Using Inferential Methods to Find a Link Between the Opioid Epidemic and White Supremacist Domestic Terrorism

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Abstract—According to the United States Congress, white supremacists are among the most significant domestic terrorism threats. Along with a steep rise in white supremacy activity in the U.S., the number of drug overdoses related to opioids increased drastically between the years 2020 and 2021 and is set to continue to increase. Prior qualitative research has indicated that many white supremacist groups believe the opioid epidemic to be a government conspiracy purposefully targeting only white Americans. Such rhetoric is used to radicalize and recruit new members to white supremacist organizations which can lead to more violence. This article addresses this putative link between white supremacy, or racially or ethnically motivated violent extremism (RMVE), and the opioid epidemic. Specifically, a detailed analysis was undertaken to identify "hotspots" in the U.S. for white supremacy incidents which co-occur with opioid use information. To do so, the geography of the opioid epidemic, location-based socioeconomic and crime factors, and white supremacist incidents as reported by the Anti-Defamation League's Hate, Extremism, Anti-Semitic and Terrorism (H.E.A.T) Map were systematically extracted for 2018 to 2021. The results of a canonical regression indicated that the most influential factors for white supremacist incidences are motor vehicle theft rate, robbery rate, and homicide rate, among others as well. A negative binomial regression model was constructed using opioid-use indicators and significant socioeconomic factors to predict the risk of RMVE incidents in every county throughout the United States. This model was able to show a significant positive association between the number of opioid overdose deaths and the number of white supremacist incidents in a given county with and without other social factors. Multidimensional scaling was implemented to show the similarity between counties while looking at the distance between opioid deaths and white supremacy incidents, as well as geographic distance. This scaling created a new map, as well as showing what counties were the most dissimilar. We conclude that the prevalence of the opioid epidemic in an area is a significant predictor of white supremacist incidents. However, its influence is overall small, and there exist other factors that also influence these incidents such as physical and mental health indicators, food insecurity, racial demographics, and unemployment levels.

Index Terms—white supremacy, opioid overdose deaths, Bayesian negative binomial regression, canonical correlation, multidimensional scaling

I. INTRODUCTION

Racially or ethnically motivated violent extremism (RMVE), such as white supremacy, has progressively become a regular part of media headlines as the number of incidents increases across the United States [1]. In August 2017, Charlottesville, Virginia saw the effects of white supremacists during a Unite the Right rally that led to the tragic death of Heather Heyer [2]. Then the whole world saw the lengths that white supremacist/far-right/extremist groups were willing to go to during the violent attack on the U.S. Capitol on January 6, 2021. These are only two of the many white supremacy-related attacks that have occurred over the past few years and the Department of Homeland Security advises that the threat environment remains heightened in the U.S. [3]. Although, the extreme right has received recognition from the U.S. government and many of the largest counterterrorism agencies as being a significant domestic terrorist threat, domestic violent extremists nonetheless "pose a sustained threat of violence to the American public, democratic institutions, and government and law enforcement officials," according to the U.S. Intelligence Community [4] [5].

At the same time, there has been a rise in opioid-related deaths over the past few decades and has recently spiked during the COVID-19 pandemic. According to the Council on Foreign Relations, this rise started with the overprescription of legal pain medications, along with the increase in opioids coming into the U.S. from foreign-based drug cartels [6]. The highest concentration of opioid overdose deaths is among non-Hispanic white men with a high school degree or less [7]. As observed in white power music lyrics, some white supremacists frame the opioid epidemic as a key issue for white Americans, criticizing the government's response to the crisis and grouping it in with other socio-economic challenges that may contribute disillusionment or even radicalization [8].

Although various research has been done on both of these subjects, this paper specifically shows the correlation between the number of opioid overdose deaths and white supremacist incidents in the U.S. between 2018 and 2021. Statistical techniques such as correlation analysis and regression were used to find the significance using data from every county in the U.S., while other socioeconomic factors were also included in the analyzes. Multidimensional scaling was utilized to create

a map of the U.S. that shows which counties are more or less similar to each other in regard to opioid overdose deaths and white supremacist incidents. By examining specific geographic locations within the U.S. that are more affected by the opioid epidemic and white supremacy radicalization, this research aims to help communities prevent more RMVE incidents from occurring by informing targeted investments in prevention resources.

