	0.32
Age: 35 to 44	0.20	0.20	0.20	0.20	0.20	0.20	0.20
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	0.13	0.13	0.13	0.13
Age: 65 and Over	0.17	0.17	0.18	0.17	0.17	0.16	0.17
Education: HS or Less	0.43	0.44	0.42	0.45	0.39	0.39	0.40
Education: Some College or More	0.57	0.56	0.58	0.54	0.60	0.61	0.60
Income: 1st Quintile	0.20	0.20	0.21	0.20	0.17	0.16	0.18
Income: 2nd Quintile	0.17	0.17	0.16	0.18	0.18	0.17	0.20
Income: 3rd Quintile	0.17	0.17	0.16	0.17	0.18	0.17	0.19
Income: 4th Quintile	0.18	0.18	0.19	0.18	0.19	0.19	0.19
Income: 5th Quintile	0.14	0.14	0.15	0.13	0.15	0.18	0.13
Observations	5,670,468	3,399,048	1,104,585	2,294,463	2,271,420	973,174	1,298,246

Notes: Observations are at the individual level. Statistics are weighted using BRFSS sample weights. "Ever (Never) Independent Rx Authority" includes respondents living in states that had independent prescriptive authority for NPs at some point (at no point) during our sample. "Independent Prescriptive Authority" and "Low Psychiatrist-to-Pop. Ratio" reflect the fraction of respondents living in a state with independent prescriptive authority or that was underserved for mental health services in the year that he/she responded, respectively. Some categorical variables do not sum to one; the difference reflects the percentage of missings.

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

	Suicides			Mental-Health-Related Deaths		
	(1) Full Sample	(2) Full Sample	(3) Low Educ.	(4) Full Sample	(5) Full Sample	(6) Low Educ.
Indep. Prescriptive Authority	0.711	0.872	0.170	-1.602	-1.172	-1.443*
	(0.641)	(0.602)	(0.468)	(1.407)	(1.408)	(0.858)
Low Psychiatrist-to-Pop. Ratio		0.493	0.487**		0.835	0.898***
		(0.309)	(0.198)		(0.510)	(0.281)
Interaction		-0.758**	-0.528**		-2.029***	-1.365**
		(0.329)	(0.238)		(0.746)	(0.579)
Total Population	0.000***	0.000***		0.000***	0.000***	
	(0.000)	(0.000)		(0.000)	(0.000)	
Population HS or Less			0.000***			0.000***
			(0.000)			(0.000)
Population Density	-0.001***	-0.001***	0.002***	-0.004***	-0.004***	0.002***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)
Percent Unemployed	117.991**	118.158**	55.450*	216.855*	217.260*	127.435*
	(57.811)	(57.864)	(27.835)	(114.260)	(114.332)	(74.840)
Percent HS or Less	19.295	18.870	-4.057	78.865	77.983	70.797***
	(40.230)	(40.226)	(18.078)	(61.329)	(61.328)	(23.027)
Percent College or More	39.221	39.015	44.208**	201.933***	201.258***	154.764***
	(37.702)	(37.597)	(20.389)	(58.584)	(58.406)	(34.014)
Median Household Income	0.001**	0.001**	0.000*	0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
Median Household Income Sq.	-0.000***	-0.000***	-0.000**	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
No. Psychiatrists	0.119***	0.119***	0.085***	0.125*	0.125*	0.127***
	(0.040)	(0.040)	(0.024)	(0.067)	(0.067)	(0.032)
No. Primary Care MDs/DOs	-0.018**	-0.018**	-0.014***	-0.027**	-0.027**	-0.017*
	(0.008)	(0.008)	(0.004)	(0.012)	(0.012)	(0.009)
Observations	313,400	313,400	313,388	313,400	313,400	313,388
R^2	0.969	0.969	0.951	0.971	0.971	0.957
Mean Dependent Variable	28.52	28.52	15.70	51.34	51.34	30.68

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. "Low Educ" is defined as having a high school degree or less.

