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Evaluating the impact of prescriptive authority for psychologists on the rate of deaths attributed to mental illness

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ABSTRACT

Background: Five states have enacted policies granting prescriptive authority to psychologists in an effort to increase access to psychoactive medications; however, little is known regarding the public health impact of these policies. Policies in two of these states, New Mexico and Louisiana, have had sufficient time to license more than a handful of prescribing psychologists. This study estimates the impact of psychologist prescriptive authority policies in New Mexico and Louisiana on deaths attributable to mental illness and suicides.

Methods: State-level annual death rates from all 50 states were obtained for deaths with an underlying cause of death attributable to mental illness and to suicide (1999–2013) from the Centers for Disease Control and Prevention's WONDER database. State characteristics were collected for the pre-policy time period (1999–2004). We estimated the impact of the policy on the rates of deaths attributable to mental illness and to suicide using a comparative interrupted time series design, and policy effect estimates were generated for New Mexico and Louisiana separately. We used the synthetic control method to create synthetic New Mexico and synthetic Louisiana for use as the comparators.

Results: Immediately following the start of psychologist prescribing, the rate of deaths attributable to mental illness declined by 4.55 deaths per 100,000 (95% CI: [-8.30, −0.79]) in New Mexico relative to the control, but there was no change in Louisiana. There was no immediate change in the suicide rate in either state; however, the annual change in the overall suicide rate was 0.12 suicides per 100,000 (95% CI: [-0.18, −0.06]) per year lower than expected in Louisiana following implementation.

Conclusions: These findings suggest that policies granting prescriptive authority to psychologists have the potential to reduce the mental health mortality gap, though considerable questions remain.

Mental illness is highly prevalent, affecting 1 in 5 Americans.[1] This presents a major issue for public health, as all-cause mortality is significantly higher among people with mental illness.[2,3] A portion of this mortality gap is attributable to suicide deaths; approximately 70% of these early deaths, however, are attributable to other health conditions.[3,4] For example, individuals with mental illness have an increased risk of death from cardiovascular disease and cancer relative to those without mental illness.[3,5]

One issue thought to contribute to excess mortality among people with mental illness is limited access to mental health care.[6,7] The United States faces an ongoing shortage of mental health care providers, especially those who can prescribe medications.[8,9] Since 2002, several states (New Mexico, Louisiana, Idaho, Illinois, and Iowa) have approved policies granting prescriptive authority to psychologists in an effort to increase access to psychotropic medications. Importantly, only the policies in New Mexico (NM) and Louisiana (LA) have been in place long enough for a significant number of psychologists to become licensed. Currently, little is known about the public health impact of these policies.[10,11] One recent study from Choudhury & Plemmons (2021) demonstrated that policies granting prescriptive authority for psychologists in NM and LA reduced the suicide rate by 5–7%.[12] However, their finding may underestimate the impact of prescriptive authority for psychologists on mortality given that the majority of deaths relating to mental illness are of other natural causes.[3,4]

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The primary objective of the present study was to examine the impact of policies granting prescriptive authority for psychologists in NM and LA on the rate of deaths attributed to mental illness using the synthetic control method, a cutting-edge approach to selecting a control group for quasi-experimental designs.[13] We hypothesized that there will be an initial decrease in the rate of deaths attributed to mental illness following the policy enactment and a steady decline in subsequent years. In addition to our primary objective, we had a secondary objective of leveraging the synthetic control method to further examine the suicide rate findings reported by Choudhury & Plemmons (2021).[12] Similar to our primary analysis, we anticipated an initial decrease in suicides following the policy enactment and a continued decline in subsequent years.