II. Background

There is a national health crisis in America that is being caused by opioids [9]. The CDC reported that in the U.S. the number of drug overdoses from opioids was around 80,000 in 2021 which was up almost 10,000 from the previous year [10]. Not only is it a major concern for physical and mental health and wellness, but it is also affecting the U.S. economy; in 2017 it was estimated that the cost of opioid misuse and fatal overdoses was around 1 trillion dollars [6]. An increasing number of individuals are turning to illegal forms of opioids as the restrictions on prescription opioids have become more restricted and the supply of drugs such as heroin and fentanyl has increased. Socioeconomic risk factors for an opioid overdose are higher for men, individuals with a disability, unemployed, have only a high school degree and live in poverty [11].

Interestingly, the opioid epidemic being viewed as a health crisis rather than a war on drugs may be rooted in racism [12]. Previous drug epidemics have been viewed as a war on drugs because they typically affected nonwhite communities [13]. Drug use is labeled as criminal in majority Black neighborhoods causing Black Americans to be 6-10 times more likely to be incarcerated for drug offenses even though they are no more likely than white Americans to use illegal drugs [12]. A reason why white individuals are predominantly being affected by the opioid epidemic is that doctors tend to prescribe opioids more frequently for whites compared to Blacks [12]. There is a long history of racial disparities in accessing health care, specifically pain management and opioid medications in America [13]. As white individuals struggle with opioid addiction, they are given greater access to medical treatments as a way to treat their addiction rather than being incarcerated as Black Americans are.

The term "white supremacy" is most often used to characterize belief systems that include thinking whites should dominate minorities, live in a whites-only society, and have their own culture that is superior and/or overall genetically advantageous to other races [14]. Many members of white supremacist organizations subscribe to the "great replacement", a conspiracy theory that suggests that forces in the Jewish community are engaged in a massive scheme to import non-white refugees into the U.S., in an attempt to "ethnically cleanse" white Americans [15]. It is often generalized as nonwhite individuals being brought to the United States to replace white voters and that immigration will lead to the extinction of the white race. This theory was heavily supported by Payton Gendron, the shooter who killed ten people and

injured three during a domestic terrorist attack at a Buffalo, New York supermarket on May 14, 2022 [16]. It was also supported by Patrick Wood Crusius, who on August 3, 2019, killed 23 and injured 23 people in a far-right terrorist attack at a Walmart in El Paso, Texas [17]. They are not alone when it comes to believing in the theory and it is at the core of many of the beliefs that white supremacists have and are attempting to spread [15].

One rhetorical argument spread by subscribers to the "great replacement" theory is that the opioid crisis is a plot by the U.S. government to essentially commit ethnic cleansing against white Americans and eventually cause them to become the minority. There exists a phenomenon called "deaths of despair", which are deaths from drug overdoses, suicide, and alcoholic liver failure, that largely affect white males without college degrees caused by economic misery from wage stagnation and a decline in jobs for people without college degrees [18]. This philosophy has become part of the recruitment material for some of these groups; convincing poor, desperate white men that the positions they find themselves in are a result of this conspiracy, radicalizing them and leading to more acts of violence.

White supremacy has been evident in the U.S. since the Europeans first arrived and certain areas have become hotspots of white supremacist activity [19]. In recent years, the Pacific Northwest region has been a hub for well-known white supremacist organizations Aryan Nations, The Order, and the Ku Klux Klan [20]. The Traditionalist Worker Party has organized in Ohio and the surrounding Midwestern states where they are targeting young, white males as well as in Appalachia to target poor white people [21]. The Southwest border states experience anti-immigrant activity and propaganda by white supremacists [22]. The Northeast, long being a central location for European immigrants, witnessed anti-Semitic and other racial violence into the 21st century - e.g. in 2022, New York had the highest number of antisemitic incidents and New Jersey was third [23]. A previous study showed areas in the U.S. that have less diversity, more poverty, less population change, and less education are correlated with more hate groups [24]. This coincides with areas that have higher opioid activity and with other research that found that counties with the most significant declines in the non-Hispanic white population were the most likely to produce individuals subscribing to insurrectionist ideations [25].

