

TITLE

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How does legalization of physician assisted suicide affect rates of suicide?

Abstract

Objectives. Several US states have legalized or decriminalised physician assisted suicide (PAS) whilst others are currently considering permitting PAS. Although it has been suggested that legalization could plausibly lead to a reduction in other suicides and to a delay in those other suicides which do occur, to date no research has tested whether these effects can be identified in practice. The aim of this paper was to fill this gap by examining the association between the legalization of physician assisted suicide (PAS) and state-level suicide rates in the USA between 1990 and 2013.

Methods. We used regression analysis to test the change in rates of non-physician-assisted suicides (non-PAS) and total suicides (non-PAS plus PAS) before and after legalization of PAS.

Results. Controlling for various socio-economic factors, unobservable state- and year effects, and state-specific linear trends, legalizing PAS was associated with a 6.3% (95% confidence interval [CI] = 2.70%, 9.9%) increase in suicides. This effect was larger in the over 65s (14.5%, CI = 6.4%, 22.7%). Introduction of PAS was not associated with a reduction in non-PAS rates, nor with an increase in the mean age of non-PAS.

Conclusion. Legalizing PAS has been associated with an increased rate of suicide relative to other states and no decrease in non-PAS. This suggests either that PAS does not inhibit (nor acts as an alternative to) non-PAS, or that it acts in this way in some individuals but is associated with an increased inclination to suicide in other individuals.

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Key words: physician assisted suicide, suicide, Oregon, Washington

Introduction

Much attention has been paid to suicide reduction as a public health issue.^{1,2} A significant stream of literature has focused on how socio-economic factors and policy changes may impact suicide rates at a population level. It is well established that adverse economic conditions can lead to significant increases in suicide rates.^{3,4} Individual-level attitudes (for example towards religion) are also known to affect suicides.^{5,6,7,8} Other authors have found that stricter alcohol regulations can be associated with fewer suicides,⁹ whilst recent research suggests that the legalization of marijuana for medical purposes may have led to a reduction in male suicides.¹⁰ Reporting of celebrity suicide also seems to have population level effects on suicide rates.^{11,12} A policy area which has received surprisingly little attention is the effect of changes to the legal code addressing suicide itself.

In recent years, several American states have moved either to legalize or to decriminalize some forms of assistance with suicide. In 1998, Oregon became the first state to legalize assisted dying for terminally ill patients.¹³ Washington State passed a similar law in 2008,¹⁴ and Vermont in 2013.¹⁵ In addition, in 2010, a court decision in Montana declared that “physician aid in dying” was not contrary to legal precedent or public policy.¹⁶ In 2013, there were 73 deaths under the assisted dying law in Oregon¹³ and 133 in Washington State.¹⁴ In each case, the number of non-physician-assisted suicides (non-PAS) was about ten times higher.

The likely effect of legalizing physician assisted suicide (PAS) on suicide rates is not easy to predict a priori. In the first place, it is necessary to distinguish between those deaths that conform with a PAS law versus non-PAS deaths (that typically are unassisted, but would also include assisted suicides outside the parameters of the law). The rationale of PAS laws is to enable people who would otherwise have died from an underlying illness such as terminal cancer to end their lives at an earlier stage with the assistance of a physician. However, in the absence of PAS, there will already be some people who are terminally ill who die by suicide.¹⁷ A recent estimate in the United Kingdom was that at least 10% of suicides involve some form of chronic or terminal illness.¹⁸ The legalization of PAS could provide an alternative for some people in these categories who would otherwise have died by non-PAS. If so, then the direct effect of legalizing PAS would be for the total number of intentional self-inflicted deaths (PAS plus non-PAS) to increase but for deaths by non-PAS to decrease.

