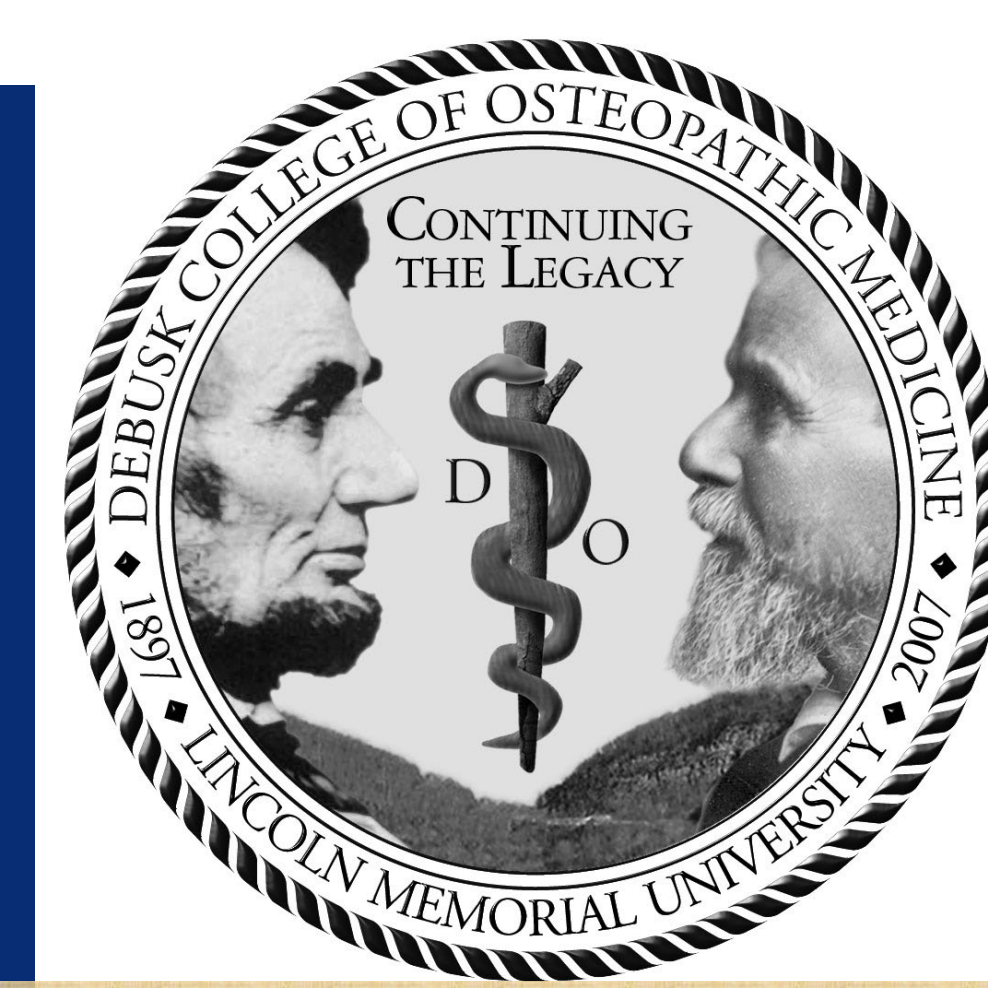# Impact of Poverty, Rurality, and Education on Drug-related Death Rates in Kentucky and Tennessee: An Ecologic exploration

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Abstract

The rate of unintentional drug-related death in Appalachia is significantly higher than the rate in the rest of the United States, even when comparing within-state rates between areas within Appalachia to those outside of Appalachia. Similarly, the difference in rate of overdose death is significantly higher in non-metro compared to metro regions of Appalachia. This study aims to examine the impact of percentage population lacking high school education and percentage population in poverty on crude unintentional drug-related deaths in rural versus metro Appalachian regions of Kentucky and Tennessee.