III. Data Description

The dataset was compiled from different credible data sources for the years of study, 2018 to 2021. For the opioid overdose death data, CDC's WONDER database was used, which is a large dataset about health and mortality in the United States. The data was filtered to extract data about opioid-related overdoses, categorized by state and county to get each county's opioid overdose death count. Counties with less than ten opioid overdose deaths were not reported. For Hate, Extremism, Anti-Semitic, and Terrorism (H.E.A.T.) related incidents, data was obtained from the Anti-Defamation

League (ADL) which is an organization whose mission is based around stopping antisemitism, extremism, and preventing hate crimes. They have a map and database that has information about hate incidents in the U.S., categorized by the type of activity it was. This database was filtered for only white supremacist incidents, removing other extremist incidents captured in the H.E.A.T. map data. For the purposes of the analysis, the total number of white supremacist incidents was aggregated for each county. For other county-level factors, a dataset was used from the County Health Rankings & Roadmaps program of the University of Wisconsin Population Health Institute. For both crime/non-crime related factors, a dataset was taken from the FBI's Crime Data Explorer Database.

Compilation of all of these datasets was done using the pandas library in Python, by first cleaning these datasets to have state, year, and county in matching formats for all datasets, then merging these datasets by matching those three columns. To ensure that the dataset was applicable to the whole United States, for counties that did not have any white supremacist incidents or opioid overdose deaths reported, zeros were filled in for those counties. Lastly, to get the opioid crude rate and white supremacy crude rate, we divided those respective columns, the count of opioid overdose deaths and white supremacist incidents, by the county population and multiplied by 100,000.

IV. METHODOLOGY

A. Repeated Measures Analysis of Variance

A one-way repeated measures analysis of variance (ANOVA) was conducted to determine the significant difference in the mean white supremacy crude rate across the years of study (2018-2021). Linear contrast coefficients (-3, -1, 1, 3) were included to determine if there is an upward linear trend across the years of study.

B. Canonical Correlation

Canonical correlation is a multivariate method of analysis that finds associations between two sets of variables – specifically, identifying the best linear combinations of one set of variables that best predicts the best linear combination of another [26]. In advance of conducting this analysis, univariate correlations between the variables were explored. Indeed, many of the external factors such as violent crime rate and homicide were highly correlated which justified a more comprehensive multivariate examination.

C. Negative Binomial

Negative binomial regression is a generalized linear regression technique used for modeling count data with high variability and was used to model a potential relationship between white supremacist incidents and opioid overdose deaths within a particular county. The variable of interest, the number of white supremacist incidents in a county, is a count with a minimum value of 0 and an unbounded maximum value, and a variance greater than its mean, meaning it generally fits the assumptions of a negative binomial distributed variable. Negative binomial regression models this variable as a function of a number of covariates. The results of this model potentially reveal the relative importance of opioid use and the additional factors as they relate to white supremacist terrorism prediction. Negative binomial regression has been used in prior studies of predictive policing to model the risk of a crime based on risk factors [27] [28], and a heat map of relative risk for white supremacist incidents for each county in the U.S. can be generated.

For the negative binomial regression, three distinct models were constructed: one full model including all predictor variables; another partial model including only the predictors remaining following backward stepwise elimination; and a model with only the opioid crude rate as a predictor. The full model was fitted with 66 explanatory variables. The numerical variables were scaled and the one categorical variable representing the presence of water violation was one-hot encoded.