There may also be significant indirect consequences of legalizing PAS. Richard Posner has conjectured that legalizing PAS may have the effect of reducing the total number of suicides and postponing those that do occur.¹⁹ His reasoning was that, without access to PAS, some patients take their own lives earlier than they might due to concerns that, once their condition deteriorates to the point when they anticipate wishing to die, they may no longer be able to end their lives without assistance. The knowledge that PAS is available for people who have physical incapacity enables such patients to delay their decision to attempt suicide. Furthermore, some may be contemplating suicide because of a mistaken and overly pessimistic belief about the progress of their disease and/or about their ability to cope with their declining condition. If people are enabled to delay their attempt

at suicide they may then come to see that they were mistaken and thus revise their suicide decision. As a result, “if physician-assisted suicide in cases of physical incapacity is permitted, the number of suicides ... will be reduced ... Moreover, in the fraction of cases in which suicide does occur ... it will occur later than if physician-assisted suicide were prevented.”¹⁹ An implication of Posner’s conjecture about delays to suicide is that there would be an increase in the average age of suicide.

Posner’s conjectures have come to renewed prominence in the context of debates over the legalization of assisted dying both sides of the Atlantic. In the House of Lords in July 2014 it was argued that “many people... are dying earlier” because of the prohibition of PAS and the some “might have chosen to live” had PAS been legal.²⁰ In 2014 “evidence of premature death” due to the lack of access to PAS was also presented before the Supreme Court of Canada. In February 2015 the court concluded that “the prohibition deprives some individuals of life.”²¹

Systematic empirical analysis of Posner hypothesis is limited. Although Posner examined state data on suicides to illustrate his hypothesis, his data predated Oregon’s legalization of PAS. To date there have been no formal tests of the impact of state-level regulation of PAS on suicide rates. Furthermore, no research has examined the association between PAS and age of suicides. In the paper we aim to fill these gaps in knowledge and to consider the implications of this evidence.

Materials and Methods

Data on the number and age-adjusted rate of suicides (non-PAS) in each state from 1990 to 2013 were taken from the Center for Disease Control (CDC) Compressed Mortality Statistics²² and also from state-level Departments of Health. To calculate total intentional self-inflicted deaths, we added deaths occurring under the auspices of the PAS regulations of Washington¹⁴ and Oregon.¹³ There were no PAS deaths recorded in Vermont in 2013.²³ Montana does not record the numbers of physician-assisted deaths and so our series may underestimate total deaths by suicide in that state. The results below are robust to excluding Montana and Vermont. Suicide rates are calculated using age-adjusted populations reported by the CDC.

No data are available on whether those committing suicide were experiencing an illness which could make them eligible for PAS. However, it is reasonable to assume that the proportion of such suicides will be higher amongst older people. For this reason, we collected data on suicide rates for different age groups for the 28 states which provide such information to the CDC. We used these data to calculate the number and rates of total suicide and non-PAS in those under and over the age of 65. Finally, we used the mid-point of age groups to estimate the mean age of suicide each year in those states for which data is available.

Data on the legalization of PAS were collected from State Departments of Health. We also collected data on a number of other socio-economic and demographic variables which have been found to affect suicide rates. State unemployment rates were taken from the Bureau of Labor Statistics. Data on per capita disposable income (adjusted for inflation) for each state were taken from

the Bureau of Economic Analysis. The percentages of the population that are black and Hispanic were calculated from the CDC state bridged-race population estimates. Annual data on the percentage of adherents to recognized religions were taken from the US Religious Census. As these data are collected at irregular intervals (1990, 2000 and 2010), we used linear interpolation to estimate values for intervening years. We used existing sources to collect indicators for states in which medical marijuana was legal in that year, for whether marijuana possession was decriminalized and whether a 0.08 blood alcohol content law was in effect.^{24, 25}

We constructed graphs of rates of total deaths by suicide and deaths by non-PAS for Oregon and Washington and rates of suicide for Montana. In each case, we compared these with the rates in all other US states.