Introduction

According to the Bureau of Labor Statistics, unemployment rates are on the rise, with 6.011 million people unemployed in the U.S as of November 2022. Of those unemployed 117,000 reside in Tennessee and 82,000 are in Kentucky. According to KY.gov, the death rate due to drug overdose is similarly on the rise in Kentucky. The commonly involved drugs are methamphetamine and fentanyl. Many factors are thought to influence the higher rate of unintentional drug deaths in rural versus urban areas, including educational level and poverty[1].

This ecologic-design study aims to compare differences in rural Appalachian populations of Tennessee and Kentucky with urban, examining the relationship between drug related overdose death rates and percentage of the population living at or below the poverty level and the relationship between drug-related death rate and percentage of population without at least a high school diploma. Figure 1 depicts the relationship between percentages of households in poverty overlaid on drug-related death rates in Appalachia for the period 2015 – 2019.
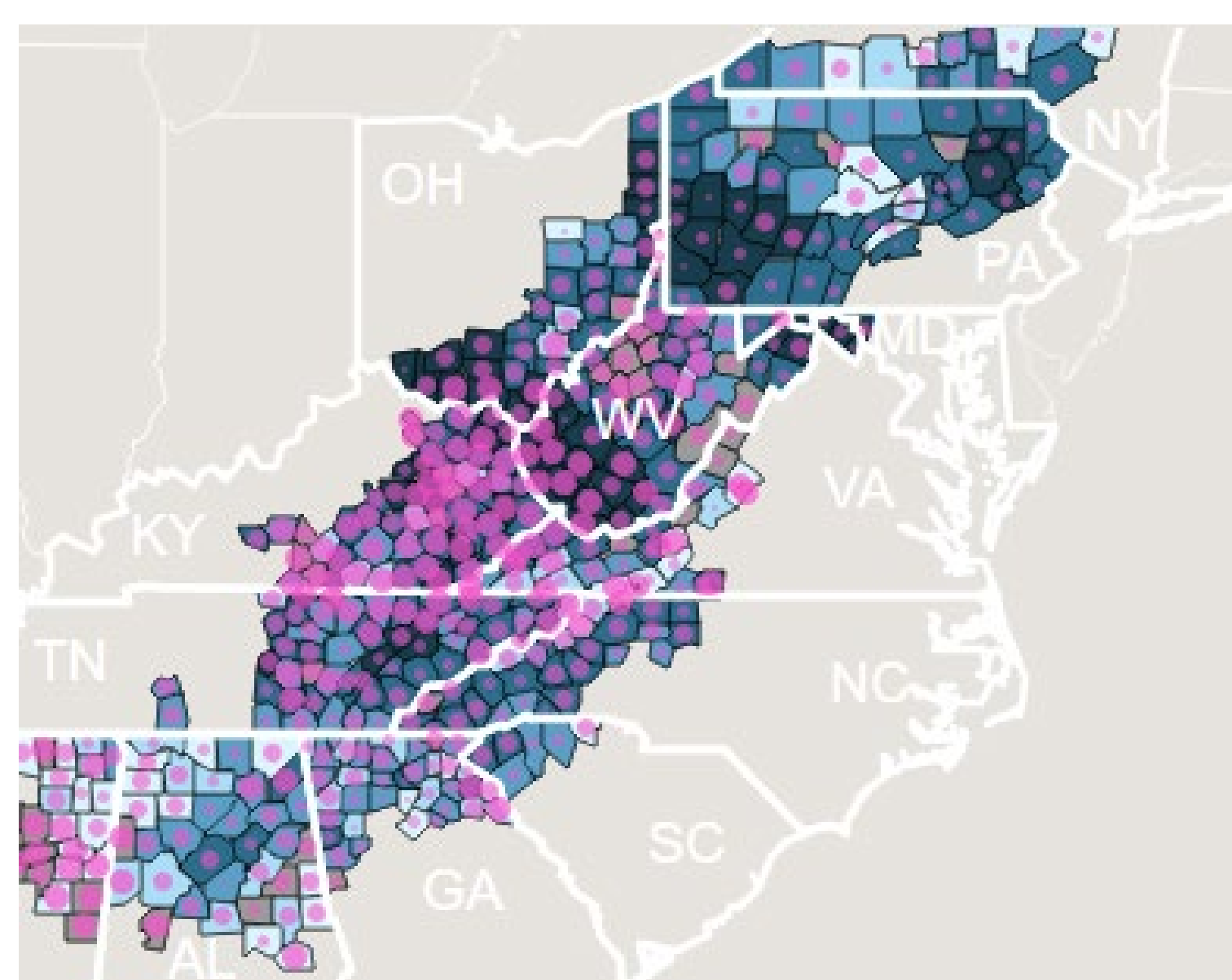