Table A.5: Suicides: Subgroup Analysis

	(1) Full Sample	(2) Black	(3) Middle Age	(4) Under 18	(5) Low Educ.	(6) Male	(7) Female	(8) Rural
Indep. Prescriptive Authority	0.872	-2.450*	0.132	0.071*	0.170	0.584	0.302*	0.020
	(0.602)	(1.458)	(0.219)	(0.037)	(0.468)	(0.504)	(0.174)	(0.052)
Low Psychiatrist-to-Pop. Ratio	0.493	0.164	0.166	0.053	0.487**	0.290	0.189	-0.025
	(0.309)	(0.141)	(0.105)	(0.038)	(0.198)	(0.201)	(0.116)	(0.028)
Interaction	-0.758**	1.449	-0.289*	-0.021	-0.528**	-0.504**	-0.246*	-0.073
	(0.329)	(1.243)	(0.154)	(0.032)	(0.238)	(0.226)	(0.129)	(0.048)
Observations	313,400	310,148	313,400	313,376	313,388	313,400	313,400	178,986
R^2	0.969	0.857	0.927	0.695	0.951	0.967	0.915	0.447
Mean Dependent Variable	28.52	2.84	7.60	0.95	15.70	21.87	6.65	1.49

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 unemployed, percent with a high school diploma or less, percent with a college degree or more, a quadratic in median income, and the number of practicing psychiatrists and primary care physicians. "Low Educ" is defined as having a high school degree or less.

Table A.6: Mental-Health-Related Deaths: Subgroup Analysis

	(1) Full Sample	(2) Black	(3) Middle Age	(4) Under 18	(5) Low Educ.	(6) Male	(7) Female	(8) Rural
Indep. Prescriptive Authority	-1.172	-1.964	-0.334	0.231***	-1.443*	-0.851	-0.282	0.001
	(1.408)	(1.594)	(0.466)	(0.078)	(0.858)	(0.978)	(0.471)	(0.148)
Low Psychiatrist-to-Pop. Ratio	0.835	0.218	0.309	0.139**	0.898***	0.556*	0.258	0.076
	(0.510)	(0.233)	(0.239)	(0.055)	(0.281)	(0.326)	(0.197)	(0.053)
Interaction	-2.029***	0.648	-0.522**	-0.094	-1.365**	-1.340**	-0.661**	-0.224*
	(0.746)	(1.138)	(0.257)	(0.060)	(0.579)	(0.509)	(0.264)	(0.124)
Observations	313,400	310,148	313,400	313,376	313,388	313,400	313,400	178,986
R^2	0.971	0.925	0.949	0.804	0.957	0.970	0.944	0.577
Mean Dependent Variable	51.34	7.21	14.88	2.06	30.68	38.32	13.02	2.40

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 unemployed, percent with a high school diploma or less, percent with a college degree or more, a quadratic in median income, and the number of practicing psychiatrists and primary care physicians. "Low Educ" is defined as having a high school degree or less.

Table A.7: Mental-Health-Related Mortality: Unweighted

	Suicides			Mental-Health-Related Deaths		
	(1) Full Sample	(2) Full Sample	(3) Low Educ.	(4) Full Sample	(5) Full Sample	(6) Low Educ.
Indep. Prescriptive Authority	0.076	0.238**	0.027	-0.256	0.085	-0.172
	(0.078)	(0.113)	(0.078)	(0.219)	(0.241)	(0.170)
Low Psychiatrist-to-Pop. Ratio		0.087*	0.067**		0.234**	0.224***
		(0.048)	(0.032)		(0.098)	(0.070)
Interaction		-0.237**	-0.118**		-0.500**	-0.299**
		(0.106)	(0.051)		(0.198)	(0.126)
Observations	313,400	313,400	313,400	313,400	313,400	313,400
R^2	0.939	0.939	0.891	0.947	0.947	0.916
Mean Dependent Variable	3.01	3.01	1.81	5.01	5.01	3.18

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 total population (or subgroup population), population density, percent unemployed, percent with a high school diploma or less, percent with a college degree or more, a quadratic in median income, and the number of practicing psychiatrists and primary care physicians. "Low Educ" is defined as having a high school degree or less.