1. Methods

1.1. Data sources

We used state-level death data pulled from the Centers for Disease Control and Prevention (CDC) via the Wide-ranging OnLine Data for Epidemiologic Research (WONDER) tool as the outcome measure for both objectives.[14] We restricted our analysis to the years 1999–2013, as 1999 was the earliest year available and limiting the analysis to 2013 allowed the use of Illinois, Iowa, and Idaho to be included as donor states for the synthetic control given their subsequent passage of prescriptive authority legislation. For our primary analysis, we used the CDC WONDER tool to query the Underlying Cause of Death file for all deaths with a mental illness as the identified underlying cause of death with the exclusion of substance use disorders (ICD-10 codes F01–F09, F20–F99). We chose to exclude substance use disorders in order to limit any potential bias attributable to the onset of the opioid epidemic. For our secondary analysis, we queried the Multiple Causes of Death file using the "intentional self-harm" category from the 113 Causes of Death list provided by the CDC WONDER tool (ICD-10 codes U03, X60-X84, and Y87). For both analyses, the rate of death per 100,000 population was used to standardize outcomes for comparisons between states.

In order to create the synthetic control, we included several other state-level factors from the pre-policy period (1999–2004) in addition to prevalence rates for the analysis outcome variable. To address population-level mental health, we included a measure of the percentage of the population with serious mental illness using the 2002–2003 combined average estimated from the National Survey on Drug Use and Health conducted by Substance Abuse and Mental Health Services Administration.[15] For population socioeconomic status, we included the percent uninsured and percent in poverty from the Census Bureau's Current Population Survey.[16] As both uninsured and poverty were reported as pooled 2-year averages, we attributed the value to the second year of the averaging period (e.g., the 2002–2003 estimate was used for 2003). Population demographics were measured as the percent White, the percent male, and the percent over the age of 15 using the Bridged-Race Population Estimates file in the CDC WONDER tool.[17]

1.2. Procedure & analysis

This was a quasi-experimental study in which we employed a comparative interrupted-time series design (CITS) with a synthetic control group using publicly available secondary data. The synthetic control method is an approach to control group selection in which potential control units (in this case, other states) are matched to the treated unit based on relevant characteristics to create a weighted average of control states that closely matches the treated unit during the pre-treatment period.[13] Combining the rigorous CITS study design with a synthetic control group has been shown to further increase the potential for causal inference.[18]

The analytic approach for both our primary and secondary objectives was the same. We constructed a synthetic control for both NM and LA using all other states and the District of Columbia as potential control states. The fit of the synthetic controls was assessed based on the root mean squared prediction error (RMSPE) during the pre-intervention period, where smaller values indicate a stronger pre-trend match. We opted not to combine NM and LA into one treated unit in order to preserve any heterogeneity that may exist due to the differences in the specific policies enacted by the states as well as any endogenous factors that may have impacted the implementation of each state's respective policy. For the CITS analysis, we used a continuous time measure (years since 1999), a treatment group indicator (NM or LA = 1, synthetic control = 0), and an intervention indicator (pre-2005 = 0, 2005 and later = 1). While NM passed their policy in 2002 and LA theirs in 2004, we used 2005 as the intervention date, as the first prescriptions written by psychologists in both states occurred in 2005.[19,20] Using these three variables and their interactions, we estimated the following parameters: the pre-intervention trend for the control group (time), baseline difference in the treatment and control group (treatment group), differences between treatment and control in the pre-intervention trend (time x treatment group), the immediate change in the control group following the intervention (intervention), the change in the post-intervention trend for the control group (time x intervention), the difference between the treatment and control in the immediate change (treatment group x intervention), the difference between the treatment and control in the post-intervention trend (time x treatment group x intervention), and the intercept. Additionally, we tested the null hypothesis that the post-intervention trends were the same for both treatment and control using the combination of the pre-intervention trend, pre-intervention trend difference, post-intervention trend, and post-intervention trend differences.

All analyses were conducted in STATA v.16.1 (StataCorp, College Station, TX). The *SYNTH* and *SYNTH_RUNNER* packages were used to construct the synthetic control.[21,22] The *ITSA* package was used to conduct the CITS analysis, including the post-intervention trend analysis using the *'posttrend'* option.[23] The *ACTEST* package was used to perform the Cumby-Huizinga test for autocorrelation through up to a lag order of 10.[24] Significant autocorrelation identified through the Cumby-Huizinga test was adjusted for by using Newey-West standard errors at the specified lag. The Cumby-Huizinga test was performed on the residuals from the lag-adjusted regression to detect remaining autocorrelation.