Figure 1. Percentage of households living in poverty (pink circles size of circle relates to percentage) overlaid on drug-related death rates 2015 – 2019, with darker shade indicating higher rate[1]

Methods

Crude drug-related deaths rates were extracted from the Centers for Disease Control and Prevention Wonder Database from 2010 – 2020[2]. The percentage of families in poverty annually and mean percentage of population with educational level below high school diploma between 2017 - 2020 were extracted from the U.S Census Bureau Database[3]. Data from the Appalachian Regional Commission[4] and Consumer Finance Protection hub[5] were used for inclusion as Appalachian and rurality, respectively.

Chi-square test with significance set at alpha ≤ 0.05 was applied to compare rural Appalachian versus urban Appalachian unintentional drug-related death rate. Mean annual crude death rates per 100K population and mean percentage households in poverty were calculated for Appalachian rural counties (AR) an Appalachian non-rural counties (ANR); linear regression was applied to evaluate the correlation. Work is underway to apply this analysis to evaluate the associations of drug-related death rate with number lacking at least a high school education for the period 2017 – 2020.

Results

The association of unintentional drug related death was associated with rural compared to urban Appalachia was statistically significant (X^2 (3, N=32620) = 4113.74, p <0.00001.

Linear regression for AR death rate was weakly positively correlated with % of households living in poverty as seen in figure 2a; the p value of 0.724 indicates that we do not reject the null hypothesis that the crude drug-related death rate explained by % households in poverty= 0 (R^2 = .015, F(1,9) = 0.13, p = 0.724. β = .84, p = 0.724, α = 25.72, p = 0.673).

