BMJ Open

Examining the policy effects of Arizona's 2016 pre-emption law on firearm suicide rates in the greater Tucson area: an observational study

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To cite: Goldstein EV, Prater LC. Examining the policy effects of Arizona's 2016 pre-emption law on firearm suicide rates in the greater Tucson area: an observational study. *BMJ Open* 2022;**12**:e058196. doi:10.1136/bmjopen-2021-058196

► Prepublication history and additional supplemental material for this paper are available online. To view these files, please visit the journal online (http://dx.doi.org/10.1136/bmjopen-2021-058196).

Received 11 October 2021
Accepted 22 April 2022

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ABSTRACT

Objective In 2016, Arizona enacted SB 1487 to nullify Tucson's ordinance permitting the municipality to destroy confiscated and forfeited firearms and instead require the firearms to be resold to the public through an auctioneer. Our objective was to examine whether firearm suicide rates increased in Pima County (greater Tucson area) relative to other Arizona counties following the enactment of Arizona's 2016 pre-emption law.

Design An observational study of a natural policy experiment. We used a difference-in-differences approach to estimate the effects of Arizona enacting SB 1487 on firearm suicide rates in Pima County. Our statistical analyses adjusted for county-level differences in population demographics (age, gender and race) and unemployment rates, as well as a proxy for firearm availability and mental health professional shortage area status.

Setting 9 Arizona counties from 2014 to 2019.

Participants A policy group was constructed using Pima County (Tucson area) observations. A comparison group was created using data from eight other Arizona counties. 54 county-year observations were analysed.

Intervention SB 1487, which pre-empted Tucson law and allowed firearms that were seized/surrendered to law enforcement to be recirculated instead of destroyed.

Outcomes and measures Annual rates of firearm and non-firearm suicides per 100 000 persons extracted from the Centers for Disease Control and Prevention WONDER system.

Results Over the study period, comparison group counties had an average of 14.87 firearm suicides per 100 000 persons per year, compared with 11.56 firearm suicides per 100 000 persons per year in Pima County. A 1.13 increase in Pima County's firearm suicides per 100 000 persons coincided with the enactment of Arizona's 2016 pre-emption law, relative to comparison group counties over the same period.

Conclusions SB 1487 was associated with higher firearm suicide rates in Pima County relative to other areas not targeted by the law, assuming fewer firearms were destroyed and more firearms re-entered the greater Tucson area through 2019.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ This study uses a quasi-experimental design to examine a natural policy experiment in Arizona, USA, accounting for other explanatory factors.
⇒ This study compares both firearm and non-firearm suicide rates at the county level, conducting empirical robustness and placebo tests.
⇒ In this and similar studies of firearm suicide in the USA, data limitations preclude adjusting for the actual number of firearms in a community, a strong risk factor for suicide.
⇒ City-level data were unavailable, and data were aggregated at the county level.
⇒ As with similar non-experimental studies, our findings should be interpreted as correlative, not causal.

INTRODUCTION

The USA is in the midst of a suicide epidemic taking the lives of over 40 000 Americans every year, with a high burden typically concentrated in the Mountain States.[1] Firearms are the most common suicide method in the USA.[1] Although suicide is a multifaceted public health problem with simultaneous biological, psychological, social and environmental contributors, access to firearms exacerbates suicide risk for suicidal persons.[2 3] Many people who attempt suicide will survive,[4] though survival is typically less likely for those who use firearms, given the 80%–90% case-fatality rate.[5 6] Internationally, the US firearm suicide rate has been estimated to be eight times higher than the average firearm suicide rate of 22 other high-income countries, even though the total suicide rate for the USA is similar to that of other countries.[7] In the Mountain States (ie, Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah and Wyoming) specifically, firearm suicide rates increased by 30.4% from 2005 to 2019 and are consistently among the top 10 in the USA.[1]