2. Results

For our primary analysis, the synthetic control group for NM (Synthetic NM) was a combination of Hawaii, Idaho, Iowa, Maine, and Oklahoma, while the synthetic control group for LA (Synthetic LA) included a combination of Florida, Mississippi, South Carolina, and Texas (Supplemental Table 1). Both synthetic controls produced small RMSPEs (NM: .6876; LA: 0.3578), suggesting a good fit. For our secondary analysis, Synthetic NM comprised Alaska, Idaho, Montana, and Nevada, while Synthetic LA included Alabama, California, Washington DC, Mississippi, South Dakota, and Texas (Supplemental Table 1). Both synthetic controls again produced small RMSPEs (NM: 0.7121; LA: 0.6932). All four synthetic controls resulted in excellent pre-intervention covariate balance (Table 1).

2.1. Deaths attributed to mental illness

In the CITS analysis for NM, there was significant autocorrelation at lags 1 ($p < .001$) and 2 ($p = .005$). After accounting for a lag of 2 in the model, the autocorrelation was no longer present in either lag (both $p > .05$). NM and Synthetic NM did not differ during the pre-intervention period with regards to their baseline rates or trend differences, further suggesting a good pre-intervention match (Table 2). There was a decrease in deaths attributed to mental illness in NM relative to Synthetic NM of 4.55 deaths per 100,000 (b = −4.55, 95%CI [−8.30,

Table 1
Pre-intervention descriptive statistics by outcome.

	Deaths Attributed to Mental Illness				Suicide Deaths			
	New Mexico	Synthetic NM	Louisiana	Synthetic LA	New Mexico	Synthetic NM	Louisiana	Synthetic LA
Death Rate (1999)	13.50	13.32	8.40	8.44	17.70	17.64	11.70	11.64
Death Rate (2002)	15.00	15.74	14.80	14.77	18.80	18.91	11.20	11.30
Death Rate (2004)	19.70	18.97	16.70	16.68	18.80	18.70	11.80	11.75
% Serious Mental Illness	10.40	10.38	8.50	8.86	10.40	9.99	8.50	9.55
% Uninsured	85.85	79.79	64.95	68.80	85.85	90.14	64.95	69.90
% in Poverty	22.37	15.65	19.42	17.89	22.37	17.50	19.42	14.98
% White	18.43	12.14	17.48	16.04	18.43	12.37	17.48	15.25
% 15 years or older	77.58	78.97	78.02	77.89	77.58	78.66	78.02	78.87
% Male	49.25	49.48	48.49	48.73	49.25	50.33	48.49	48.43

Table 2
Comparative interrupted time series regression results by outcome.

Predictor	Deaths Attributed to Mental Illness						Suicide Deaths					
	New Mexico			Louisiana			New Mexico			Louisiana		
	Estimate		95% CI	Estimate		95% CI	Estimate		95% CI	Estimate		95% CI
Time	1.18	1.03	1.33	1.72	1.54	1.90	0.29	0.16	0.41	−0.02	−0.14	0.10
Treatment Group	0.44	−0.51	1.38	0.09	−0.64	0.81	0.64	−0.29	1.58	−0.39	−1.01	0.22
Time x Treatment Group	−0.10	−0.46	0.26	−0.02	−0.29	0.26	−0.13	−0.41	0.14	0.00	−0.23	0.23
Intervention	7.32	3.96	10.69	0.23	−3.21	3.67	−0.34	−1.56	0.88	0.30	−0.30	0.90
Time x Intervention	1.86	1.39	2.34	1.48	0.79	2.16	0.06	−0.09	0.21	0.30	0.19	0.41
Intervention x Treatment Group	−4.55	−8.30	−0.79	0.28	−4.78	5.33	−0.50	−2.22	1.22	−0.05	−1.07	0.98
Time x Intervention x Treatment Group	−0.07	−0.82	0.68	−0.06	−0.96	0.85	0.15	−0.21	*0.51*	−0.12	−0.34	0.10
Constant	13.01	12.53	13.48	8.62	8.16	9.09	17.54	17.18	17.89	11.53	11.20	11.87