The total number of observations with non-missing data was 10,887 which includes several years of county observations for each of the variables. The data were split into training and test sets with the test set comprised of 20% of the non-missing observations. The models were each trained using 10-fold cross-validation and 29 training iterations. Model performance was tested and compared using the likelihood ratio tests, deviance, and Pseudo-R2. The partial models were preprocessed, split, and trained similarly, with the only difference being the number of predictors.

D. Multidimensional Scaling

As a final means for examination, multidimensional scaling (MDS) was employed. MDS uses the differences of elements through pairwise matrices between elements. Once the pairwise distance matrix is determined, the scaling shows the dissimilarity of the individual elements that can then be plotted.

The idea for this particular method was to find a distance matrix that takes into account the opioid crude rate, white supremacist incident rate, as well as the geographical distance between counties. This allows us to take into account the distance between rates but also let physical distance be a factor as well. For this, we chose to analyze data from the year 2021 and only observe the counties that had white supremacist incidents and opioid overdose death counts greater than zero. In total, there were 696 counties to create a multidimensional scaled map.

The desired elements of this matrix represent the squared Euclidean distance between two counties divided by the geographical distance between those respective counties. Since the comparison is between all 696 counties, the matrix is required to be symmetric and positive definite for multidimensional scaling to be successful. To preserve the positive and symmetric characteristic of this final matrix, the matrix was computed as

$$D^* = U^T * L^{\frac{1}{2}} * pinv(G) * L^{\frac{1}{2}} * U \tag{1}$$

Where U is the eigenvector, and L is the eigenvalue of the squared Euclidean matrix E, and G is the geographic distance matrix that is subjected to a Penrose pseudo-inverse procedure. Equation (1) is derived from [29], but adding the extra element of matrix G. This also allows the ability to have the 'division' of the two matrices while keeping the positive and symmetric properties.

The first calculation was the sum of squares for both opioid and white supremacy crude rates to make matrix E. These were calculated individually and then added together. This was calculated by

$$x_{i,j} = (y_i - y_j)^2 \qquad (2)$$

Where y_i and y_j are the crude rates for county i and j. Equation (2) creates matrix X, a 696x696 matrix of the square difference between each county. Once this was calculated, the matrices were centered because it centers the data on the covariance instead. This matrix was calculated with the equation from [29].

$$b_{i,j} = x_{i,j} - mean_i - mean_j + mean_X \qquad (3)$$

These two matrices were then added together to create the final matrix of the squared Euclidean distance between counties in relation to opioid and white supremacy crude rates. Singular Value Decomposition was performed to obtain the eigenvalues and eigenvectors for equation (1).

The next matrix created was the distance matrix between counties relating to geographic location. The geographic location refers to the latitude and longitude coordinates of the center of the county. This data was obtained from the Python U.S. zip code dataset to create a matrix of longitude and latitude coordinates. Since this matrix involved geographic coordinates, the metric to calculate the pairwise distance between counties is the Haversine method. Because of this, the coordinates are converted into radians due to the equation of the Haversine distance and then rescaled to kilometers. This, in turn, created the geographical distance matrix between pairs of counties. Similar to the first calculated matrix, the matrix was also centered.

Once both matrices are created with the respective elements, equation (1) is computed. The result is a symmetric matrix with the diagonal containing only positive values. MDS is then applied, seeking two, distance-preserving, latent component dimensions. This created the coordinates for each county, and when plotted, resulted in the similarity map with respect to crude rates scaled by the physical distance between counties.

V. Results

A. Repeated Measures Analysis of Variance

The one-way repeated measures ANOVA showed there to be a significant difference in the mean white supremacy crude rate across the years of study, $F(3, 12,564) = 66.28$, $p < 0.001$. The single-degree of freedom effect using linear contrast coefficients (-3, -1, 1, 3) was statistically significant, $F(1, 12,564) = 192.5$, $p < 0.001$, indicating that there is a positive linear trend in average crude rates from 2018 to 2021.