Federal firearm safety and control reforms are controversial and difficult to enact and enforce, making state governments responsible for most firearm policymaking.[8] Frequently, in the USA, policies are enacted to curb homicide after incidents of highly publicised mass shootings, even though most firearm mortality is attributable to suicide.[1 9] Even so, these policy changes often have implications for firearm suicide through the mechanism of supply or access restriction.[2 3 8] There is evidence demonstrating that stricter firearm safety laws enacted at the state level, such as child access prevention laws[10] and risk-based, time-limited civil protection orders for firearm removal,[11] can reduce the rate of firearm suicide. However, these policies are enacted inconsistently from state to state, leaving many firearm-related issues unaddressed and motivating municipalities to enact firearm policies consistent with dangers or concerns specific to their citizens. This issue has caused controversy between state and local governments, including Richmond, Virginia, where a state pre-emption law prevented banning firearms at a white supremacist rally but allowed banning of less lethal weapons (eg, knives).[12 13]

Tensions between Arizona's government and local legislators in Tucson have been particularly problematic for firearm policymaking.[14] Absent action from state legislators, local policymakers in the city of Tucson passed an ordinance requiring firearms confiscated by (or voluntarily surrendered to) Tucson police to be destroyed, resulting in the elimination of over 4800 firearms in Pima County from 2013 to 2016.[14] However, in 2016, the Arizona legislature enacted SB 1487 to pre-empt Tucson's ordinance. Upheld by the Arizona Supreme Court, SB 1487 forced Tucson to stop the destruction of confiscated firearms and resell the firearms to the public by auction or face an annual financial penalty of $115 million.[15]

For these reasons, SB 1487 likely disrupted the number of firearms in Tucson in two ways. First, SB 1487 no longer allowed Tucson police to actively accept firearms voluntarily turned in by citizens or through buyback programmes for the purpose of destroying those firearms. Second, SB 1487 required Tucson to resell all confiscated or forfeited firearms through a local auctioneer. The city of Tucson auctions resold nearly 600 firearms in just one 5-month period in 2017,[16] and many firearms likely re-entered Tucson and surrounding communities through 2019. The legal implications of SB 1487 have been discussed elsewhere,[17] such as conceding to states over firearm-related policymaking, restricting local efforts to enact public safety interventions, and imposing one of the most punitive fiscal measures known to be applied to local government in the US. However, less is understood about the health-related implications of Arizona's 2016 pre-emption law, specifically how it may have affected firearm suicide rates in the greater Tucson area. This example of an exogenous local policy affecting the Tucson (Pima County) area relative to other counties in Arizona provided ideal conditions for a natural policy experiment.[18]

Our objective was to examine whether firearm suicide rates increased in Pima County relative to other Arizona counties following Arizona's 2016 pre-emption law. Given the systematic link between firearm availability and suicide and considering the availability of same-day firearm purchasing in Arizona,[19] we hypothesised that firearm suicide rates (but not non-firearm suicide rates) would increase in Pima County following the enactment of SB 1487, which restricted local firearm destruction and likely introduced a new supply of firearms in Tucson area communities.

METHODS

Our primary data source was the Centers for Disease Control and Prevention (CDC) WONDER system,[20] an interactive database compiling information on the underlying causes of death in the USA. Data from the Bureau of Labor Statistics (BLS) local area unemployment statistics programme[21]; Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF) Federal Firearms Licensees database[22]; and the Area Health Resource Files (AHRF) were also used. CDC data restrictions prevent the analysis of county-level suicide rates involving less than 10 decedents. For this reason, counties with restricted data were excluded from the analysis. This included the six least-populated counties (with also the lowest firearm suicide counts) in Arizona. The remaining counties represented 93.4% of the state population in 2019 (data not shown).

We used a quasi-experimental study design taking advantage of a natural policy experiment. Our final analytical sample included 54 county-year observations, including six observations for each of nine counties from 2014 through 2019, permitting multiple years of data both before and after the pre-emption law was enacted.[23]

Dependent variables

Our primary dependent variable was a measure of the annual rate of firearm suicides (International Classification of Diseases, 1oth Revision, codes X72–X74) per 100 000 persons (all ages). Because the 2016 pre-emption law should not have affected non-firearm suicide rates in Pima County, we also examined a second dependent variable measuring the annual rate of non-firearm suicides per 100 000 persons (all ages) as a robustness test. Both variables were created using data extracted from the CDC WONDER system.