−0.79]) immediately following the start of psychologist prescribing (Fig. 1); however, there was not a significant change in the trend following the intervention (b = −0.07, 95%CI [−0.82, 0.68]). The overall post-intervention trend between NM and Synthetic NM did not significantly differ (Difference = −0.17, 95%CI [−0.77, 0.45]).

Similar to NM, there was significant autocorrelation at lags 1 ($p < .001$) and 2 ($p = .007$) for LA that were no longer significant after including a lag of 2 in the CITS model (both $p > .05$). There were no significant differences between LA and Synthetic LA during both the pre-intervention and post-intervention period (Table 2). The overall post-intervention trend between LA and Synthetic LA did not significantly differ (Difference = −0.07, 95%CI [−1.03, 0.89]; Supplemental Figure 1).

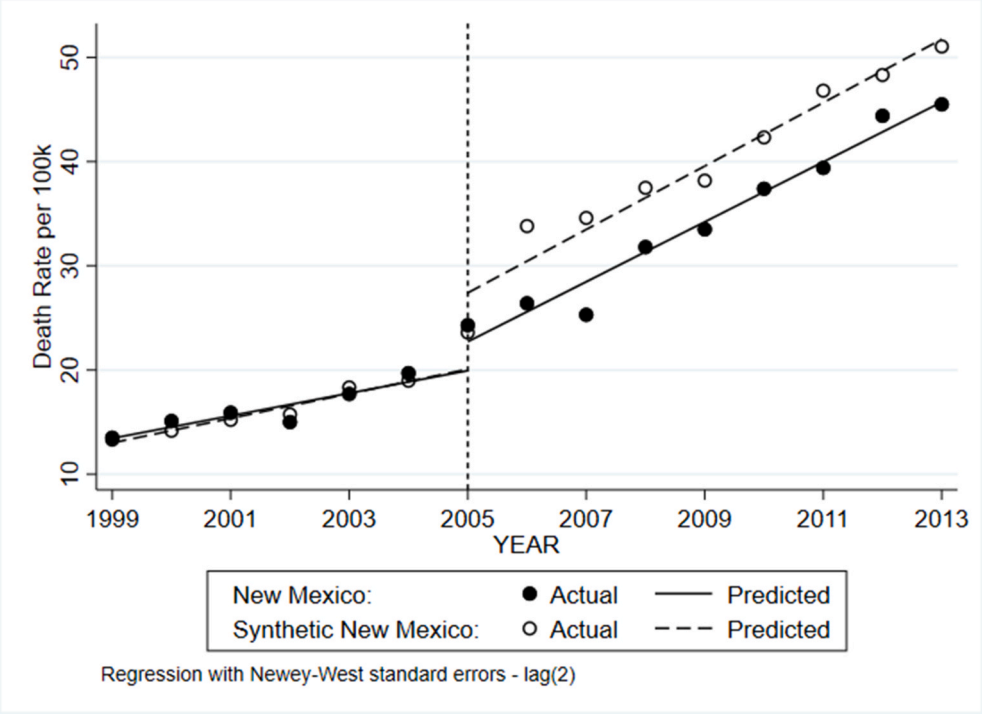

Fig. 1. Changes in Deaths Attributable to Mental Illness Following the Implementation of Psychologist Prescriptive Authority in New Mexico. The initial difference between New Mexico and Synthetic New Mexico (−4.55 deaths per 100,000 population) is significant at p < .05.