B. Canonical Correlation

The squared canonical correlation coefficients found between the white supremacy crude rate and opioid crude rate with the external factors were 0.59 and 0.66, respectively. Wilk's lambda test was implemented to test the significant effect of these canonical correlations which was statistically significant, $F(62,9248) = 79.41$, $p < 0.001$. The results of the canonical correlation illustrated that there was a significant relationship between white supremacy and opioid crude rate, as well as a relationship between those two variables and the external factors. The external factors that had the highest absolute value of coefficients in a regression equation for white supremacy incidents included motor vehicle theft rate, robbery rate, homicide rate, number of physically unhealthy people, and food environment index, among others.

$$Y = -8.157 * HR + 3.655 * RR + 1.736 * MVT \qquad (4)$$

The regression equation above shows that for each increase or decrease in units of the external variables, the white supremacy crude rate variable, Y, changes in that amount as well. For example, for every one unit increase in Homicide Rate, the white supremacy crude rate will decrease by -8.157 units.

C. Negative Binomial

TABLE I

Model	Log-Likelihood	Pseudo R-Squared	Deviance
1. Full	-10,237	0.8714	9,980.8
2. Reduced	-11,756	0.8244	12,721.0
3. Opioid Only	-18,426	0.1514	26,359.0

Table 1 shows the results of the three regression models. The R^2 estimate was calculated using Cohen's pseudo R^2. The opioid-only model captured approximately 15% of the variance with the single predictor. The coefficient of opioid deaths was 0.4632 meaning an increased opioid crude rate leads to an increased white supremacy crude rate. The reduced model included 15 variables found to capture the most variance using backward stepwise regression. Both the full and reduced models achieved impressive R^2 values, with the reduced model capturing only about 5% less variance despite having 46 fewer variables. A likelihood ratio test was implemented to test the goodness of fit of the full and reduced negative binomial models. The likelihood ratio test evaluates the goodness of fit of two models using $(-2log\frac{l_1}{l_2}$, where l_1 and l_2 are the likelihood functions of the models) as the test statistic and comparing it to a chi-squared distribution. The test statistic for comparing the full and reduced negative binomial models was $-3,038.85$ with df=2, $p < 0.001$. Because the p-value is significant at the $\alpha = 0.05$ level of significance, there is sufficient evidence to support the alternative hypothesis that the full model is a better fit than the reduced model. Therefore, we selected the full negative binomial model as our final model.

Table 2 above shows the regression coefficients of the final model. According to the Wald test, 25 variables were found

TABLE II

Variable	Coefficient
1. Percent Non-Hispanic, White	6.9651
2. Percent Black	4.8396
3. Percent Hispanic	4.6975
4. Percent American Indian/ Alaska Native	1.5766
5. Percent Asian	1.4226
...	...
18. Opioid Death Rate	0.2363

to be insignificant, so these variables were discarded from the model. The final model includes 41 predictors and an intercept term. The 5 covariates that have the largest influence on the number of white supremacist incidents all describe the racial makeup of a county. Interestingly, the racial category with the largest influence on the response is the percentage of the white population. This means that as the percentage of the white population grows in an area, the more likely there is to be a white supremacist incident. Following the racial indicators are variables that describe the health levels of a county, including the opioid crude rate. Only one of the crime statistics, assault rate, is among the top 25 most influential variables. The opioid crude rate is the 19th most predictive variable. It is predicted to have a positive influence on the number of white supremacist incidents. If the crude rate of opioid deaths increases by 1, the number of expected white supremacist incidents increases by 0.2363, holding other variables constant.

D. Multidimensional Scaling

Once the final matrix was run through MDS, the result would create a map of the United States. The center of this final map is the origin of (0,0), and counties were then plotted around that. If there is no similarity and no relationship between the rates with respect to their distances, the result would be a normal map of the United States with counties in their respective spots. In the original scaled graph, there is a cluster of counties that is difficult to observe at first glance. When zoomed in, there are roughly 550 counties. The spread of those counties can be found in Figure 1.