We then used grouped logistic regression to estimate the association between PAS and suicide rates. We estimated the association for total suicide and non-PAS and also (for the 25 states with available data) separately for suicides by those aged under- and over-65. The coefficient on PAS can be interpreted as the estimated percentage change in suicide rates associated with the legalization of PAS-states. Finally we used ordinary least square (OLS) regressions to estimate the association between the legalization of PAS and the estimated age of non-PAS. For the logistic regressions, we used Huber-White standard errors which control for heteroskedasticity. For the OLS regressions, we clustered standard errors by state. We highlighted estimates that are significantly different to zero at the 10%, 5% and 1% level.

In each regression, we included an indicator (dummy) variable for each state and for each year. These control for unobservable state and year fixed effects, respectively and mean that the coefficient on PAS legalization can be interpreted as the average percentage change in suicide rates before and after legalization of PAS relative to the change over the same time period in States that did not legalize PAS. We estimated further specifications of our models in which we included independent variables measuring factors which have previously been found to be associated with suicides: the proportion of the population that is black, the proportion that is Hispanic, the proportion of the population that adheres to a recognized religion, the unemployment rate, the annual per capita disposable income, whether marijuana was legal for medical reasons, whether marijuana was decriminalized for recreational purposes and whether a 0.08 blood alcohol content law was in place. We also estimated a specification which includes state-specific linear trends. These help control for state-specific effects which change gradually over time and which are not captured by other variables, though they decrease the residual variability in the dependent variable and in the covariates. As a result, they may reduce the power of the tests to pick up effects as significant.

Results

Compared to non-PAS states, states legalized PAS were characterized by higher rates of suicide, lower rates of religious adherence and a lower proportion of the population who were black or

Hispanic. On the basis of other characteristics (unemployment, per capital income and mean age of suicide), PAS states were very similar to the controls (see Table A1 in the Appendix).

Table 1 reports average numbers and rates per 100,000 residents of non-PAS, PAS (where available) and total suicides per year in each of the four legalizing states both before and after legalization. The Table also reports the equivalent figures for states which have not legalized PAS. Figure 1 compares presents trends of the total suicide rates in Oregon and Washington with those in all other US states, before and after legalization of PAS. Figure 2 provides the same comparison for non-PAS suicide rates, this time including Montana.

Table 2 reports results of grouped logistic regressions of the associations between PAS and total suicide rates. Controlling for state and year fixed effects, PAS is associated with an 8.9% increase in suicide rates, an effect which is strongly statistically significant (95% CI = 6.6%, 11.2%). Once we control for a range of demographic and socio-economic factors, PAS is estimated to increase rates by 11.79% (95% CI = 9.3%, 14.1%). When we include state-specific time trends, the estimated increase is 6.3% (95% CI = 2.7%, 9.9%).

Table 2 also reports the estimated association between PAS and non-physician-assisted suicides (non-PAS). Controlling for state and year fixed effects, PAS is estimated to be associated with a 1.6% increase in non-PAS rates but this is not statistically significant (95% CI = -0.8%, 3.9%). The estimated effect is larger and statistically significant once other covariates are included (4.4%, 95% CI = 1.9%, 6.8%). However, when we include state-specific linear trends, the estimated increase is 1.1% and not statistically significant (95% CI = -2.5%, 4.8%).

In Table 3, we report the estimated associations between PAS and suicide for under- and over-65s. We find a significant positive association with total suicides for both age groups but the effect for under-65s is generally smaller and not as statistically significant once we include state-specific trends. In no case do the estimates suggest a significantly negative association between PAS and non-PAS. Indeed, for the under-65 group, the association is found to be positive though only significantly so when we do not include state-specific trends.

The estimated association between the mean age of non-PAS and PAS is negative but generally insignificant (see Table 4). The exception is the case in which we include covariates but not state time trends. Here the estimated effect of PAS is a reduction is -0.9% and statistically significant (95% CI = -1.8%, 0.0%).

Taken together, our results provide strong evidence that legalization of PAS is associated with increases in the overall rate of suicide. We find no evidence that PAS is associated with reductions in the non-PAS rate or with increases in the mean age of death for non-PAS.