2.2. Suicide deaths

Autocorrelation was present in the CITS analysis for NM at a lag of 1 ($p < .001$). After including a lag of 1, there remained a small amount of residual autocorrelation at a lag of 2 ($p = .011$). We used a lag of 2 in the analysis in response to the residual autocorrelation, however, the autocorrelation at lag 2 remained significant ($p = .011$). There were no significant pre-intervention differences between NM and Synthetic NM, nor were there any significant post-intervention differences Table 2). Additionally, the overall post-intervention trend did not significantly differ between NM and Synthetic NM (difference in slope = 0.02, 95%CI [−0.21, 0.24]; Supplemental Figure 2).

There was significant autocorrelation at lag 1 ($p < .001$), lag 2 ($p = .007$), and lag 3 ($p = .028$). Using a lag of 3 in the model addressed the autocorrelation in lag 2 ($p = .487$) and lag 3 ($p = .380$), and reduced but did not eliminate the autocorrelation in lag 1 ($p = .011$). There were no significant differences between LA and Synthetic LA in the pre-intervention period (Table 2). Following the intervention, LA did not see a significant immediate change (b = −0.047, 95%CI [−1.07, 0.98]) or a change in the trend (b = −0.12, 95%CI [−0.34, 0.10]); however, the overall trend for LA was 0.12 suicides per 100,000 people per year lower (95%CI [−0.18, −0.06]) than for Synthetic LA (Fig. 2).

3. Discussion

Mental illness is a major public health issue that is highly prevalent and contributes to significant mortality. We examined the impact of prescriptive authority policies for psychologists in NM and LA on deaths attributed to mental illness and suicide deaths, and found mixed evidence that these policies may have reduced deaths. In NM, we found an initial decrease in deaths attributed to mental illness and no effect on annual suicide rates. In LA, we found no impact on deaths attributed to mental illness, but the overall trend for the suicide rate was lower following the policy implementation. These findings suggest that policies granting prescriptive authority to psychologists have the potential to reduce mortality among people with mental illness. However, the disparate findings by state raise many questions regarding the impact of specific policy components and implementation.

Regarding deaths attributable to mental illness, questions remain regarding the policy impact seen in NM regarding the absence of a trend change. The initial decrease in deaths is consistent with what we would expect from an increase in access to treatment with psychotropic medications; however, we expected a decrease in the rate of deaths over time as more psychologists became licensed to prescribe, but this did not appear to be the case. We hypothesize that this may reflect a limitation in existing psychologist prescriptive authority policies, in that there is no mechanism to increase the total number of mental healthcare providers in the state. Those psychologists who sought to add prescribing to their current scope of practice were able to do so, reflected by the initial decrease in deaths, but the policy likely did not increase the number of psychologists. Only one county (Los Alamos) in NM is not at least partially designated as a mental health provider shortage area by the U. S. Health Resources & Services Administration as of 2022,[25] suggesting that there is a severe limit on the potential benefit of prescriptive authority policies. Furthermore, insurance coverage could be a significant limiting factor on the impact of the policy given that people with mental illness are less likely to have health insurance.[26,27] A recent survey found that 2.8% of patients seen by prescribing psychologists were pro bono, suggesting that uninsured patients with mental illness are likely unaffected by this policy.[28] Future studies are needed to examine the mechanism of action by which this policy exhibited an initial decrease, but not a decrease over time, in deaths attributable to mental illness. Additional work is needed to examine how to incorporate workforce expansion efforts and health insurance coverage as an additional component of future policies.

An additional question relating to deaths attributable to mental illness is why NM experienced an initial reduction, but LA saw no changes. We hypothesize that this may be, at least partially, related to the substantial destruction wrought by Hurricane Katrina in the same year that prescribing started in LA. While the synthetic control method would account for exogenous shocks at the national level and the inclusion of other gulf states (i.e., Texas and Mississippi) in the synthetic