Independent variables

There were two independent policy variables. The first variable was an indicator of being affected by Arizona's pre-emption law, SB 1487. Arizona enacted the pre-emption law in 2016 to nullify Tucson's ordinance allowing the Tucson Police Department to destroy unclaimed and forfeited firearms and instead required the firearms to be made available through resale. The variable equalled 1 for Pima County (Tucson area) observations (policy

group) and 0 for all other county observations (comparison group).

The second variable was a measure of policy-enactment timing equal to 1 for observations after the 2016 law was enacted and 0 for observations before 2016.

Covariates

Our empirical approach assumes that confounders varying across the policy and comparison groups are time-invariant and time-varying confounders are group invariant. Our fully adjusted multivariate statistical models included a vector of covariates to absorb residual variance in the outcomes and adjusted for potential confounding factors varying between the two groups. Population demographic covariates included county-level measures of age (% of population <25 years old), gender (% of population male) and race (% of population white) in each county-year. BLS data were used to adjust for differences in county-level unemployment rates, a proxy for socioeconomic status differences shown to be correlated with suicide risk.[24] ATF data were used to construct a county-level proxy measure of firearm ownership, as firearm availability is associated with suicide.[2] The variable adjusted for the per capita rate of category 1 and category 2 federal firearm licences in each county-year, which may be the most suitable proxy for county-level analyses.[25] Recent studies have shown mental health professional shortage areas are associated with higher suicide rates at the county level.[26] For this reason, we also included a measure of mental health professional shortage area status (partial or full shortage area county-year) using data from the AHRF, as defined by the US federal government.[27]

Analysis

We used a linear two-group, two-period difference-in-differences (DID) estimation approach to examine the effect of SB 1487 as a widening or narrowing of the gap in suicide rates in Pima County compared with eight other Arizona counties from the prepolicy-enactment period to the postpolicy-enactment period.[18] The prepolicy-enactment reference period was the average of outcomes from 2014 and 2015. We estimated four models using the following general regression approach:

$$Y_{ct} = \beta 0 + \beta 1\ policy\ group + \beta 2\ post\ policy - enactment\ period + \beta 3(policy\ group \times post\ policy - enactment\ period) + BZ_{ct} + \Sigma_{ct} \quad (1)$$

where Y_{ct} was the annual firearm (or non-firearm) suicide rate for county c at time t, including the vector of covariates (Z_{ct}) in the adjusted models.

Model 1 estimated the policy parameters (independent variables) without covariate adjustment for our primary dependent variable. Model 2 estimated the policy parameters with covariate adjustment. As a robustness test, we also estimated models 3 and 4, examining the effects of the 2016 pre-emption law on our measure of non-firearm suicide rates in the policy and comparison group counties.

The coefficient of interest was the DID policy estimate (β_3) for the interaction of the two independent variables, coinciding with Arizona's decision to enact the 2016 law pre-empting Tucson's firearm destruction ordinance. This empirical approach assumed that absent the 2016 policy, the average changes in the firearm suicide rates would have been the same in both Pima County (Tucson area) and the comparison group counties, known as the common trends assumption.[28 29] β_3 is thus an estimate of the change in Pima County's average firearm suicide rate from the prepolicy-enactment to the postpolicy-enactment period minus the change in the comparison group counties' average firearm suicide rate over the time period. This approach also assumed that there were no other unmeasured policy changes or factors coinciding with the timing of Arizona's 2016 pre-emption law that could have affected firearm suicide rates in Pima County relative to the comparison group counties.

A corollary of this common trends assumption was examined graphically.[18 30] We also conducted a placebo test of the expected policy effects and prepolicy common trends assumption.[23] For this test, we performed an additional DID estimation using a 'fake' policy group for our primary dependent variable. Specifically, we replicated our estimation of model 2 using Maricopa County observations for our policy group and all other non-Pima counties for the comparison group. Because the 2016 pre-emption law should not have affected firearm suicide rates in Maricopa County relative to the other comparison counties, the DID estimate (β_3) from the placebo test model should not statistically differ from 0.

To correct for serial correlation and heteroscedasticity in the error terms, robust SEs were clustered at the county level, and the statistical models were weighted by county-year population. We established an a priori two-sided significance level of 0.05. All analyses were conducted using Stata V.17.0.