As seen in figure 2b, linear regression for ANR death rate was inversely correlated with household poverty; we reject the null hypothesis (R^2 = .87, F(1,9) = 58.7, p < .001. β = -3.67, p < .001, α = 96.46, p < .001.).
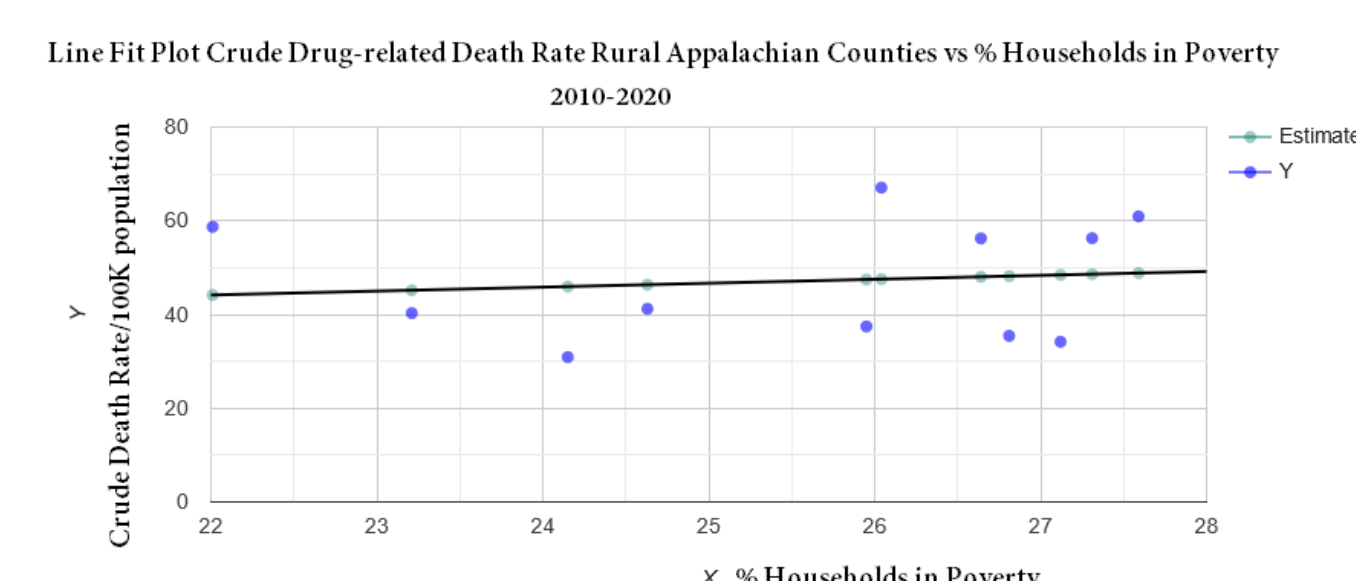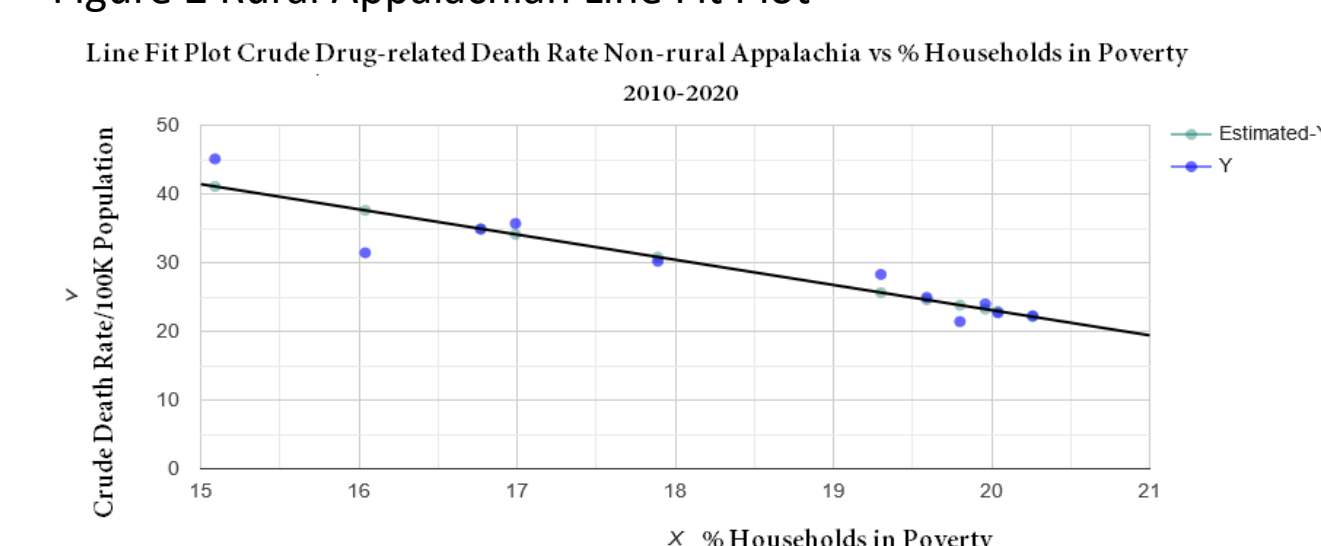

Figure 2 Rural Appalachian Line Fit Plot

Figure 3 Non-rural Appalachian Line Fit Plot

Discussion

Our preliminary Chi-square analysis confirms that unintentional drug-related deaths are associated significantly with living in rural Appalachia compared to urban Appalachia. Our results do not indicate a significant correlation between poverty and unintentional drug-related crude death rates for rural Appalachia. Surprisingly, our results indicate that in non-rural Appalachia, a negative correlation exists between % households in poverty and drug-related death rates.

Due to limitations in the study design, these results must be interpreted cautiously. CDC WONDER data for drug-related death rates in rural counties is often suppressed for confidentiality purposes; age-adjusted death rates are not uniformly available even where data is not suppressed. Furthermore, the ecologic design of this study limits applicability.

Further analyses will evaluate the relationship to educational level; it is hoped that identification of these associations may guide future policy to address this critical public health crisis facing our community.

References

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