MDS1 and MDS2 are the values computed after MDS. The color in Figure 1 is the Euclidean distance of each county from the origin, which is calculated as

$$e = \log \sqrt{(MDS1 - 0)^2 + (MDS2 - 0)^2} \qquad (5)$$

Since the range of Euclidean distance values was large and going upwards of 10,000, taking the log of those values helped make the range smaller to observe the similarity between counties.

Based on Figure 1, there is a similarity between many of the counties. When points on the graph are close together, they show signs of similarity, even if they are not close geographically. The closer they are to the graph's origin, the more similar the county is to all the others. The farther a county is from its origin, the more dissimilar it is from the rest. However, even if two counties are dissimilar to others, those counties can have similarities if they are close by. Since
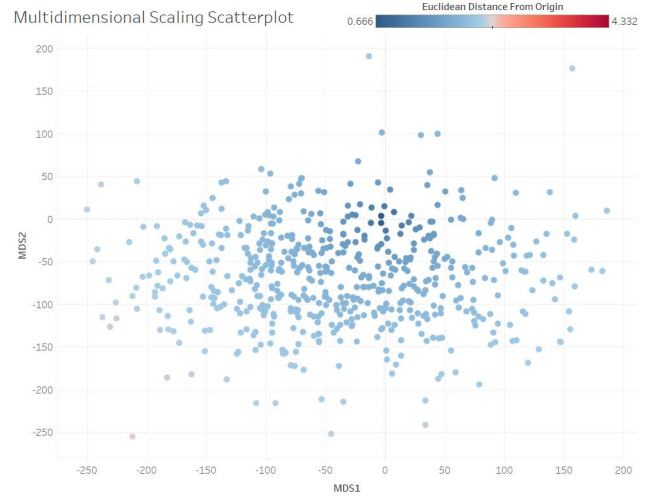

Fig. 1. Multidimensional scaling zoomed in on about 550 counties.

the geographic location was considered, the closeness means the distance did not affect the similarity between counties.

While this creates a distorted map of where counties are located based on their respective distances, a visual of where these counties are located can help better understand why they are so dissimilar. To make this final comparison and how it relates to the U.S., Figure 2 plots each county, colored by the same metric as Figure 1.
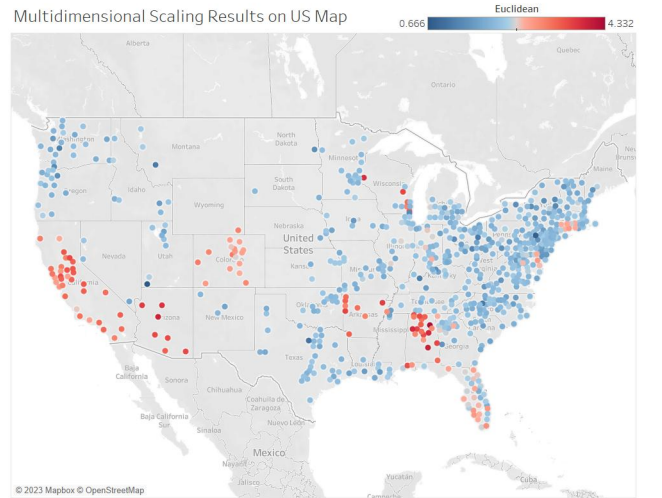

Fig. 2. Log Euclidean distances plotted on the U.S. Map.

When plotted on top of the U.S. map, the Euclidean distance from the origin shows more clearly the counties most dissimilar from the rest. Close examination indicates that clusters of highly-varying counties are found around the U.S. For example, the state of California only contains counties that have high dissimilarity (colored red). There are seven states, including the District of Columbia, whose counties have a large Euclidean distance from the origin, implying they have high dissimilarity in contrast to other counties. This was cross-

referenced with Figure 1 by coloring the figure by state, which showed none of the counties were from that state.

Even though these states had counties with high dissimilarity, other states had a mix of similar and dissimilar. One main example is the state of Florida. With further investigation, some of the counties that are more dissimilar are located where a city or a county right outside a city is located. Further scrutiny of other states with the same type of mixture, some counties with more dissimilarity are either located relatively close to cities or are in more rural areas of the state.

