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## Opioid Overdose Deaths in Vermont: Effectiveness of Buprenorphine Provider Density on Mortality Rates

## **Objectives**

To determine whether the number of buprenorphine providers is associated with the number opioid related deaths per county; and whether a rural setting in Vermont affects mortality rates due to a possible lack of Buprenorphine providers.

## **Methods**

We compared the incidence of overdose deaths per county to the number of buprenorphine providers per county, as listed on the Vermont Department of Health website. Tukey HSD and Bonferroni statistical tests were run to measure a linear association between deaths per county and city town code (CTC). Grand Isle County was excluded from the analysis due to no deaths.

## **Results**

Counties with medium provider densities had higher numbers of overdose deaths compared to counties with higher and lower provider densities. Some limitations in the study included the lack of diversity and the inability to synchronize the Vermont mortality data registry from 2017-2019 to the date buprenorphine providers received their x-waiver.

## **Conclusion**

Further evaluation needed of the buprenorphine program in Vermont and the impact of other factors that may have an effect on opioid related death rates.

## INTRODUCTION

Over the last two decades, rates of opioid abuse and opioid-related overdose deaths have significantly increased across the United States.<sup>1</sup> More than 49,000 people died from opioid misuse in 2017 alone.<sup>2</sup> Opioid use disorders (OUD) have tragically impacted individuals, families, and communities across the United States through increased crime and violence, and expanded health care costs.<sup>3</sup>

Previous research has shown that medication assisted treatment (MAT), which is the combination of opioid substitution medication and counseling, is more effective at reducing morbidity and mortality associated with OUD than using time-limited medication, abstinence, or psychosocial interventions.<sup>1,4</sup> Through the expansion of the Buprenorphine Waiver Program, providers who complete training to obtain an x-waiver are allowed to prescribe buprenorphine to patients in other clinical settings rather than limiting this service to opioid treatment programs.<sup>5</sup> Despite these interventions, only a small percentage of patients who need treatment for OUD actually receive it.<sup>5</sup>

Access to buprenorphine services through waived providers is not distributed evenly across the United States as many of them practice primarily in urban areas.<sup>5,6</sup> Additionally, buprenorphine providers are only allowed to prescribe to a set number of patients for the first year of having their x-waiver, with incremental increases for each subsequent year. Rural counties have a lower supply of buprenorphine-prescribing physicians per 100,000 residents.<sup>6</sup> Vermont is a small and rural state with varying levels of buprenorphine providers by county.<sup>7,8</sup>

This research study addressed the following questions: Is the number of buprenorphine providers associated with the number of opioid related deaths per county?; and does a rural setting in Vermont affect mortality rates due to a possible lack of buprenorphine providers? The objective of this research was to examine if overdose mortality is impacted by rurality and number of buprenorphine providers.

## METHODS

This study was a cross-sectional analysis of overdose deaths per county in Vermont from 2017-2019. The dataset was obtained from the Vermont Electronic Death Registration System and consisted of individuals whose primary cause of death was listed as illicit drug poisoning, illicit opioid poisoning, prescription opioid poisoning, other pharmaceutical poisoning, and all opioid poisoning. These causes correspond with ICD-10 codes, X40, X41, X42, X43, X44, X60, X60, X61, X62, X63, X64, X85, Y10, Y11, Y12, Y13, or Y14.

A map of Vermont buprenorphine providers and treatment centers per county was accessed from the Vermont Department of Health (VDH). Treatment directory and resource guides listed on the VDH website were posted as of October 30, 2017; only deaths occurring in 2017, 2018, and 2019 were included in our analysis to align time frames. Proximity to treatment was based on town where the death occurred. Three treatment options in New Hampshire accessible to Vermont residents were excluded from the study.

