

How Does Legalization of Physician-Assisted Suicide Affect Rates of Suicide?

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

Methods: We used regression analysis to test the change in rates of nonassisted suicides and total suicides (including assisted suicides) before and after the legalization of PAS.

Results: Controlling for various socioeconomic factors, unobservable state and year effects, and state-specific linear trends, we found that legalizing PAS was associated with a 6.3% (95% confidence interval 2.70%–9.9%) increase in total suicides (including assisted suicides). This effect was larger in the individuals older than 65 years (14.5%, CI 6.4%–22.7%). Introduction of PAS was neither associated with a reduction in nonassisted suicide rates nor with an increase in the mean age of nonassisted suicide.

Conclusions: Legalizing PAS has been associated with an increased rate of total suicides relative to other states and no decrease in non-assisted suicides. This suggests either that PAS does not inhibit (nor acts as an alternative to) nonassisted suicide, or that it acts in this way

in some individuals but is associated with an increased inclination to suicide in other individuals.

Key Words: physician-assisted suicide, suicide, Oregon, Washington

A significant stream of literature has focused on how socioeconomic factors and policy changes may affect suicide rates at the population level. It is well established that adverse economic conditions can lead to significant increases in suicide rates.^{1,2} Individual-level attitudes (eg, toward religion) also are known to affect suicides.^{3–6} Other authors have found that stricter alcohol regulations can be associated with fewer suicides,⁷ whereas research suggests that the legalization of marijuana for medical purposes may have led to a reduction in suicide among boys and men.⁸ Reporting of celebrity suicide also seems to have population-level effects on suicide rates.^{9,10} A policy area that has received surprisingly little attention is the effect of changes to the legal code addressing suicide itself.

Several US states have moved either to legalize or to decriminalize some forms of assistance with suicide. In 1998, Oregon became the first state to legalize physician-assisted suicide (PAS) for patients with terminal illness.¹¹ Washington state passed a similar law in 2008¹² and Vermont followed in 2013.¹³ In addition, in 2010 a Montana court decision declared that

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Key Points

- It has been claimed that the legalization of physician-assisted suicide (PAS) is likely to lead to a reduction in other suicides and in the total number of suicides (including PAS).
- Although several US states have legalized or decriminalized PAS, no research to date has established whether these effects can be identified in practice.
- Controlling for various socioeconomic factors, for unobservable state and year effects, and for state-specific linear trends, we found that legalizing PAS was associated with a significant increase in total suicides (including PAS) and no reduction in rates of nonassisted suicide.
- Some estimates suggested that legalizing PAS was associated with a significant increase in nonassisted suicides, but when we included state-specific trends, the estimated association, although positive, was no longer statistically significant.

“physician aid in dying” was not contrary to legal precedent or public policy.¹⁴ In 2013, there were 73 deaths under the assisted dying law in Oregon¹¹ and 133 in Washington state.¹²

The likely effect of legalizing PAS on suicide rates is not easy to predict a priori. It is necessary to distinguish between those deaths that conform with PAS law versus suicides outside this legal framework (which we term “nonassisted suicides,” although in practice these would include some 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. In the absence of PAS, however, there will be people who are seriously ill who die by suicide.^{15,16} A study from Switzerland found that in the 20% of nonassisted suicides that involved physical illness, “the range of physical illnesses reported with suicide is similar to that reported with assisted suicide.”¹⁷

Similarly, in Oregon, approximately 25% of individuals carrying out nonassisted suicides were found to have had physical health problems, whereas in the cohort of men older than 65, 66% had a physical illness (26% with cancer, 25% with chronic pain, and 16% with heart disease).¹⁸ The legalization of PAS could provide an alternative to nonassisted suicide for some people with chronic or terminal illnesses. If so, the direct effect of legalizing PAS would be for the total number of intentional self-inflicted deaths (including assisted suicides) to increase but for deaths by nonassisted suicide to decrease.

There also may 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 The knowledge that PAS is available for people who are physically incapacitated could enable such patients to delay their decision to attempt suicide. Furthermore, some may be contemplating suicide because of an overly pessimistic belief about the progress of their disease and/or about their ability to cope with their declining condition. If people delayed their attempt at suicide they might then come to see that they had been mistaken. 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 about the legalization of assisted dying on both sides of the Atlantic Ocean. In 2014 “evidence of premature death” resulting from the lack of access to PAS was presented before the Supreme Court of Canada. In February 2015 the court concluded that “the prohibition deprives some individuals of life.”²⁰ In the UK 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.²¹ On the same basis, the Swiss organization EXIT claims that the “option of physician-assisted suicide is actually an effective form of suicide prevention.”²²

Systematic empirical analysis of the 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 on the impact of the state-level regulation of PAS on suicide rates. Furthermore, no research has examined the association between PAS and the age of suicides. In this article we aim to help fill these gaps in knowledge by exploiting the “natural experiments” that have occurred in various states legalizing or decriminalizing PAS at different times.