VI. Discussion

The ANOVA analyses revealed that there has been a significant increasing trend in the mean white supremacy crude rate from 2018 to 2021. This finding is in alignment with the findings of threat monitoring agencies as well as the U.S. Congress's conclusions on the threat of white supremacists. The canonical correlation between the opioid and the white supremacy crude rate was found to be significant, making it a potentially useful variable for regression purposes.

The results of negative binomial regression show that the opioid crude rate is among the most influential predictors and has a positive association with the number of white supremacist incidents. However, more predictors have a larger influence on the response. This is to be expected as incidents are dependent upon many different factors, including the factors analyzed but also including personal factors that can't be quantified, like upbringing. Despite this, we believe that threat monitoring agencies should take this issue into account as, like many of the other health and socioeconomic indicators, the opioid crude rate was found to be significant and has the potential to better indicate a white supremacy threat. It is also interesting that the covariate with the largest influence is the percentage of the white population, and that the variables with the largest magnitude are all racial demographics. The magnitude of the percent white variable is larger than many of the health and crime indicators. This may suggest that the number of white supremacist incidents in majority white counties is higher despite differing socioeconomic factors.

MDS showed a novel mapping between counties utilizing the metrics derived from equation(1). This mapping, however, shows only some cursory association between white supremacy and opioid crude rate concerning physical distance. This can be seen through the states with mixed similarities and the location of those counties, so counties that are in rural places or located near or within cities. However, inferring a causal relationship between the two is challenging. Nevertheless, this result aligns well with the negative binomial model with opioid deaths as the only key predictor.

VII. Conclusion

This paper employed different statistical methodologies to analyze the trends and associations between RMVE incidents committed by white supremacists and other factors such as opioid overdose deaths, external variables like violent crime rate, and demographic indicators in different counties across the United States. ANOVA testing proved that a positive linear growth in the mean white supremacy crude rate exists over the 2018 to 2021 period. Negative binomial regression analysis showed a positive association between the crude rate of opioid overdose deaths and the number of white supremacist incidents, although this association decreased with additional factors added to the model. Canonical correlation analysis identified external factors such as homicide rate, food insecurity rate, and unemployment rate as highly significant to the white supremacy crude rate. MDS found similarities between counties with nonzero crude rates to create a distorted U.S. map. Overall, these findings may be informative for policymakers, community organizations, and law enforcement agencies in identifying potential hotspots for white supremacist activity and designing appropriate interventions to combat this form of extremism.

VIII. Limitations and Future Work

One of the limitations of the present work involves the quality of the data employed. Various covariates experienced some missingness, and some variables were dropped. For the remaining variables with less missingness, the median value of the variable for each county was imputed. The white supremacist incident data reported by the Anti-Defamation League is not a complete account of all the white supremacist incidents that have occurred in the U.S., only the verifiable events. In addition, the data is limited in quality the further back in time they were reported. Therefore, only the four most recent years for which data were available at the beginning of this study, which includes 2018-2021, were chosen for analysis.

A method that could potentially be investigated in the future would be attempting to forecast white supremacist incidents based on opioid use and other covariates using time series forecasting given a data set that includes more periods of white supremacist incidents and more reliable estimates of our covariates over these time periods. Investigating how opioid use might affect white supremacist incidents in a hierarchical sense is also of interest. There is potential to improve the models described here by constructing a hierarchical regressor that systematically takes either state or county as a grouping variable. Because criminal activity over an area as large as the U.S. is so varied, it is likely beneficial to generate different estimates based on such grouping variables to take advantage of differing spatial scales. Finally, further research incorporating other significant factors into the MDS approach to see how the similarity between counties changes is likely needed. Another area of future research is performing a time-depended version of MDS over multiple years, thereby seeking to identify possible temporal trends of counties' relative positions along MDS-extracted eigenvectors.

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