Samantha Uy Tesy

ECO 441K

Dr. Helen Schneider

December 4, 2020

# The Effect of Minimum Wage on Suicide Mortality in the United States

**Abstract**

Suicide is one of the leading causes of death in the United States and its rate is continuing to rise. In this paper, I assessed the relationship between state minimum wage and its effect on suicide mortality. I created a regression model to demonstrate this relationship. The regression included the independent variable, suicide mortality, the dependent variable of interest, minimum wage, and other explanatory variables. Data was obtained from all 50 states. Suicide mortality data was collected from Center of Disease Control (CDC) for the year 2018. Minimum wage data was collected from the National Conference of State Legislatures and reflects the current state minimum wage in effect as of January 1st, 2020. This paper found that the p-value for suicide mortality was statistically significant ($p\text{-}value < 0.05$). The model indicated that an increase in minimum wage by one dollar will lead to a 0.42 decrease in suicides per 100,000 people. Government agencies can use this information to develop legislation towards increasing state minimum that would potentially lead to a decrease in suicide mortality.

## Introduction

Suicide is one of the leading causes of death in the United States. In 2018 alone, 1.4 million people attempted suicide while 48,344 Americans died by suicide. And this number continues to rise. From 1999 to 2018, suicide rates increased by 35 percemt from 10.5 to 14.2 people per 100,000. Suicide rates are not only increasing, they are growing more rapidly; the overall suicide rate increased from a stable trend of 0.8% from 1999 until 2006 to 2.1% from 2006 to 2018 in the United States (Hedegaard et. al, 2020, p.1). This rapid increase is even more evident in women. According to Hedegaard et. al (2020), while suicide rates amongst men were consistently 3.5 to 4.5 times that of females, female suicide rates have increased by 55% compared to 28%in males from 1999 to 2018 (p. 5). Clearly, the rate at which Americans commit suicide is a major public health concern.

While there are several factors that influence suicide rates such as mental illnesses, drug/alcohol abuse, and bullying, there is strong evidence to suggest that poverty has an effect on an individual's risk for suicide. For example, according to the World Health Organization (WHO), 79% of global suicides occur in low and middle-income countries in 2016. Furthermore, a study conducted by Kerr et. al found that poverty rates were "strongly associated with suicide rates for both genders and all age groups" in the United States. Gaps in existing research include a lack of representation on suicide rates of non-White populations due to limitations in data. Furthermore, these studies often did not clearly explain any intersectionalities between subgroups such as race and gender.

In the United States, death by suicide is a growing and costly problem. In addition to internal costs such as emotional toll and distress, there are significant external costs on society. The total cost of suicides and non-fatal suicide attempts in the United States is estimated to be 70 billion dollars per year in medical and work-lost costs (CDC). Given these statistics, reducing suicide rates should be a priority for policymakers.

**Literature Review**

Existing empirical literature on the relationship between minimum wage and suicide rates is new and limited. While several studies have demonstrated the effects of financial stress on health outcomes, the effect of economic interventions, like minimum wage, on suicide rates is unclear. Gertner et. al (2019) found that a “one-unit increase in the minimum wage was associated with a 1.9% decrease in the annual age-adjusted state suicide rate” (p. 652). Gertner et. al (2019) estimated the relationship of changes in state minimum wages and age-adjusted suicide rates, controlling for time-varying state characteristics related to suicide rates (p. 648). Gertner et. al (2019) also found that there was no substantial evidence to suggest the effect of minimum wage on suicide rates differed by race or sex (p.651). Similarly, Kaufman et. al (2019) found a negative association between minimum wage and suicide rates. However, they estimated that a one-dollar increase in the minimum wage is associated with a 3.5% reduction in the suicide rate in adults aged 18 to 64 when “controlling for state-specific time-varying economic variables” (p.3). The negative association differed when

controlling for varying levels of education. Kaufman et. al estimated a 6%reduction in sucide per one dollar increase among adults aged 18 to 64 with less than a high school education (p.3).