Methods

Data on the number and age-adjusted rate of (nonassisted) suicides in each state from 1990 to 2013 were taken from the Centers for Disease Control (CDC) Compressed Mortality Statistics²³ and from state-level departments of health. To calculate total suicides (ie, all intentional self-inflicted deaths), we added deaths occurring under the auspices of the PAS regulations of Washington¹² and Oregon.¹¹ There were no PAS deaths recorded in Vermont in 2013.²⁴ Montana does not record the numbers of physician-assisted deaths. The results below are robust to excluding Montana and Vermont. Suicide rates are calculated using age-adjusted populations reported by the CDC.

Among men older than age 65 who die by suicide, a significant proportion had experienced serious illnesses of a kind that could make them eligible for PAS.¹⁸ For this reason, we collected data on nonassisted suicide rates for different age groups for the 28 states that provide such information. We used these data to calculate the rates of total suicide and nonassisted suicide in individuals younger than and older than age 65. Finally, we used the midpoint of the age groups to estimate the mean age of suicide each year in those states for which data are available.

We also collected data on other socioeconomic and demographic variables that have been found to affect suicide rates. State unemployment rates were taken from the Bureau of Labor Statistics, and 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, and annual data on the percentage of adherents to recognized religions were taken from the US Religious Census. Because 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, whether marijuana possession was decriminalized, and whether a 0.08 blood alcohol content law was in effect.^{25,26}

We constructed graphs of rates of total deaths by suicide and deaths by nonassisted suicide for Oregon and Washington and rates of suicide for Montana. In each case, we compared

these with the rates in all of the 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 for nonassisted suicide and (for the 25 states with available data) separately for suicides by those younger than and older than age 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 squares regressions to estimate the association between the legalization of PAS and the estimated age of nonassisted suicide. For the logistic regressions, we used Huber-White standard errors, which control for heteroskedasticity, and for the ordinary least squares regressions, we clustered standard errors by state. We highlighted estimates that are significantly different from zero at 10%, 5%, and 1% levels.

In each regression, we included an indicator (dummy) variable for each state and 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 the legalization of PAS relative to the change during 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 that previously have 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 that includes state-specific linear trends. These help control for state-specific effects that change gradually

over time and that are not captured by other variables, although 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 recognize effects as significant.

Results

States that legalized PAS were characterized by higher rates of nonassisted suicide, lower rates of religious adherence, and a lower proportion of the population that was black or Hispanic. In relation to unemployment, per capita income and mean age of suicide, PAS states were similar to non-PAS states (Appendix Table A1, <http://links.lww.com/SMJ/A36>).

Table 1 reports average numbers and rates per 100,000 residents of nonassisted suicide, PAS (where available), and total suicides per year in each of the four states where assisted suicide is legal both before and after legalization. Table 1 also reports the equivalent figures for non-PAS states. Figure 1 compares present trends of the total suicide rates in Oregon and Washington with those in all of the other US states, before and after the legalization of PAS. Figure 2 provides the same comparison for nonassisted 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 total suicide rates (including assisted suicides), an effect that is strongly statistically significant (95% confidence interval [CI] 6.6%–11.2%). Once we control for a range of demographic and socioeconomic 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 1. Suicides per year and rates per 100,000 in PAS and non-PAS states, 1990–2013

	Nonassisted suicides		Assisted suicides		Total suicides		Suicides in 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	1080	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

N is the mean number of suicides per year. Rate is calculated per 100,000 age-adjusted population. In Montana, PAS was decriminalized 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. PAS, physician-assisted suicide