Vermont Death Registry from 2015 to 2019 contained death information for 26,738 individuals. After excluding deaths that did not occur in our time frame or have a primary cause

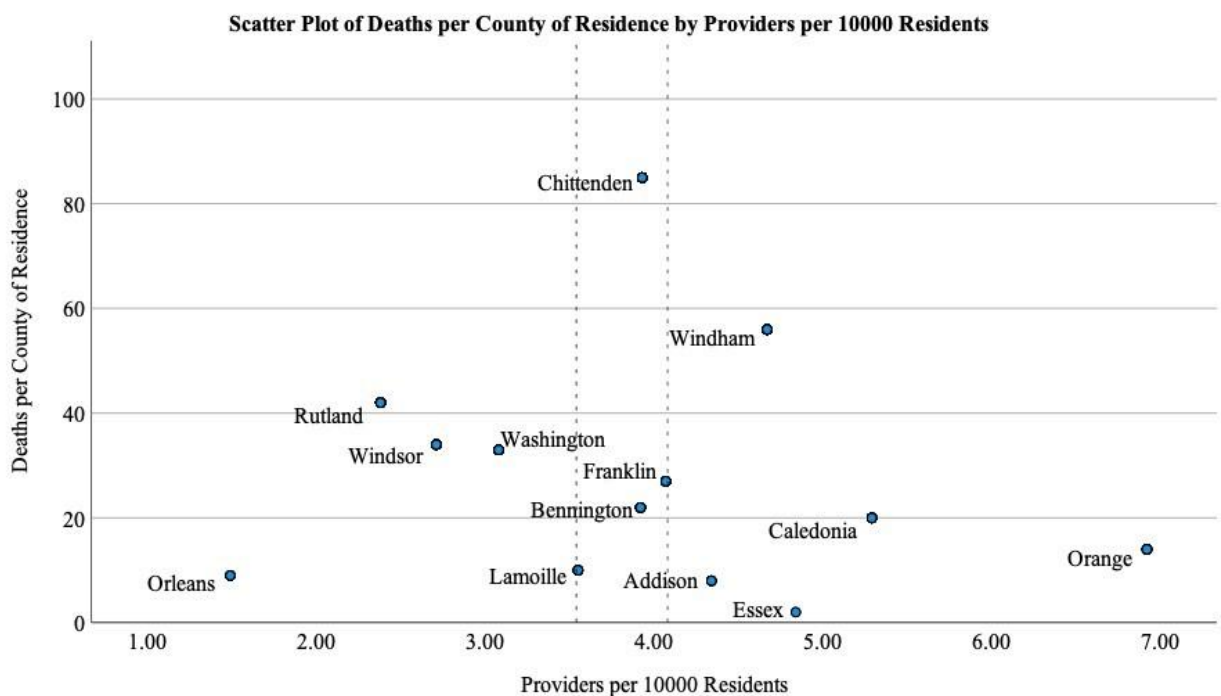
of death as previously stated, 365 valid cases were left. After further examination of the remaining dataset three additional\_cases were excluded due to a lack of City Town Code (CTC), leaving 362 valid cases.

Data were stratified among 2017-2019 deaths to include the underlying cause of death, as described above, per county. The incidence of overdose deaths per county was then compared to the number of buprenorphine providers per county, as listed on the VDH website. Statistical testing used ANOVA (IBM SPSS) with Tukey and Bonferroni post hoc comparisons (alpha level was 0.05). The University of Vermont Institutional Review Board has reviewed this project and determined that it qualifies as exempt from additional review.

## RESULTS

Visual analysis of the data shown in Figure 1 indicates no linear association between the number of overdose deaths and the number of available buprenorphine providers in a given Vermont county. As shown in Figure 1, there is a wide distribution between the number of deaths per county of residence and the number of buprenorphine providers per county per 10,000 residents. The vertical lines along the X-axis refer to the percentile breakdown of cases into low, medium and high provider density, and these different provider density groups were used in further analysis.