Discussion

The potential impact on suicide generally has recently become a feature of the debate over legalization of PAS. Until now, however, there has been a dearth of empirical evidence to evaluate

such claims. In this study we sought to address this gap by exploiting the ‘natural experiments’ which have occurred through various states legalizing or decriminalizing PAS at different times. By examining the change in suicide rates before and after legalization relative to the change in states which did not legalize PAS, we are able to control for unobservable state-specific effects which might otherwise lead one to observe spurious correlations. By examining changes occurring at different times, we can also control for time-specific unobservable factors.

The formal regression analysis found clear evidence that PAS has been associated with an increase in the overall rate of death by suicide (including both PAS and non-PAS). These estimates were robust to the inclusion of state-specific time trends. The results pertaining to non-PAS rates alone were equivocal. Some estimates suggested that PAS was also associated with a significant increase in the rate of non-PAS. However, when we included state-specific trends, the estimated association, though positive, was smaller and was not statistically significant.

The association between PAS and total deaths by suicide is stronger for the over-65 group. There is no evidence that PAS is associated with significant reductions in non-PAS for either older or younger people. Further, the estimates of the determinants of the mean age at suicide do not suggest that PAS leads, on average, to delays in non-PAS.

It should be noted that the rise in rates of death by suicide and the absence of a fall in rates of non-PAS are both net effects and do not necessarily mean that legalizing PAS has no suicide-inhibiting effects of the kind outlined by Posner and others.^{19, 20, 21} Rather, the results suggest that, if such inhibitory mechanisms exist, they are counteracted by equal or larger opposite effects. Drawing on resources from social learning theory, Stack and Kposowa show how “persons socialized in nations with relatively high rates of suicide are more likely to be exposed to suicidal role models, which provide positive definitions of suicide”.⁵ Such mechanisms increase the level of individual approval of suicide and hence reinforce the high rate of suicide within the culture. This is analogous to the effect of reporting^{11, 12, 26} that ‘normalizes’ suicide. It may be that legalizing PAS also provides positive role models that help normalize suicide more generally.²⁷

Conclusion

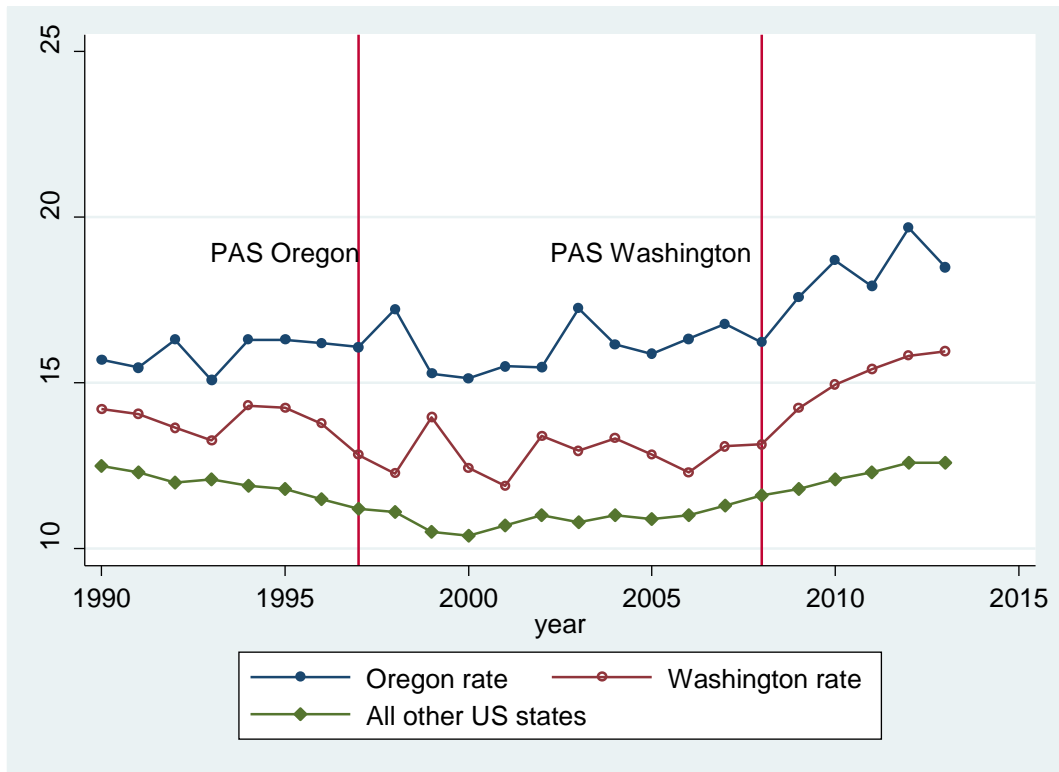
The evidence from suicide rates in states that have legalized PAS is not consistent with Posner’s conjecture that such legal changes would lead to delays in, and net reductions in, suicide. Rather, the introduction of PAS seemingly induces more self-inflicted deaths than it inhibits. Furthermore, while perhaps 10% of suicides involve chronic or terminal illness, the available evidence does not support the conjecture that legalising assisted suicide would lead to a reduction in non-physician-assisted suicides. This suggests either that PAS does not inhibit (nor acts as an alternative to) non-PAS, or that it acts in this way in some individuals but is associated with an increased inclination to suicide in other individuals.