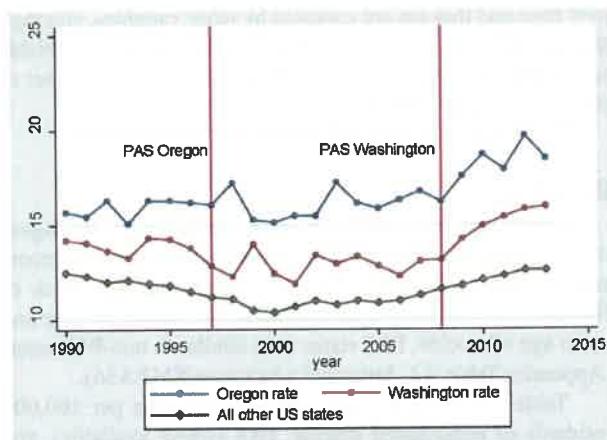


Fig. 1. Total suicide rates per 100,000 residents, PAS and non-PAS states, 1990–2013. Vermont is excluded because PAS was legalized in 2013 and no PASs were recorded in that year. Montana is excluded because PAS was decriminalized rather than legalized and as such, no data are collected on PAS. The vertical lines indicate the timing of the legalization of PAS in the two states. PAS, physician-assisted suicide.

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

In Table 3, we report the estimated associations between PAS and suicide for those younger than and older than age 65 years. We find a significant positive association with total

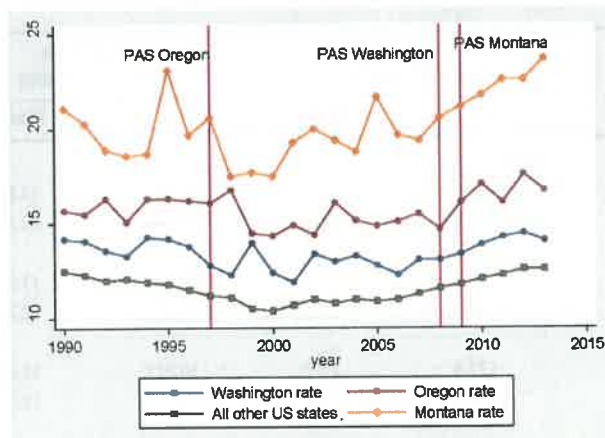


Fig. 2. Nonassisted suicide rates per 100,000 residents, PAS and non-PAS states, 1990–2013. Vermont is excluded because PAS was legalized in 2013 and no PASs were recorded in that year. The vertical lines indicate the timing of the legalization/decriminalization of PAS in each state. PAS, physician-assisted suicide.

Table 2. Estimates of the relation between total suicide/ nonassisted suicide rates and PAS, 1990–2013

	Total	Nonassisted suicides
State and year effects	0.089*** (CI 0.066–0.112)	0.016 (CI –0.008 to 0.039)
State and year effects + covariates	0.117*** (CI 0.093–0.141)	0.044*** (CI 0.019–0.068)
State and year effects + covariates and state time trends	0.063*** (CI 0.027–0.099)	0.011 (CI –0.025 to 0.048)

Results are from logistic regressions grouped by annual, state-level populations, $N = 1224$; 95% CIs are reported in parentheses using Huber-White standard errors. Regression coefficients are reported that can be multiplied by 100 to yield percentage effects. Logistic regression is used because of 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 regression with suicide rates as the dependent variable give similar results and are presented in the Appendix (<http://links.lww.com/SMJ/A36>). Covariates are measured at the state level and include the unemployment rate, annual per capita real income, percentage of the population that is Hispanic, percentage of the population that is black, percentage of the population that reports adhering 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. CI, confidence interval; PAS, physician-assisted suicide. *** $P < 0.01$.

suicides for both age groups, but the effect for the younger-than-65-years group is generally smaller. In no case do the estimates suggest a significantly negative association between the legalization of PAS and nonassisted suicide. Indeed, for the younger-than-65 group, the association is found to be positive and significantly so when we do not include state-specific trends.

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

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

Discussion

By examining the change in suicide rates before and after legalization relative to the change in states that did not legalize PAS, we are able to control for unobservable state-specific effects that may otherwise lead one to observe spurious correlations. By examining changes occurring at different times, we also can control for time-specific unobservable factors.

