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The Effects of Climate on Suicide Rates in 36 Oregon Counties

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Abstract

This study looked at average temperature, amount of rainfall and amount of sunshine in all 36 Oregon counties and how they affect suicide rates. Climate information was gathered over the past 30 years and suicide rates were measured between the years 2013 and 2016. It was hypothesized that there would be a negative relationship between low temperature and suicide rates. It was also predicted that there would be a negative relationship between high temperatures and suicide rates. This study found that there was a negative relationship between average high temperature and sucide rates. It also found there is to be a negative relationship between median household income and suicide rates.

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Introduction

Suicide has excedingly become a national epidemic over the past decade. It is the second leading cause of death in the United States for people between the ages of 10-34. In 2000 the sucide rate was at the lowest it had been nationally in the previous 40 years. However since then it has exponentially grown (*Preventing Suicide*, 2019). Previous studies that have looked at suicide rates in the U.S. have found that men are more likely to die from sucide than women are. This could be because men are more likely to attempt suicide with intent and with a firearm which leads to a deadly consequence and women are more likely to lack intent and attempt suicide by overdosing with pills (Leslie, 1996). The high rate among men could also be explained by the likelihood that men are highly hesitant of seeking help. There in no one cause of suicide, multiple factors can be contribute to it. Like substance abuse, mental illness, life crises, and major world events. This study attmepts to look at other potential causes of suicide and answer the question, "does a certain type of climate lead to higher rates of suicide?" It investigates a potential causal relationship between climate and suicide rates. It looks at the 36 different counties of Oregon over the past 30 years. Even though generally the state of Oregon has a temperate climate, there is a wide variation in temperature in different areas around the state.

The dependent varibles being measured in this study is the suicide rates in the different counties in the state of Oregon. The rate of suicide is a total value, measured per 100,000 people in the 36 counties of Oregon between the years of 2013-2016. The independent variables that are predicted to impact suicide rates are the average annual low temperature in the 36 counties,

the average annual high temperature, the average median household income, the unemployment rate, the average rainfall, the average days of sunshine, and a comfort index. The average annual temperatures are measured over the last 30 year period. The average rainfall is measured in inches and over the last 30 year period. The average day of sunshine is measured in days over the last 30 year period. The median household income and unemployment rates are measured for the year of 2016 (Data USA, 2019). The comfort index is an arbitrary index calculated using 7 different climate variables such as daily highs and lows in temperature and total precipitation (Best Places, 2019).

When looking at the average low temperature and the suicide rates, it was predicted that there will be a negative correlation, the lower the average temperature is in a given state, the higher the suicide rate will be. This could be because people in colder climates are exposed to more rain and might experience depression. When looking at the average high temperature and the suicide rates, it was predicted that there will be a negative correlation, the higher the average temperature is in a given state, the lower the suicide rate will be.

Methodology

The data was analyzed using an Ordinary Least Squares (OLS) regression in gretl. Table 1 shows the summary statistics for all the independent variables. Table 2 shows the regression results for the four different regressions that were run. To account for a non linear relationship that might exist between the variables natural log of the variables were added and the regressions were run again.

The results show there are two variables that are significant in all of the regressions that were run; average high temperature and average annual median household income. Column (1)

in Table 2 shows that if the median household income increases by one dollar then there is a

predicted decrease in the suicide rate by 0.004. This variable has a statistical significance of

99%; which indicates that annual household income affects suicide rates. Column (1) in Table 2

also shows average high temperature at the 99% statistical significance. This confirms the

hypothesis that high average temperature and suicide rates have a negatively relationship. It

indicates that high temperature has an effect on suicide rates; as temperature increases suicide

rates decrease. Table 2 shows that if the temperature increases by one degree then there is a

predicted decrease in the suicide rate decrease by 0.7229. The R^2 for the regression is at 0.31

which means that the model explains 31% of the variability of the collected data around its

mean.

The second regression (column 2) in Table 2 takes into account unemployment rates and

average low temperatures along with average high temperature and median household income.

The results show that when average low temperatures increase by one degree then suicide rates

decreases by 0.1984. The unemployment rate variable shows that when the rate increases by 1

unit then suicide rates decreases by 0.1015. This regression shows that average low temperatures

and unemployment rates are not statistically significant, but the average high temperature and

median household income variables are still significant at the 99% and 95% respectively. The R^2

shows that 32% of the variability of the collected data is around its mean.

The third regression (column 3) in Table 2 included the natural log for the unemployment

rate, average rainfall, and average household income variables. The results show that as

unemployment rates increase by 1%, suicide rates increase by 0.001. This was not statistically

significant. Table 2 also shows that a 1% increase in amount of rainfall leads to a 0.058 increase

in rates of suicide rates. This was significant at the 95% level, leading us to believe there is a relationship between average amount of rainfall and suicide rates. Median household income shows a statistical significance at the 99% level in column (3). As median household increases by 1%, suicides rates decrease by 0.276. This, once again leads us to believe there is a strong relationship between median household income and suicide rates. The R^2 shows a 0.30 which mean that 30% of the data collected is around its mean.

The last regression (column 4) in Table 2 included the natural log of average low temperature, natural log of median household income, and natural log of average high temperature. These results showed similarities; with the previous regressions with median household income and average high temperature being statistically significant at the 95% level. A 1% increase in average high temperature leads to a 0.724 decrease in suicide rates. A 1% increase in median household income results in a 0.191 decrease in suicide rates. Although average low temperature is not statistically significant in this regression the table shows that a 1% increase in low temperature leads to a 0.071 decrease in suicide rates. The R^2 shows a 0.34 meaning that 34% of the data collected is around its mean.