Table A.8: Mental-Health-Related Mortality: State-Specific Linear Time Trends

	Suicides			Mental-Health-Related Deaths		
	(1) Full Sample	(2) Full Sample	(3) Low Educ.	(4) Full Sample	(5) Full Sample	(6) Low Educ.
Indep. Prescriptive Authority	-1.607	-1.480	-1.759	-1.799	-1.444	-2.001
	(1.851)	(1.875)	(1.517)	(2.007)	(2.017)	(1.307)
Low Psychiatrist-to-Pop. Ratio		0.131	0.312*		-0.046	0.388*
		(0.267)	(0.170)		(0.390)	(0.219)
Interaction		-0.631*	-0.326		-1.792**	-0.960*
		(0.365)	(0.275)		(0.827)	(0.551)
Observations	313,400	313,400	313,388	313,400	313,400	313,388
R^2	0.971	0.971	0.953	0.974	0.974	0.961
Mean Dependent Variable	28.52	28.52	15.70	51.34	51.34	30.68

Notes: Observations are at the county-quarter level and are population weighted. Standard errors are clustered by state. All regressions include county fixed effects, quarter fixed effects, year fixed effects, and state-specific linear time trends. Additional controls include total population (or subgroup population), population density, percent unemployed, percent with a high school diploma or less, percent with a college degree or more, a quadratic in median income, and the number of practicing psychiatrists and primary care physicians. "Low Educ" is defined as having a high school degree or less.

Table A.9: Suicides: "Leave Out" Robustness

	(1) ID	(2) NV	(3) UT	(4) CO	(5) WY	(6) NE	(7) NM	(8) ND	(9) MI
Indep. Rx Authority	0.799	0.953	0.672	1.041*	0.863	1.000	0.781	0.923	0.911
	(0.629)	(0.750)	(0.556)	(0.602)	(0.603)	(0.601)	(0.604)	(0.607)	(0.604)
Low Psych-to-Pop.	0.493	0.482	0.444	0.450	0.493	0.488	0.493	0.493	0.436
	(0.315)	(0.318)	(0.308)	(0.313)	(0.309)	(0.310)	(0.311)	(0.309)	(0.336)
Interaction	-0.777**	-0.755**	-0.933***	-0.722**	-0.768**	-0.754**	-0.704**	-0.740**	-0.774**
	(0.371)	(0.315)	(0.300)	(0.355)	(0.332)	(0.345)	(0.328)	(0.331)	(0.334)
Observations	309,000	311,700	310,500	307,100	311,100	304,100	310,100	308,100	305,100
R^2	0.969	0.969	0.969	0.969	0.969	0.969	0.969	0.969	0.969

	(1) IA	(2) WI	(3) KY	(4) MD	(5) DE	(6) RI	(7) CT	(8) ME	(9) HI
Indep. Rx Authority	0.857	0.821	0.934	1.076	0.811	0.961	0.871	0.725	0.827
	(0.605)	(0.661)	(0.630)	(0.683)	(0.615)	(0.605)	(0.611)	(0.623)	(0.623)
Low Psych-to-Pop.	0.490	0.485	0.504	0.360	0.490	0.514	0.489	0.489	0.488
	(0.311)	(0.313)	(0.317)	(0.274)	(0.309)	(0.310)	(0.311)	(0.311)	(0.309)
Interaction	-0.827**	-0.750*	-0.728**	-0.643**	-0.735**	-0.787**	-0.767**	-0.711**	-0.741**
	(0.359)	(0.379)	(0.344)	(0.294)	(0.320)	(0.326)	(0.331)	(0.322)	(0.325)
Observations	303,500	306,200	301,400	311,000	313,100	312,900	312,600	311,800	312,900
R^2	0.969	0.969	0.969	0.970	0.969	0.969	0.969	0.969	0.969

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, population density, percent unemployed, percent with a high school diploma or less, percent with a college degree or more, a quadratic in median income, and the number of practicing psychiatrists and primary care physicians.