The formal regression analysis uncovered clear evidence that PAS has been associated with an increase in the overall rate

Table 3. Estimates of the relation between total suicide/nonassisted suicide rates and PAS, 1990–2013: younger than 65 years old and 65 years old and older

	Deaths by suicide, <65 y old		Deaths by suicide ≥65 y old	
	Total	Nonassisted	Total	Nonassisted
State and year effects	0.049*** (0.023–0.070)	0.025* (–0.002 to 0.052)	0.197*** (0.144–0.248)	0.005 (–0.058 to 0.049)
State and 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 to 0.071)
State and year effects + covariates and state time trends	0.044** (0.003–0.086)	0.016 (–0.027 to 0.058)	0.145*** (0.064–0.227)	–0.045 (–0.132 to 0.041)

Results are from logit regressions grouped by annual, state-level populations, $N = 975$ for younger than 65 years old and 675 for 65 years old and older; 95% CIs are reported in parentheses. Regression coefficients are reported that can be multiplied by 100 to yield percentage effects using Huber-White standard errors. Logistic regression is used because of the dichotomous nature of the dependent variable (1 if a resident committed suicide, 0 if not). Covariates are measured at the state level and include the unemployment rate, annual per capita real income, percentage of the population that is Hispanic, percentage of the population that is black, percentage of the population that reports adhering 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 younger than 65 years old and 65 years old and older is statistically significant at conventional levels for total suicides, but not for nonassisted suicides. CI, confidence interval; PAS, physician-assisted suicide. * $P < 0.1$; ** $P < 0.05$; *** $P < 0.01$.

of death by suicide (including assisted suicides). These estimates were robust to the inclusion of state-specific time trends. The results pertaining to nonassisted suicide rates were equivocal. Some estimates suggested that PAS also was associated with a significant increase in the rate of nonassisted suicide. When we included state-specific trends, however, the estimated association, although positive, was smaller and no longer statistically significant.

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

It should be noted that the rise in overall rates of death by suicide and the absence of a fall in rates of nonassisted suicide 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.^{19–21} Rather, the results suggest that if such inhibitory mechanisms exist, they are counteracted by equal or larger opposite effects. Drawing on resources from the social learning theory, Stack and Kposowa demonstrate that “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.”³ Such mechanisms increase the level of individual approval of suicide and therefore reinforce the high rate of suicide within the culture. This is analogous to the effect of media reporting that “normalizes” suicide.^{9,10,27} It may be that legalizing PAS also provides positive role models who help normalize suicide more generally.²⁸

Conclusions

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 and net reductions in suicide. Rather, the introduction of PAS seemingly induces more self-inflicted deaths than it inhibits. Furthermore, although a significant proportion of nonassisted suicides involve chronic or terminal illness, especially in those older than age 65, the available evidence does not support the conjecture that legalizing assisted suicide would lead to a reduction in nonassisted suicides. This suggests either that PAS does not inhibit (nor acts as an alternative to) nonassisted suicide or that it acts in this way in some individuals but is associated with an increased inclination to suicide in others.

There are several limitations to the analysis in this study that suggest our results should be treated with some caution.

Table 4. Estimates of the relation between natural log of mean age of nonassisted suicide and PAS, 1990–2013

	Nonassisted suicide
State and year effects	–0.004 (CI –0.012 to 0.005)
State and year effects + covariates	–0.009** (CI –0.018 to –0.000)
State and year effects + covariates and state time trends	–0.010 (–0.023 to 0.004)

Results are from ordinary least squares regressions weighted by state-level populations, $N = 674$; 95% CIs are reported in parentheses using Huber-White standard errors clustered at the state level. Regression coefficients are reported that can be multiplied by 100 to yield percentage effects. Covariates are measured at the state level and include the unemployment rate, annual per capita real income, percentage of the population that is Hispanic, percentage of the population that is black, percentage of the population that report adhering 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. CI, confidence interval; PAS, physician-assisted suicide. ** $P < 0.05$.

First, whether nonassisted or assisted, suicide raises ethical and existential issues for the individuals concerned and political questions of public policy that are not addressed in this article. The aim of this study was to help inform those decisions but is not intended to imply that the complex issue of assistance in suicide can be resolved purely by statistical analysis. Neither has this article considered whether the prevention strategies that are effective with nonassisted suicide also may inhibit assisted suicide, although this may sometimes be the case. For example, research has shown that “the protective effect of a religious affiliation is evident for both assisted and nonassisted suicides.”^{5,29}

Although many suicides occur among people who would not have been eligible for PAS (thereby possibly limiting our ability to identify any direct effect of PAS on nonassisted suicide), our findings of a significant increase in total suicides (and more so in the older-than-65 group) and that there was no significant decrease in nonassisted suicides, even among those older than age 65, provide some reassurance of 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 also should be noted that all states that have legalized or decriminalized PAS are in the northern United States; indeed, three of the four states share a border with Canada. To date, there are no analogous data for southern US states. Furthermore, for some PAS states, we have 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 also may resolve the question of whether there is a significant association between legalizing PAS and increases in nonassisted suicide. The evidence examined here was equivocal on that point.

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

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