RESULTS

Over the study period, the comparison group counties had an average of 14.87 firearm suicides per 100 000 persons per year, compared with 11.56 firearm suicides per 100 000 persons per year in Pima County (table 1). Figure 1 illustrates the geographical variation in firearm suicide rates for each Arizona county in 2019, as well as the relative land size of each county. By 2019, Pima County's firearm suicide rate increased to 14.13 deaths per 100 000 persons. Figure 2 describes the unadjusted firearm suicide rates in Pima County and the comparison group counties from 2005 through 2015, depicting similar prepolicy trends between Pima County and the comparison group counties.[18] This suggests the corollary of the common trends assumption was satisfactory for our dependent variable of interest. Online supplemental figure A1 describes the unadjusted non-firearm suicide rates over the study period.

Table 1 Characteristics of the pooled analytical sample, by policy group: 2014–2019

	Policy group		Comparison group	
	Mean	SD	Mean	SD
Firearm suicides per 100 000 persons	11.56	1.52	14.87	6.28
Non-firearm suicides per 100 000 persons	8.74	0.83	10.66	5.24
Unemployment rate (%)	4.95	0.67	7.77	4.64
Population, white (%)	86.59	0.25	82.49	14.44
Population <25 years old (%)	33.19	0.72	31.86	5.77
Population, male (%)	49.19	0.03	50.34	1.05
Per capita rate of federal firearm licences	0.00019	0.00001	0.00034	0.00016
Mental health professional shortage area status				
Partial shortage area county-years (%)	33.33	0.52	34.04	0.48
Full shortage area county-years (%)	66.67	0.52	65.96	0.48

Authors' analysis of the Centers for Disease Control and Prevention WONDER; Bureau of Labor Statistics; Bureau of Alcohol, Tobacco, Firearms and Explosives; and Area Health Resource Files data. For each variable shown in the table, unadjusted mean annual percentages or rates are shown from across the study period. The policy group contained 6 observations and the comparison group contained 48 observations.

Table 2 presents our multivariate analysis findings. The model 1 results show Arizona's enactment of the 2016 pre-emption law was associated with an increase in Pima County's firearm suicide rate by an additional 1.20 suicides per 100 000 persons from the prepolicy period to the postpolicy period, relative to the change over the same period in the comparison group counties (95% CI 0.79 to 1.61, p<0.01). Model 2 produced similar estimates of the effect of the 2016 pre-emption law following covariate adjustment. In the adjusted model, a 1.13 increase in Pima County's firearm suicides per 100 000 persons coincided with the enactment of the 2016 law, relative to the comparison group counties over the same period (95% CI 0.51 to 1.74, p<0.01). Consistent with previous studies, our proxy for firearm availability was also positively associated with higher firearm suicide rates.[25]

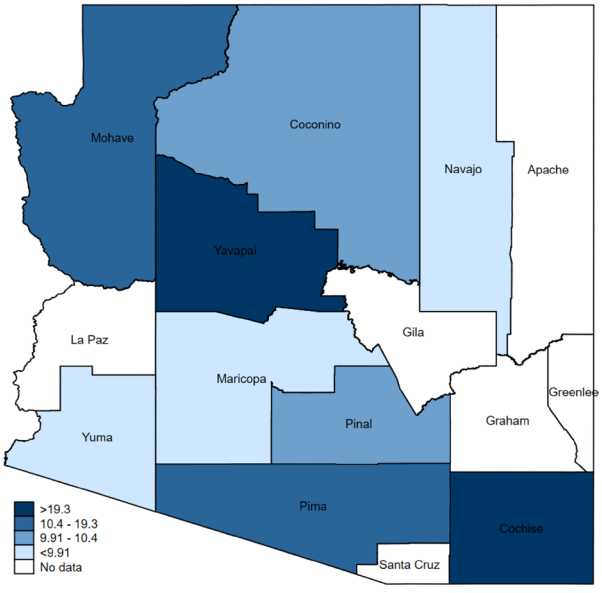

Figure 1 Firearm suicides per 100 000 persons in Arizona, by county in 2019. Notes: Authors' analysis of the Centers for Disease Control and Prevention WONDER data. This map describes the firearm suicide rate per 100 000 persons in 2019 for each county included in our analyses. This map also illustrates the relative land size of each Arizona county. Pima County had 14.13 firearm suicides per 100 000 persons in 2019. Counties excluded from our analyses are shown in white.