**Figure 1:**



When stratifying data by provider density into high, medium, and low-density per capita groups, similar results were shown. A univariate analysis was run on each group to determine impact of provider density on overdose deaths, and a one-way ANOVA test was then run to determine the mean difference in deaths between low, medium, and high provider density

counties. The average number of deaths was higher in medium provider density counties than in high and low provider density counties, with medium provider density counties averaging 62.97 deaths per 10000 residents, high density counties averaging 38.00 deaths per 10000 residents and low provider density counties averaging 32.73 deaths per 10000 residents. Tukey and Bonferroni tests of association between groups yielded similar results as shown in table 1, with statistically significant differences in mean deaths between medium-density counties and high-density counties (p-value <.001) and between medium-density counties and low-density counties (p-value <.001). These post-hoc tests were both run to control for type 1 error rates between groups, with both tests resulting in similar mean differences between groups. Sex, veteran status, marital status were determined to be potential confounders and univariate analyses of variance tests of between-subjects effects were run to determine significance. However, none of the variable were determined have a statistically significant impact on the average number of deaths per provider density grouping (p-values 0.519, 0.261, 0.957 respectively). As shown in table 1, there was not a statistically significant difference in mean deaths between the low and high provider density groups (p-value 0.166 Tukey, 0.211 Bonferroni).

**Table 1:**

*Multiple Comparisons*

Dependent Variable: Deaths per County of Residence

	Low, Medium, High Providers per Capita (per 10000 residents)	Low, Medium, High Providers per Capita (per 10000 residents) Comparison	Mean Difference in Deaths	Std. Error	Sig.
Tukey HSD	Low	Medium	-30.24*	2.685	.000
		High	-5.27	2.900	.166
	Medium	Low	30.24*	2.685	.000
		High	24.97*	2.871	.000
	High	Low	5.27	2.900	.166
		Medium	-24.97*	2.871	.000
Bonferroni	Low	Medium	-30.24*	2.685	.000
		High	-5.27	2.900	.211
	Medium	Low	30.24*	2.685	.000
		High	24.97*	2.871	.000
	High	Low	5.27	2.900	.211
		Medium	-24.97*	2.871	.000

Based on observed means.

The error term is Mean Square(Error) = 472.130.

\*. The mean difference is significant at the .05 level.

**DISCUSSION**

Our study found counties with medium provider densities (3.56-4.07 providers per 10,000 residents) had a higher number of overdose deaths. Counties with high (over 4.08

providers per 10,000 residents) and low provider densities (1-3.55 providers per 10,000 residents) had comparatively lower rates of overdose deaths.

Vermont has one of the highest capacities to treat OUD in the nation with 10.56 people in treatment per 1,000.<sup>7</sup> Nationally, the majority of providers with a buprenorphine waiver practice in urban counties, which leaves rural counties without access to outpatient treatment for OUD.<sup>6</sup> Interestingly, we found that the counties in Vermont with the highest provider densities (Caledonia, Essex, and Orange) were among the least populous counties and the most populous county, Chittenden, had medium provider density.

Studies have shown obtaining a buprenorphine waiver alone does not mean a provider will prescribe to patients, with only 75% of waived providers treating patients since obtaining their waiver.<sup>6</sup> Waivered providers have also been shown to treat fewer patients than their approved patient-limit capacity.<sup>5</sup> Vermont has adopted a hub and spoke system and increased the number of buprenorphine providers, but it does not directly ensure patients will receive treatment. Further investigation of buprenorphine provider utilization, number of patients in treatment per provider, and disparities in access to providers needs to be evaluated.

This study is limited by several factors. Due to Vermont's aging population, there may be lower rates and distribution of drug-related fatalities.<sup>8</sup> Vermont is also one of the whitest states in the US and subsequently this study was unable to stratify results by race or ethnicity. Chittenden County is also the largest county in Vermont with more than twice the population density compared to the second most populous county, and this variation could have skewed data.

Additionally, mortality data was used to compare overdose death and buprenorphine provider density. Individuals may have sought treatment anywhere in Vermont and the VDH provider map lists three treatment options which are in New Hampshire. Finally, this study was unable to synchronize the Vermont mortality data registry from 2017, 2018, and 2019 with the date providers received their waiver, thus their scope of practice is unknown at the time of associated mortalities.

Vermont has made tremendous strides in increasing the capacity to treat patients with OUD – Further evaluation of treatment for OUD from Vermont buprenorphine providers is needed to assess if all patients who want treatment have access.



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