Additionally, Dow et. al (2020) found that non-drug-related suicides fell "discontinuously after higher minimum wages [were] implemented (p.8)." Dow et. al estimated that a 10% increase in minimum wage decreased suicide rates by 2.7% (p.10). In contrast to Gartner, Dow et. al (2020) found that the effects of economic policies varies by gender with the "relative reduction in suicide deaths [being] larger for women" (p. 10). Thompson et. al (2016) found that impoverished individuals suffering from a substance use disorder (SUD) were more likley to commit suicide than indivduals not in poverty (p. 327). Leveraging individual level time-series data, Thompson et. al (2016) found that impoverished individuals with SUD were at a "35% increased likelihood for first-time suicide ideation or attempt" than individuals not in poverty (p. 327).

In summary, the existing pieces of literature that specifically studied minimum wage all found that there is a negative association between minimum wage and suicide rates, though their results varied. Although Thompson et. al (2016) found an association between the combined effects of SUD and poverty on suicide ideation, those trends match the results of the other three papers as lower-income adults are more likely to receive minimum wage than high-income adults. Authors and commentators agree that exploring individual-level and family-level data as well as determining the difference in impact on separate racial groups as well as gender can reveal more about the

underlying reasons for the differential impacts of minimum wage on suicide rates (Ahern, 2020, p. 873).

This study contributes to previous literature by helping to estimate the precise effect of state-specific minimum wage on suicide mortality. We use states as the unit of analysis and collect data at the state-level.

**Empirical Model**

Linear regression is used to estimate the relationship between state-level suicide mortality rates and state minimum wage. In this paper, we estimate the following regression model:

$$Suicide\ Mortality = \alpha + \beta\ Minimum\ Wage\ \beta\ Uninsured\ Poverty\ \beta\ Income\ _1 + _2 + \beta_3 + _4 +$$

$$\beta_5 Depression + \beta_6 Substance\ Use + \beta_7 High\ School\ Degree + \beta_8 Ethnicity + \beta_9 Region + u$$

In the model above, the dependent variable, *Suicide Mortality,* measures the number of suicides per 100,000 total population at the state-level. The independent variable of interest is *Minimum Wage* which measures the minimum wage for that state in U.S. dollars (USD).

The income variables include *Median Income* in each state as well as *Poverty* which is the proportion of the population that falls below the federal poverty line. The variable, *Uninsured*, measures the proportion of the state population that does not have health insurance. The *Depression variable* measures the proportion of the state population that suffered a major depressive episode (MDE). The *Substance Use*

variable measures the proportion of the state population that met the criteria for substance use disorder for illicit drug and alcohol abuse. The *High School Degree* variable measures the proportion of the state population, 25 years or older, that have obtained only a high school degree. The *Ethnicity* variables control for race, the white population is excluded. Finally, we control for geographic region; the northeast is excluded because it has the lowest suicide mortality rates relative to the other regions.

**Data**

Suicide mortality data was obtained from the Center of Disease Control and Prevention. The data is for the year 2018 and is adjusted for the state population. The data is available at:

https://www.cdc.gov/nchs/pressroom/sosmap/suicide-mortality/suicide.htm

Minimum wage data was obtained from the National Conference of State Legislatures and reflects the current state minimum wage in effect as of January 1st, 2020 in USD. Five states do not participate in a state-mandated minimum wage and therefore their minimum wage was set to the federal minimum wage: Alabama, Louisiana, Mississippi, South Carolina, and Tennessee. The state-level data can be found at:

https://www.ncsl.org/research/labor-and-employment/state-minimum-wage-chart.aspx

High school degree data was obtained from the United States Department of Agriculture Economic Research service and measures the percentage of the population, 25 years and older, that has completed high school only; the data is based

on the U.S. Census Bureau and can be found at: https://data.ers.usda.gov/reports.aspx?ID=17829

SUD and Depression data was obtained from the Substance Abuse and Mental Health Services Administration (SAMHSA) and is based on the 2017-18 National Survey on Drug Use and Health. The SUD data measures the proportion of the state population that meets the criteria for illicit drug or alcohol dependence or abuse. The Depression data was measured as the proportion of the state aged 18 and older that experienced MDE in 2017 to 2018. The state-level data can be found at: https://www.samhsa.gov/data/report/2017-2018-nsduh-state-prevalence-estimates