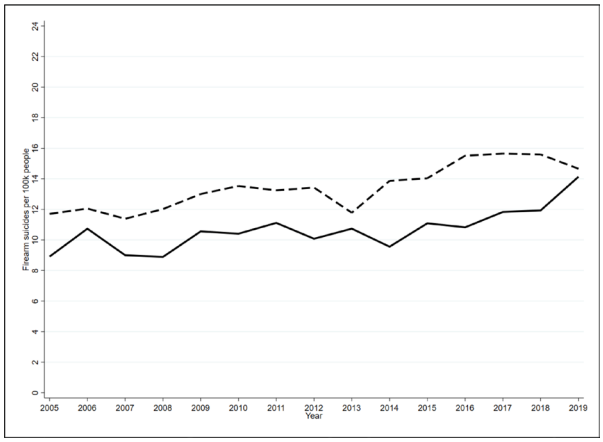

Figure 2 Unadjusted trends in the firearm suicide rate, by policy group, 2005–2019. Notes: Authors' analysis of Centers for Disease Control and Prevention WONDER data. This figure shows the unadjusted trends in firearm suicide rates between Pima County (solid black line) and comparison group counties (dashed black line) from 2005 to 2019, allowing for a visual examination of the prepolicy common trends assumption in the primary dependent variable. The postpolicy-enactment period was 2016–2019. Tucson's ordinance requiring firearms confiscated by (or voluntarily surrendered to) Tucson police to be destroyed was adopted in 2005 and would have been implemented in subsequent years.

Table 2 Estimating the effect of Arizona's 2016 pre-emption law on firearm suicide rates in Pima County: 2014–2019

	1	2
	Unadjusted model	**Adjusted model**
Policy variables		
SB 1487 exposure		
Comparison group	Ref	Ref
Policy group (enactment of state law, SB 1487, pre-empting firearm disposal ordinance in Tucson, Pima County)	0.13 (–3.03 to 3.29)	0.52* (0.13 to 0.90)
Policy-enactment timing		
Prepolicy enactment	Ref	Ref
Postpolicy enactment	0.67** (0.26 to 1.08)	0.30 (–0.34 to 0.90)
Policy group×postpolicy enactment (DID estimate)	1.20** (0.79 to 1.61)	1.13** (0.51 to 1.74)
Covariates		
Unemployment rate (%)		0.24** (0.02 to 0.39)
Population, white (%)		–0.10** (–0.17 to –0.03)
Population <25 years old (%)		–0.75** (–1.06 to –0.42)
Population, male (%)		–0.53* (–0.92 to –0.14)
Per capita rate of federal firearm licences		20,066.99** (12 901.60 to 27 232.37)
Mental health professional shortage area status		
Partial shortage area		Ref
Full shortage area		0.22 (–1.05 to 1.50)
Constant	10.192** (7.03 to 13.34)	64.97** (32.80 to 97.14)
Observations	54	54
R2	0.02	0.90

Authors' analyses of Centers for Disease Control and Prevention WONDER; Bureau of Labor Statistics; Bureau of Alcohol, Tobacco, Firearms and Explosives; and Area Health Resource Files data. 95% CIs are shown in parentheses. Observations reflect county-year data. The 'Policy group×postpolicy enactment' coefficient is the DID policy estimate attributable to the state's decision to enact the law pre-empting Tucson's ordinance allowing destruction of unclaimed and forfeited firearms. The DID estimate tested the difference in the changes in the average suicide outcomes from the prepolicy-enactment period to the postpolicy-enactment period between Pima County and the comparison group counties.
*P<0.05, **P<0.01.
DID, difference-in-differences; ref, reference.