Table A.10: Mental-Health-Related Deaths: "Leave Out" Robustness

	(1) ID	(2) NV	(3) UT	(4) CO	(5) WY	(6) NE	(7) NM	(8) ND	(9) MI
Indep. Rx Authority	-1.031	-1.252	-1.353	-0.691	-1.185	-0.915	-1.464	-1.111	-0.972
	(1.507)	(1.622)	(1.392)	(1.515)	(1.414)	(1.445)	(1.403)	(1.424)	(1.437)
Low Psych-to-Pop.	0.833	0.770	0.811	0.771	0.835	0.842	0.832	0.839	0.797
	(0.518)	(0.516)	(0.513)	(0.509)	(0.510)	(0.510)	(0.512)	(0.511)	(0.536)
Interaction	-2.022**	-1.932**	-2.093***	-2.049**	-2.051***	-2.228***	-1.959**	-2.071***	-2.046***
	(0.801)	(0.723)	(0.743)	(0.794)	(0.754)	(0.725)	(0.747)	(0.741)	(0.727)
Observations	309,000	311,700	310,500	307,100	311,100	304,100	310,100	308,100	305,100
R^2	0.971	0.971	0.972	0.972	0.971	0.971	0.971	0.971	0.972

	(1) IA	(2) WI	(3) KY	(4) MD	(5) DE	(6) RI	(7) CT	(8) ME	(9) HI
Indep. Rx Authority	-1.205	-1.783	-1.222	-0.314	-1.266	-1.260	-1.177	-1.372	-1.470
	(1.432)	(1.375)	(1.442)	(1.392)	(1.442)	(1.403)	(1.431)	(1.488)	(1.415)
Low Psych-to-Pop.	0.846	0.835	0.851	0.729	0.831	0.853	0.837	0.835	0.810
	(0.512)	(0.514)	(0.523)	(0.470)	(0.509)	(0.513)	(0.512)	(0.511)	(0.511)
Interaction	-2.191***	-1.920**	-1.958**	-2.139***	-1.994***	-1.949**	-2.049***	-1.965**	-1.874**
	(0.803)	(0.814)	(0.767)	(0.717)	(0.733)	(0.746)	(0.751)	(0.734)	(0.742)
Observations	303,500	306,200	301,400	311,000	313,100	312,900	312,600	311,800	312,900
R^2	0.971	0.971	0.971	0.972	0.971	0.971	0.972	0.971	0.971

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, population density, percent unemployed, percent with a high school diploma or less, percent with a college degree or more, a quadratic in median income, and the number of practicing psychiatrists and primary care physicians.