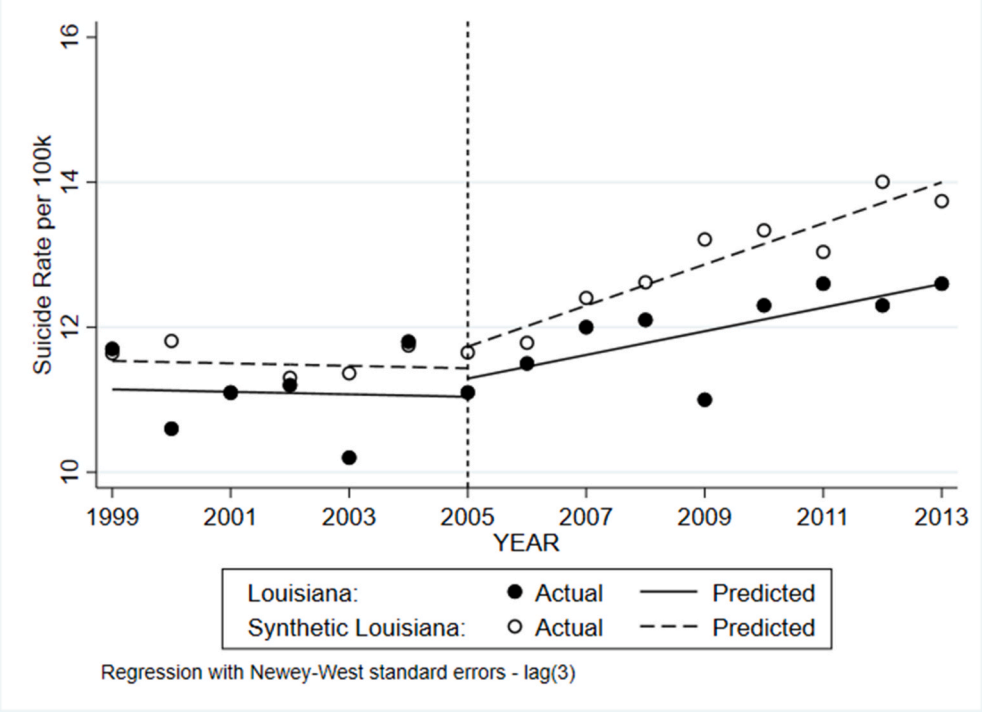

Fig. 2. Changes in the Suicide Rate Following the Implementation of Psychologist Prescriptive Authority in Louisiana. The overall trend in the suicide rate is significantly lower in Louisiana than Synthetic Louisiana in the post-implementation period at p < .05 (0.16 versus 0.28 deaths per 100,000 people per year).

control would accommodate some of the broader impacts of Hurricane Katrina, it could still represent a competing event that makes such a policy evaluation difficult. In particular, there was a significant increase in mental illness[29] and mental health treatment disruptions[30] following Hurricane Katrina, as well as a reduction in the initiation of new treatment.[30] Such a dramatic shift in the mental health landscape may have negated any immediate impacts of prescriptive authority for psychologists and hindered the onset of long-term improvements. Future studies examining the impact of prescribing psychologists at the individual level may elucidate any effects that prescriptive authority had on deaths attributable to mental illness in LA.

The second objective of our study was to replicate the findings of Choudhury & Plemmons (2021) using a substantially different method.[12] While we did not find significant immediate or trend changes, the estimates were consistent with Choudhury & Plemmons in direction of the effects. The one exception to this was the trend change in NM, which was positive (i.e., suicide rate increasing annually). Interestingly, we did find evidence of an overall suicide rate trend difference in LA following the start of prescribing by psychologists, suggesting that the policy slowed the increasing trend seen in the synthetic control. Given that suicidal ideation increased in LA following Hurricane Katrina,[29] we believe that this finding may represent an under-estimate of the true effect of the policy on suicide deaths in the state. This overall trend difference suggests the effect of psychologist prescriptive authority on the suicide rate in LA has had a protracted implementation period, such that a small trend change may have occurred and is as of yet undetectable in the available annual estimates. Future studies should examine suicide antecedents, such as self-harm-related healthcare utilization, in order to examine this trend further. Additionally, it will be imperative to identify what policy components and state factors contributed to this overall trend difference in LA but not NM.