The results of our placebo test are shown in online supplemental table A1. The DID estimate from the placebo test model did not statistically differ from 0 at the 0.05 level (β_3=–0.86, 95% CI –2.36 to 0.64; p=0.216). In other words, the 2016 pre-emption law did not significantly affect firearm suicide rates in the fake policy group (Maricopa County) compared with the remaining comparison group counties. These supplemental results further suggest the common trends assumption was satisfactory for our main outcome. If the DID estimate from the placebo test significantly differed from zero, the impact would have likely come from some underlying difference in the trends between the two groups. In turn, this would cast doubt on the assumption of similar prepolicy trends between our main policy and comparison groups.

Online supplemental table A2 shows the results of our robustness test, describing the estimated effects of the 2016 pre-emption law on non-firearm suicide rates in Pima County. In models 3 and 4, the new law was not statistically associated with changes in the non-firearm suicide rate. In the adjusted model (model 4), and in contrast to the main firearm suicide model results, the proxy for firearm availability was also not associated with the non-firearm suicide rate. The unemployment rate was independently associated with higher non-firearm suicide rates in the adjusted model (β=0.33, 95% CI 0.02 to 0.64; p=0.03; model 4).

DISCUSSION

Our findings suggest a modest but statistically significant increase in the firearm suicide rate in Pima County (greater Tucson area) during the years following the enactment of Arizona's 2016 pre-emption law. Relative to the comparison counties, the 2016 law coincided with a 10.9% relative increase in the firearm suicide rate in Pima County from the prepolicy period to the postpolicy

period. Although the mean annual firearm suicide rate was higher in the comparison group counties over the full study period (table 1), by 2019, the firearm suicide rate in Pima County increased and was nearly equivalent to the firearm suicide rate in the comparison counties (14.1 and 14.6 per 100 000 persons, respectively).

Despite having a firearm suicide rate 52.4% higher than the national average,[1] the state of Arizona responded to firearm safety and control policies adopted by the local Tucson government with a pre-emption measure including significant punitive financial consequences.[17] Other authors—and this paper—have demonstrated and discussed the link between firearm availability and suicide rates.[2 3 31 32] Following Arizona's 2016 pre-emption law, Tucson was not only no longer able to destroy confiscated and forfeited firearms, but it was also required to redistribute those firearms by way of auction. As additional firearms may have re-entered the greater Tucson area through 2019 (and were no longer removed and destroyed), our findings suggest SB 1487 may have contributed to higher firearm suicide rates in Pima County relative to other counties not targeted by the new law. Not surprisingly, we also found the 2016 pre-emption law did not impact non-firearm suicide rates in Pima County relative to other counties over the same period, further suggesting that SB 1487 affected firearm suicide specifically in Pima County.

State pre-emption of municipal policies has several adverse consequences for localism, resting on the idea that state power supersedes local government and that municipalities are relegated to primarily executing state policy.[33] This notion can be detrimental to public health. Pre-emption efforts interfering with local firearm safety policies have been supported and encouraged by the firearm industry.[34 35] State pre-emption of local government authority on other public health issues such as nutrition policy[36 37] and tobacco control[38] has also been documented, seemingly used by organised interests to wield power over local public health initiatives. Following a strategic push by several influential lobbying entities, over 40 states have passed some version of pre-emptive law designed to undermine local authority over firearm safety.[36 39] Our study is the first to empirically show that state pre-emption of local firearm laws appears to have specifically affected suicide-related outcomes.

Limitations

This study had several limitations, and readers should carefully interpret the findings. First, unobserved characteristics not accounted for in models 2 and 4 may have biased our estimates, imposing limits to causal interpretations of our findings. Specifically, we did not adjust for county-level measures of veteran population size or unmet mental healthcare needs. Veteran status and different mental illnesses are often suicide risk factors, although mental illness is less likely to be diagnosed among those who use firearms for suicide.[40] We also could not directly adjust for firearm availability, though we used the proxy measure of firearm availability recommended for county-level analysis in an attempt to address this concern.[25] We also assumed that there were no other unmeasured policy changes coinciding with the timing of Arizona's 2016 pre-emption law that could have affected firearm suicide rates in Pima County relative to the comparison group counties. As with other non-experimental studies, our findings should be interpreted as correlative, not causal.