The evidence remains equivocal on whether legalizing PAS is associated with a significant increase in non-PAS. Some estimates suggested that PAS was also associated with a significant increase in the rate of non-PAS but when state-specific trends were included this fell below the level of statistical significance.

There are a number of limitations to the analysis in this study which suggest our results should be treated with some caution. In the first place, only a minority of suicides take place amongst people who are terminally ill and might be eligible for PAS. This may limit our ability to identify any direct effect of PAS on non-PAS. That said, our finding that there was no significant decrease in non-PAS even amongst over-65s (a group amongst which we might expect a high proportion of suicides to be eligible for PAS), provides some reassurance as to the robustness of our results. Next, there are still relatively few states that have legalized PAS and it is hard to know how well the effects can be generalized. It should also be noted that all states that have legalized or decriminalized PAS are in the North of the United States, indeed three of the four share a border with Canada. There are as yet no analogous data for states in the South of the United States. Further, for some PAS states, we have very few post-legalization observations. It will be important to further monitor the longer term impact of PAS as more data points become available. Further evidence may also resolve the question of whether there is a significant association between legalizing PAS and increases in non-PAS.

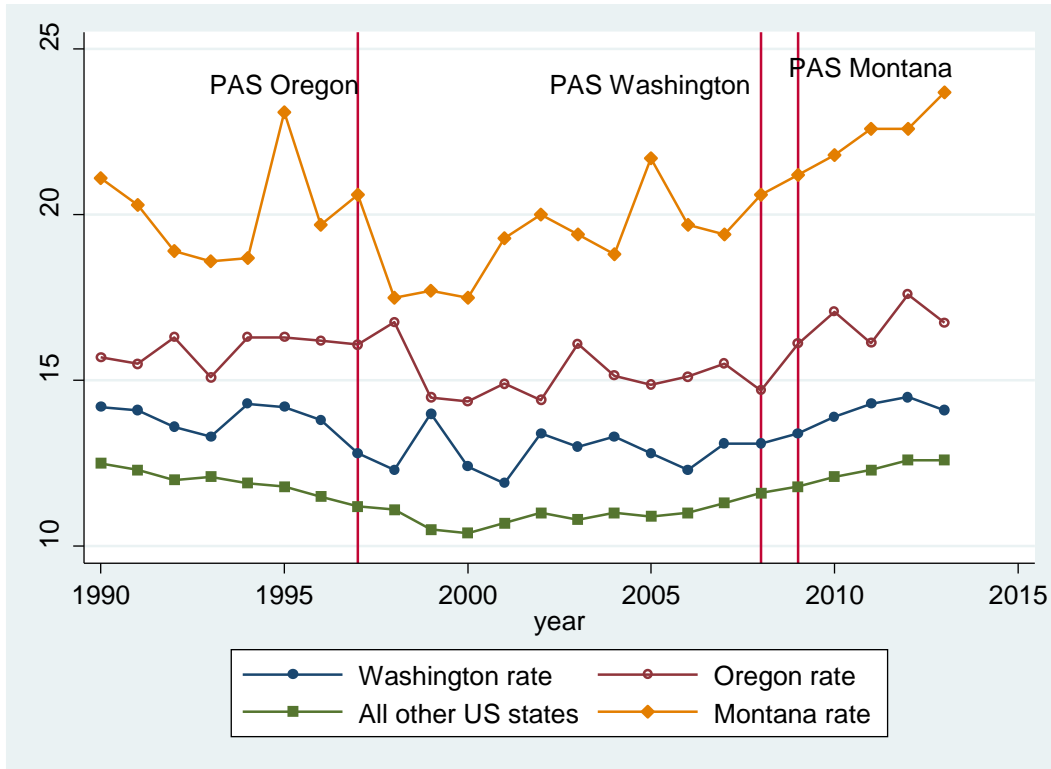
Finally, our use of state and time effects and state-specific trends allow us to control for many unobservable differences between states. However, it is possible that there remain other unobservable factors affecting observed suicide rates and which are correlated with the legalization of PAS and which might affect our conclusions. For this reason, we believe it is important that the