While the majority of our suicide rate findings were not significant, it is reassuring that they were directionally consistent with Choudhury & Plemmons. We hypothesize that methodological and data differences may explain the difference in significance. Namely, our study relied on state-level annualized data to examine the suicide rate per 100,000 population using a synthetic control CITS model, while Choudhury & Plemmons (2021) used individual data summarized by month to estimate the percentage change in suicide deaths in a fixed-effects difference-in-difference model.[12] Although changes at the monthly level should correspond to a shift in annualized data, it is possible that variance existing at the monthly level is not readily apparent when combined at the annual level. Furthermore, our use of an annual time period versus their monthly data resulted in a substantial difference in sample size (30 vs 12,227) that afforded Choudhury & Plemmons more power to detect a small effect. Methodologically, differences in the specified control group may have contributed to differences in outcomes as well, due to the important role that control group selection plays in quasi-experimental methods.[31,32] Choudhury & Plemmons (2021) used all other states as their control group, which may not be representative of what would have occurred in NM and LA in the absence of the policy.[12] It is plausible that our use of the synthetic control method provided a more accurate counterfactual that led to the non-significant finding. Future studies should build upon the respective strengths of these two studies through the application of quasi-experimental methods with strong control groups using individual-level data such as insurance claims.

Finally, while our findings were limited to two states in the United States, the disease burden associated with mental health is a growing international concern, especially among low- and middle-income countries (LMICs) where the prevalence of mental illness is on the rise.[33,34] One of the primary barriers to improving mental health care in LMICs is the profound workforce shortage, with 0.1–1.7 psychiatrists and 0.1 to 1.6 psychologists per 100,000 population in LMICs compared to 8.6 psychiatrists and 10.7 psychologists per 100,000 population in high-income countries.[35] Increasing the treatment capacity of the limited mental health workforce via psychologist prescriptive authority policies may be one approach low and middle income countries could explore to address this growing mental health burden. In particular, a policy similar to that implemented in New Mexico may be beneficial, as deaths attributable to mental illness represent between 7.7% and 11.1% of the total disease burden in LMICs.[36]

3.1. Limitations

This study is not without limitations. First, although death certificate data is a core component of national surveillance efforts and widely used in public health research, it is not without flaws. Several studies have noted that death certificate errors are common and can vary by state, contributing to potential misclassification of the underlying cause of death.[37,38] One major advantage of the synthetic control method is the ability to control for time-variant unobserved confounding,[13] and should therefore account for unmeasured heterogeneity in classification of death between states over time; however, it is possible that death certificate coding errors may bias our estimates and confidence intervals in unforeseen ways. Second, there was limited state-level mental health data available to use in the creation of the synthetic control. While our synthetic control resulted in a close match with NM and LA across all four models, our only included measure of mental health was a 2003 estimate of serious mental illness. Ideally, we would have liked to include data from more years, as well as some measure of treatment availability. Finally, incorporating a lag was not sufficient to eliminate all autocorrelation for some of the models. Fortunately, autocorrelation is a problem for standard errors, not parameter estimates, and our use of Newey-West standard errors adjusts for autocorrelation; however, it is worth noting this methodological challenge.

3.2. Public health implications

Our results provide evidence that policies granting prescriptive authority to psychologists were associated with an immediate reduction in deaths attributable to mental illness in New Mexico and a lower than expected suicide rate in Louisiana. These findings suggest that such policies may be an effective step towards reducing the mental health mortality gap, although considerable questions remain regarding the mechanisms of action underlying the identified changes. Future work is needed to examine the effects of these policies on non-fatal mental health outcomes, such as emergency department utilization and mental health expenditures at the state and individual level.

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CRediT authorship contribution statement

Phillip M. Hughes: Conceptualization, Data curation, Formal analysis, Methodology, Visualization, Writing – original draft, Writing – review & editing. **Robert E. McGrath:** Conceptualization, Writing – review & editing. **Kathleen C. Thomas:** Conceptualization, Supervision, Writing – review & editing.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.sapharm.2022.12.006.

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