Table A.11: Self-Reported Mental Health: Full Regression Results

	Days in Poor Mental Health			21+ Days in Poor Mental Health		
	(1) Full Sample	(2) Full Sample	(3) Low Educ.	(4) Full Sample	(5) Full Sample	(6) Low Educ.
Indep. Prescriptive Authority	-0.134*	-0.093	-0.095	-0.003	-0.002	-0.002
	(0.072)	(0.083)	(0.136)	(0.002)	(0.002)	(0.004)
Low Psychiatrist-to-Pop. Ratio		0.113	0.157		0.002**	0.004*
		(0.075)	(0.124)		(0.001)	(0.002)
Interaction		-0.186*	-0.267*		-0.003	-0.005**
		(0.109)	(0.140)		(0.002)	(0.002)
Male	-0.940***	-0.940***	-0.917***	-0.012***	-0.012***	-0.013***
	(0.028)	(0.028)	(0.060)	(0.001)	(0.001)	(0.002)
White	0.123	0.122	-0.101	-0.002	-0.002	-0.007*
	(0.104)	(0.104)	(0.172)	(0.003)	(0.003)	(0.004)
Black	-0.087	-0.087	-0.513*	-0.005	-0.005	-0.017***
	(0.175)	(0.175)	(0.257)	(0.005)	(0.005)	(0.006)
Hispanic	-0.664***	-0.663***	-1.287***	-0.019***	-0.019***	-0.035***
	(0.139)	(0.139)	(0.200)	(0.004)	(0.004)	(0.005)
Employed	-1.246***	-1.246***	-1.669***	-0.033***	-0.033***	-0.045***
	(0.040)	(0.040)	(0.062)	(0.001)	(0.001)	(0.002)
Health Insurance	-0.355***	-0.355***	-0.103*	-0.009***	-0.009***	-0.004***
	(0.047)	(0.047)	(0.055)	(0.001)	(0.001)	(0.001)
Age: 18 to 34	1.444***	1.445***	1.877***	0.010***	0.010***	0.023***
	(0.064)	(0.064)	(0.114)	(0.001)	(0.001)	(0.004)
Age: 35 to 44	1.651***	1.652***	2.255***	0.025***	0.025***	0.042***
	(0.072)	(0.072)	(0.119)	(0.002)	(0.002)	(0.004)
Age: 45 to 54	1.667***	1.667***	2.322***	0.032***	0.032***	0.050***
	(0.057)	(0.057)	(0.108)	(0.001)	(0.001)	(0.003)
Age: 55 to 64	0.760***	0.760***	1.149***	0.015***	0.015***	0.024***
	(0.042)	(0.043)	(0.115)	(0.002)	(0.002)	(0.004)
Age: 65 and Over	-1.225***	-1.225***	-1.240***	-0.029***	-0.029***	-0.030***
	(0.046)	(0.046)	(0.130)	(0.002)	(0.002)	(0.005)
Education: HS or Less	0.451***	0.451***		0.005	0.005	
	(0.088)	(0.087)		(0.003)	(0.003)	
Education: Some College or More	0.059	0.059		-0.007**	-0.007**	
	(0.085)	(0.084)		(0.003)	(0.003)	
Income: 1st Quintile	1.973***	1.973***	1.652***	0.043***	0.043***	0.037***
	(0.053)	(0.053)	(0.083)	(0.002)	(0.002)	(0.003)
Income: 2nd Quintile	0.665***	0.665***	0.268***	0.010***	0.010***	0.001
	(0.022)	(0.022)	(0.032)	(0.001)	(0.001)	(0.001)
Income: 3rd Quintile	0.044	0.044	-0.397***	-0.005***	-0.005***	-0.016***
	(0.049)	(0.049)	(0.061)	(0.001)	(0.001)	(0.002)
Income: 4th Quintile	-0.467***	-0.467***	-0.873***	-0.017***	-0.017***	-0.028***
	(0.051)	(0.050)	(0.066)	(0.001)	(0.001)	(0.002)
Income: 5th Quintile	-1.274***	-1.274***	-1.633***	-0.035***	-0.035***	-0.044***
	(0.065)	(0.065)	(0.099)	(0.002)	(0.002)	(0.003)
Observations	5,670,468	5,670,468	2,296,282	5,670,468	5,670,468	2,296,282
R^2	0.044	0.044	0.044	0.024	0.024	0.025
Mean Dependent Variable	3.33	3.33	3.86	0.06	0.06	0.07

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. "Low Educ" is defined as having a high school degree, less than a high school degree, or missing education information. For both income and education, the omitted category is a dummy equal to one if the relevant information is missing and zero otherwise.