Second, because we conducted a county-level analysis and estimated the effects of the 2016 pre-emption law on county-level firearm suicide rates, readers should refrain from making inferences about individual behaviour. For example, we could not directly examine at the person level whether Arizona's 2016 pre-emption law resulted in suicidal persons acquiring firearms that would have previously been confiscated and destroyed by Tucson police or newly resold firearms to make suicide attempts.

Third, Tucson was the municipality with the firearm destruction policy, yet city-level data were unavailable, and data were aggregated at the county level. Tucson is the only major city in Pima County, and the Tucson metropolitan statistical area is defined as Pima County. The majority of Pima County resides in Tucson, which demographically resembles the county as a whole. However, smaller rural areas in Pima County may have been less sensitive to the potential increase in firearms available through auction after SB 1487. It may be more likely they already possessed firearms, though not necessarily handguns,[41] which is the type of firearm used in most urban and rural suicides.[42]

Fourth, SB 1487 likely disrupted the number of firearms in Tucson in two ways. SB 1487 no longer allowed Tucson police to actively accept firearms voluntarily turned in by citizens or through buy-back programmes for the purpose of destroying those firearms. Instead, SB 1487 required Tucson to resell all confiscated or forfeited firearms through a local auctioneer. Tucson's 2005 ordinance contributed the elimination of over 4800 firearms from 2013 to 2016.[14] However, in this and other studies, data limitations preclude knowing the actual number of firearms in a community. Because we cannot directly measure the number of firearms before and after the policy change, we make a logical assumption that more firearms entered Pima County after the new policy was enacted. Notably, Tucson firearm auctions have been administered in-person and online to persons with federal firearms licences (eg, dealers and pawnbrokers) by a third-party auctioneer based in Tucson.

Fifth, it is possible persons outside the city of Tucson could have won the confiscated and forfeited firearms; however, it is likely many bidders were from the greater Tucson area because the auctioneer was located in Tucson and the auctions were advertised locally. Notably, some firearms sold for as little as $15.[43] It is feasible local pawnbrokers and dealers could have won the firearms cheaply and then resold them at a discount. Persons seeking firearms may be more likely to purchase them from pawnbrokers or dealers than at a government auction. Beyond

the general link between greater firearm availability and suicide risk, studies have suggested some persons purposely buy firearms with the intent of suicide.[44]

Finally, as described earlier, CDC data restrictions prevented us from constructing our dependent variables for all Arizona counties. The generalisability of our results is limited to the comparison counties included in our analytical sample; however, the included counties represented about 93.4% of the state population in 2019.

CONCLUSIONS

Access to firearms exacerbates suicide risk,[2 3] and the risk of substitution towards other methods when highly lethal means are absent is likely small,[45] especially during a suicidal crisis. Although the extent to which Tucson's 2005 ordinance contributed to lower firearm suicide rates remains elusive, the ordinance resulted in the elimination of over 4800 firearms from 2013 to 2016 alone. In turn, Arizona's 2016 pre-emption law pre-empting Tucson from enacting or enforcing policies to decrease local firearm availability coincided with higher firearm suicide rates in Pima County.

Just as the medical community and policymakers can advocate for state-level firearm reforms shown to prevent suicide,[8 11] policy actors and advocates must also be aware of other state-level policy issues that can intentionally or unintentionally affect suicide risk in their states. Further examination of existing pre-emption laws is needed to determine whether these policies are counterproductive to suicide prevention efforts, including additional analyses of the effects of Arizona's 2016 pre-emption law over time. The research community must also continue to evaluate relationships between pre-emption law and broader public health measures.

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Contributors EVG planned the concept and study design, performed the data analysis, and drafted and revised the manuscript. LCP contributed to the study design, data interpretation and manuscript revision. Both authors revised and approved the final manuscript. EVG is responsible for the overall content as guarantor.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, conduct, reporting or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval This study conducted secondary data analysis of public use data and did not rise to the level of 'human subjects research' per the University of Utah institutional review board policy on Secondary Data Analysis of Public Use Datasets (B2819).

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available in a public, open access repository. Data are available in public, open access government locations at https://wonder.cdc.gov/ and https://www.atf.gov/resource-center/data-statistics and https://www.bls.gov/lau/.

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