quantitative approach in this paper is supplemented with qualitative research looking at the circumstances and motivation of those who die by suicide within jurisdictions that have legalized physician assisted suicide, and also research looking at how attitudes to suicide vary in jurisdictions with different legislative frameworks in place. Such research might help to identify mechanisms that lie behind the bare statistics considered in this study.

Figure 1: Total suicide rates per 100,000 residents in PAS and non-PAS states, 1990-2013



Notes: Vermont is excluded as PAS was legalized in 2013 and no PAS suicides were recorded in that year. Montana is excluded as PAS was decriminalized rather than legalized and, as such, no data are collected on PAS. The vertical lines indicate the timing of the legalization of PAS in the two states.

Figure 2: Non-PAS rates per 100,000 residents in PAS and non-PAS states, 1990-2013



Notes: Vermont is excluded as PAS was legalized in 2013 and no PAS suicides were recorded in that year. The vertical lines indicate the timing of the legalization/decriminalization of PAS in each state.

Table 1: Suicides per year and rates per 100,000 in PAS and non-PAS States, 1990-2013

		Non-PA Suicides		PA Suicides		Non-PAS + PAS		Non-PAS States	
		N	Rate	N	Rate	N	Rate	N	Rate
Oregon	Pre-PAS	495.5	15.9	0	0	495.5	15.9	29,435	11.8
	Post-PAS	590.6	15.6	47.1	1.2	637.8	16.9	32,545	11.3
Washington	Pre-PAS	767.7	13.3	0	0	767.7	13.3	29,984	11.3
	Post-PAS	992.8	14.0	88.0	1.2	1,080	15.3	37,301	12.2
Montana	Pre-PAS	177.9	19.7	0	0	177.9	19.7	30,237	11.3
	Post-PAS	233.8	22.7	-	-	233.8	22.7	37,866	12.3
Vermont	Pre-PAS	83.9	13.5	0	0	83.87	13.5	31,180	11.4
	Post-PAS	112.0	16.8	0	0	112.0	16.8	39,069	12.5

Notes: N is the mean number of suicides per year. Rate is calculated per 100,000 age-adjusted population. In Montana, PAS was decriminalised in 2010 but no data are collected on the number of assisted deaths. The post-PAS periods are as follows: Oregon 1998-2013; Washington 2009-2013; Montana 2010-2013; Vermont 2013.