Table A.12: Days in Poor Mental Health: Subgroup Analysis

	(1) Full Sample	(2) Black	(3) Middle Age	(4) Low Educ.	(5) Low Inc.	(6) Male	(7) Female
Indep. Prescriptive Authority	-0.093	-0.007	-0.244**	-0.095	-0.109	-0.116	-0.068
	(0.083)	(0.105)	(0.101)	(0.136)	(0.202)	(0.078)	(0.111)
Low Psychiatrist-to-Pop. Ratio	0.113	0.158	-0.047	0.157	0.201**	0.096	0.130
	(0.075)	(0.180)	(0.055)	(0.124)	(0.097)	(0.074)	(0.080)
Interaction	-0.186*	-0.705***	-0.032	-0.267*	-0.240	-0.147	-0.219*
	(0.109)	(0.203)	(0.100)	(0.140)	(0.147)	(0.105)	(0.125)
Observations	5,670,468	448,457	1,080,687	2,296,282	1,971,688	2,233,330	3,437,138
R^2	0.044	0.043	0.075	0.044	0.054	0.041	0.040
Mean Dependent Variable	3.33	3.77	3.66	3.86	4.34	2.77	3.85

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 dummies for whether the respondent is male, white, black, hispanic, employed, and has health insurance. Dummies for age groups, education groups, and income quintiles are also included. "Low Educ" is defined as having a high school degree, less than a high school degree, or missing education information. "Low Inc" is defined as being in the bottom two quintiles of income.

Table A.13: 21+ Days in Poor Mental Health: Subgroup Analysis

	(1) Full Sample	(2) Black	(3) Middle Age	(4) Low Educ.	(5) Low Inc.	(6) Male	(7) Female
Indep. Prescriptive Authority	-0.002	0.002	-0.008***	-0.002	-0.003	-0.002	-0.002
	(0.002)	(0.003)	(0.003)	(0.004)	(0.005)	(0.002)	(0.003)
Low Psychiatrist-to-Pop. Ratio	0.002**	0.007*	-0.003***	0.004*	0.005**	0.003**	0.002
	(0.001)	(0.004)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)
Interaction	-0.003	-0.020***	0.006***	-0.005**	-0.004	-0.003	-0.003
	(0.002)	(0.005)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)
Observations	5,670,468	448,457	1,080,687	2,296,282	1,971,688	2,233,330	3,437,138
R^2	0.024	0.022	0.049	0.025	0.031	0.024	0.023
Mean Dependent Variable	0.06	0.07	0.07	0.07	0.08	0.05	0.06

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 dummies for whether the respondent is male, white, black, hispanic, employed, and has health insurance. Dummies for age groups, education groups, and income quintiles are also included. "Low Educ" is defined as having a high school degree, less than a high school degree, or missing education information. "Low Inc" is defined as being in the bottom two quintiles of income.

Table A.14: 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) MI
Indep. Prescriptive Authority	-0.111	-0.078	-0.104	-0.035	-0.093	-0.100	-0.095	-0.096	-0.091
	(0.080)	(0.087)	(0.083)	(0.094)	(0.083)	(0.083)	(0.083)	(0.083)	(0.085)
Low Psychiatrist-to-Pop. Ratio	0.117	0.114	0.115	0.116	0.113	0.115	0.114	0.114	0.151**
	(0.075)	(0.075)	(0.075)	(0.075)	(0.075)	(0.075)	(0.075)	(0.075)	(0.068)
Interaction	-0.205*	-0.191*	-0.140	-0.202*	-0.185*	-0.193*	-0.171	-0.189*	-0.221**
	(0.113)	(0.109)	(0.123)	(0.110)	(0.109)	(0.112)	(0.125)	(0.111)	(0.109)
Observations	5,571,593	5,608,071	5,554,971	5,543,660	5,585,488	5,499,136	5,566,294	5,602,195	5,552,622
R^2	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044