Results & Interpretations

Although not all variables in our data set are statistically significant our results do show the independent variables have some impact to suicide rates. These variables have an impact in people's lives and because of that we consider them significant enough to take into account when discussing suicide prevention. We were able to discover a strong relationship between the median household income and average high temperature. These two variables were statistically significant in all four of the regressions we ran and we believe they are also economically

significant. Putting the regressions results into a real world context, we can understand that most

raises come in at least hundreds of dollars if not thousands annually increasing the effect on

suicide rates from 0.0004 to 0.4. We hold that to be a large impact on the rate of suicide. At the

beginning of this study we had hypothesized that temperature and suicide rates would have a

negative relationship. We had also hypothesized that annual median household income and

suicide rates would have a negative relationsip. This study has confirmed both of the original

hypotheses.

There were several limitations to our study. The timelines for all of this data used in this

current study overlap but are not the same and the climate data used in this study is not from an

official government report. In addition to the variables we measured one variable we would have

liked to look at was mental health education or awareness in a given county. We predict the

amount of mental health education a community receives or mental health awareness a

community has would negatively affect the rates of suicide. If we pursued this research further

we would like to find a way to quantify and measure mental health education in each county.

This could look like measuring the number of free mental health clinics in the county or even

measuring the number of mental health providers in the county. This could also be a survey

given to residents in each county asking them about their own mental health awareness and their

awareness of the community resources that are available to them. If this study gets replicated we

also suggests that the timelines for each variable are the same. Some issues may arise from that

because there is no way to be sure of the accuracy of the relationships observed between the

variables will be.

These findings could help guide the next steps we take in suicide prevention. With the knowledge that income significantly affects suicide rates we can advocate for and work towards financial security in families and in communities. We can also take steps to provide mental health education in areas with low annual temperatures and low median household incomes that now according to our findings can be considered high risk for suicided. In 2016, the CDC reported that there were 44,965 suicide deaths, which was an increase of 1.2 percent from the year before. Suicide continues to be one of the top ten leading causes of death in the United states (AFSP, 2018). The CDC explains that suicide is usually not caused by one single factor. Currently our efforts are focused on identifying and providing treatment for people who have mental health conditions. By attempting to identify potential environmental influences on suicide rates we can gain insight and fight this growing epedemic.

References

AFSP. (2018). Suicide Rate is Up 1.2 Percent According to Most Recent CDC Data

(Year 2016). Retrieved from

https://afsp.org/suicide-rate-1-8-percent-according-recent-cdc-data-year-2016/.

Best Places (2019). Retrieved from https://www.bestplaces.net/climate/county/oregon.

Data USA. (2019). Retrieved from https://datausa.io/.

Lester, D. (1996). Gender differences in methods for suicide. *Perceptual and Motor Skills*, *82*(3,

Pt 2), 1154. https://doi.org/10.2466/pms.1996.82.3c.1154

McNamee, G. L., & Highsmith, R. M. (2019). Climate. Retrieved from

https://www.britannica.com/place/Oregon-state/Climate.

Preventing Suicide |Violence Prevention|Injury Center|CDC. (2019, September 5). Retrieved

from https://www.cdc.gov/violenceprevention/suicide/fastfact.html.

Story Map Series. (2019). Retrieved from

https://www.arcgis.com/apps/MapSeries/index.html?appid=9c59be59ef7142dfad40d95e3

b36f588.

Table 1[1]

Summary Statistics of Explanatory Variables

Variables	*M*	Meidan	Minimum	Maximum	*SD*
Average Temp. (low)	28.932	32.950	16.5	39.2	7.62
Average Temp. (high)	81.697	82.250	68	91.3	5.9553
Average Rainfall	39.6	43.5	11	89	24.663
Median Household Income	49248	45644	32769	80946	11365
Unemployment Rate	4.9	4.95	3.8	6.4	0.616
Rates of Suicide	24.4	23.8	11.7	55.8	9.1975

[1] Comfort Index, Average temperatures low and high, Average rainfall and Days of sunshine were measured over 30 years from 1988-2018. Median Household Income and Unemployment Rate were measured for the year 2016. Rates of Suicide is a cumulative number of suicides per 10,000 people from 2013-2016

Table 2

Regression Results

Dependent Variable: Suicide Rates

Regressor	(1)	(2)	(3)	(4)
Avg. High Temp.	-0.7229** (0.299)	-0.8687** (0.352)		
Median Household Inc	-0.0004*** (0.0001)	-0.0003** (0.0001)		
Avg. Low Temp.		-0.1984 (0.283)		
Unemployment Rates		-0.1015 (1.760)		
ln (Unemployment Rates)			0.1141 (8.25)	
ln(*Avg. Rainfall*)			5.8499** (2.64)	
ln(*Avg. High Temp.*)				-72.3269** (27.46)
ln(*Avg. Med Household Income*)			-27.575*** (6.81)	-19.0602** (7.85)
ln(*Avg. Low Temp.*)				-7.0541 (7.17)
Intercept	102.78	119.19	300.22	570.45
Summary Statistics				
SER	8.48	8.68	8.71	8.42
R^2	0.317	0.327	0.300	0.346