Table 2: Estimates of the relationship between total suicide/non-PAS rates and PAS, 1990-2013

	Total	Non-PAS
State & year effects	0.089*** (0.066, 0.112)	0.016 (-0.008, 0.039)
State & year effects + covariates	0.117*** (0.093, 0.141)	0.044*** (0.019, 0.068)
State & year effects + covariates & state time trends	0.063*** (0.027, 0.099)	0.011 (-0.025, 0.048)

Notes: results are from logistic regressions grouped by annual, state-level populations, N = 1224. 95% confidence intervals are reported in brackets using Huber-White standard errors. Regression coefficients are reported which can be multiplied by 100 to yield percentage effects. Logistic regression is used due to the dichotomous nature of the dependent variable (=1 if a resident committed suicide; = 0 if not). Grouped regression reflects the fact that the data are grouped together at the state-year level. Results using ordinary least squares (OLS) regression with suicide rates as the dependent variable give very similar results and are presented in the Appendix. Covariates are measured at state level and include the unemployment rate, annual per capital real income, percentage of the population that are Hispanic, percentage of the population that are black, percentage of the population that report being adherents to a recognized religion, whether possession of marijuana was decriminalized, whether marijuana was legalized for medical purposes and whether a 0.08 blood alcohol law was in place.

*** P < .01, ** P < 0.05, * P < 0.1

Table 3: Estimates of the relationship between total suicide/non-PAS rates and PAS, 1990-2013: aged under-65 and 65+

	Deaths by suicide under-65		Deaths by suicide aged 65+	
	Total	Non-PAS	Total	Non-PAS
State & year effects	0.049*** (0.023, 0.070)	0.025* (-0.002, 0.052)	0.197*** (0.144, 0.248)	-0.005 (-0.058, 0.049)
State & year effects + covariates	0.079*** (0.052, 0.107)	0.054*** (0.026, 0.082)	0.217*** (0.163, 0.271)	0.014 (-0.042, 0.071)
State & year effects + covariates & state time trends	0.044** (0.003, 0.086)	0.016 (-0.027, 0.058)	0.145*** (0.064, 0.227)	-0.045 (-0.132, 0.041)

Notes: results are from logit regressions grouped by annual, state-level populations, N = 975 for under-65 and 675 for 65+. 95% confidence intervals are reported in brackets. Regression coefficients are reported which can be multiplied by 100 to yield percentage effects using Huber-White standard errors. Logistic regression is used due to the dichotomous nature of the dependent variable (=1 if a resident committed suicide; = 0 if not). Covariates are measured at state level and include the unemployment rate, annual per capital real income, percentage of the population that are Hispanic, percentage of the population that are black, percentage of the population that report being adherents to a recognized religion, whether possession of marijuana was decriminalized, whether marijuana was legalized for medical purposes and whether a 0.08 blood alcohol law was in place. The difference between the coefficients for under-65 and 65+ are statistically significant at conventional levels for total suicides but not for non-PAS.

*** P < .01, ** P < 0.05, * P < 0.1

Table 4: Estimates of the relationship between natural log of mean age of Non-PAS and PAS, 1990-2013

	Non-PAS
State & year effects	-0.004 (-0.012, 0.005)
State & year effects + covariates	-0.009** (-0.018, -0.000)
State & year effects + covariates & state time trends	-0.010 (-0.023, 0.004)

Notes: results are from OLS regressions weighted by state-level populations, N = 674. 95% confidence intervals are reported in brackets using standard errors clustered at the state level. Regression coefficients are reported which can be multiplied by 100 to yield percentage effects. Covariates are measured at state level and include the unemployment rate, annual per capital real income, percentage of the population that are Hispanic, percentage of the population that are black, percentage of the population that report being adherents to a recognized religion, whether possession of marijuana was decriminalized, whether marijuana was legalized for medical purposes and whether a 0.08 blood alcohol law was in place.

*** P < 0.01, ** P < 0.05, * P < 0.1

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