	(1) IA	(2) WI	(3) KY	(4) MD	(5) DE	(6) RI	(7) CT	(8) ME	(9) HI
Indep. Prescriptive Authority	-0.095	-0.123	-0.093	-0.081	-0.091	-0.094	-0.091	-0.132*	-0.084
	(0.083)	(0.083)	(0.084)	(0.109)	(0.084)	(0.084)	(0.083)	(0.070)	(0.088)
Low Psychiatrist-to-Pop. Ratio	0.114	0.117	0.113	0.113	0.114	0.113	0.113	0.112	0.114
	(0.076)	(0.075)	(0.075)	(0.074)	(0.075)	(0.075)	(0.075)	(0.075)	(0.075)
Interaction	-0.187*	-0.094	-0.189*	-0.185	-0.187*	-0.185*	-0.185*	-0.176	-0.187*
	(0.110)	(0.129)	(0.110)	(0.112)	(0.110)	(0.109)	(0.110)	(0.111)	(0.110)
Observations	5,571,881	5,591,738	5,534,032	5,534,900	5,600,670	5,588,177	5,568,789	5,579,304	5,573,140
R^2	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044

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 dummies for whether the respondent is male, white, black, hispanic, employed, and has health insurance. Dummies for age groups, education groups, and income quintiles are also included.

Table A.15: 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) MI
Indep. Prescriptive Authority	-0.003	-0.002	-0.002	-0.001	-0.002	-0.002	-0.002	-0.002	-0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Low Psychiatrist-to-Pop. Ratio	0.002**	0.002**	0.002**	0.002**	0.002**	0.002**	0.002**	0.002**	0.003**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Interaction	-0.003	-0.003	-0.001	-0.003	-0.003	-0.002	-0.002	-0.003	-0.003
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Observations	5,571,593	5,608,071	5,554,971	5,543,660	5,585,488	5,499,136	5,566,294	5,602,195	5,552,622
R^2	0.024	0.024	0.024	0.024	0.024	0.024	0.024	0.024	0.024

	(1) IA	(2) WI	(3) KY	(4) MD	(5) DE	(6) RI	(7) CT	(8) ME	(9) HI
Indep. Prescriptive Authority	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.003*	-0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)
Low Psychiatrist-to-Pop. Ratio	0.002**	0.002**	0.002**	0.002**	0.002**	0.002**	0.002**	0.002**	0.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Interaction	-0.003	-0.002	-0.003	-0.002	-0.003	-0.003	-0.003	-0.002	-0.003
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Observations	5,571,881	5,591,738	5,534,032	5,534,900	5,600,670	5,588,177	5,568,789	5,579,304	5,573,140
R^2	0.024	0.024	0.024	0.024	0.024	0.024	0.024	0.024	0.024

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 dummies for whether the respondent is male, white, black, hispanic, employed, and has health insurance. Dummies for age groups, education groups, and income quintiles are also included.

Table A.16: Self-Reported Mental Health: State-Specific Linear Time Trends

	Days in Poor Mental Health			21+ Days in Poor Mental Health		
	(1) Full Sample	(2) Full Sample	(3) Low Educ.	(4) Full Sample	(5) Full Sample	(6) Low Educ.
Indep. Prescriptive Authority	-0.016	-0.032	0.025	0.000	-0.000	-0.000
	(0.159)	(0.162)	(0.180)	(0.002)	(0.002)	(0.002)
Low Psychiatrist-to-Pop. Ratio		-0.059	-0.103		-0.001	-0.002
		(0.067)	(0.097)		(0.001)	(0.002)
Interaction		0.088	0.102		0.002	0.002
		(0.123)	(0.144)		(0.002)	(0.002)
Observations	5,670,468	5,670,468	2,296,282	5,670,468	5,670,468	2,296,282
R^2	0.045	0.045	0.045	0.025	0.025	0.025
Mean Dependent Variable	3.33	3.33	3.86	0.06	0.06	0.07

Notes: Observations are at the individual level with BRFSS sample weights. Standard errors are clustered by state. All regressions include state fixed effects, year fixed effects, and state-specific linear time trends. Additional controls include dummies for whether the respondent is male, white, black, hispanic, employed, and has health insurance. Dummies for age groups, education groups, and income quintiles are also included. "Low Educ" is defined as having a high school degree, less than a high school degree, or missing education information.