State characteristics include poverty rate (percent of the population at or below poverty), annual median income, and proportion of the state population that is uninsured. Uninsurance data measures percent of uninsured adults in each state; the data is based on the estimates by the U.S. Census Bureau. Ethnicity data measures the population distribution by race in each state and is based on analysis of the Census Bureau's American Community Survey. All other state characteristics were obtained for 2017-2018 from the Kaiser Family Foundation. State-level data can be found at: https://www.kff.org/statedata/

Table 1 below presents descriptive statistics

Table 1. Descriptive Statistics

| Variable | Mean | Standard Deviation | Minimum Value | Maximum Value |
|---|---|---|---|---|
| Suicide Mortality | 16.45 | 4.51 | 8.30 | 25.20 |
| Minimum Wage (USD) | 9.06 | 1.91 | 7.25 | 13.50 |
| % Uninsured | 9.16 | 3.57 | 3.19 | 20.23 |
| Poverty Rate | 12.76 | 2.92 | 7 .00 | 20.00 |
| Median Income (USD) | 59794.62 | 9857.23 | 43469 | 80776 |
| % Depression | 7.60 | 0.94 | 5.58 | 9.97 |
| % Substance Use Disorder | 7.68 | 1.09 | 6.01 | 11.28 |
| % High School Degree Only | 28.40 | 3.91 | 20.60 | 40.50 |
| % White | 68.3 | 15.94 | 20.40 | 93.20 |
| % Black | 10.24 | 94.61 | 0.60 | 37.60 |
| % Hispanic | 12.21 | 10.56 | 1.40 | 49.50 |
| % Asian | 4.32 | 5.78 | 0.60 | 39.40 |
| % Native American/ Native Alaskan | 1.51 | 2.91 | 0 | 15.1 |
| % Native Hawaiin/ Pacific Islander | 0.43 | 1.46 | 0 | 10.2 |
| % Other/ Mixed | 3.08 | 2.52 | 1.40 | 18.4 |
| West | 0.26 | 0.44 | 0 | 1 |
| South | 0.32 | 0.47 | 0 | 1 |
| Midwest | 0.24 | 0.43 | 0 | 1 |
| Northeast (omitted) | 0.18 | 0.39 | 0 | 1 |

Table 1 above shows a wide variance in suicide mortality across states from 8.30 people in New York to 25.20 people in Wyoming with an average of 16.45 people per 100,000 total population. Minimum wage rates in the United States varied from state to state with the lowest being the federal mandated minimum wage of $7.25 in 20 states and the highest being $13.50 in Washington.

**Empirical Results**

Table 2 below shows the multiple linear regression analysis of the independent variables on the state-level suicide mortality rate. Regression results in Table 2 below show that minimum wage is an important determinant of suicide mortality. Higher minimum wage rates tend to lower suicide mortality. When minimum wage increases by one dollar, suicide mortality decreases by approximately 0.40 people per 100,000 (*p-value* < 0.10). The goodness of fit is 0.8839 which indicates that 88.39% of the variance in suicide mortality can be attributed to the explanatory variables in the regression (R-squared = 0.8839).

Table 2. Regression Results

```
. regress suiciderate18 minwage20 uninsured2018 poverty2018kff medianannualincome2017 hs2018 wes
> t south midwest northeast black hispanic asian nativeamericanalaskiannative nativehawaiianpaci
> ficislander other depression18 substanceabuse2018
note: northeast omitted because of collinearity
```

| Source | SS | df | MS | Number of obs | = | 50 |
|---|---|---|---|---|---|---|
| | | | | F(16, 33) | = | 15.70 |
| Model | 881.583485 | 16 | 55.0989678 | Prob > F | = | 0.0000 |
| Residual | 115.821526 | 33 | 3.5097432 | R-squared | = | 0.8839 |
| | | | | Adj R-squared | = | 0.8276 |
| Total | 997.40501 | 49 | 20.3552043 | Root MSE | = | 1.8734 |

| suiciderate18 | Coef. | Std. Err. | t | P>\|t\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| minwage20 | -.3981404 | .2266747 | -1.76 | 0.088 | -.8593136 | .0630328 |
| uninsured2018 | .1663077 | .1389768 | 1.20 | 0.240 | -.1164428 | .4490582 |
| poverty2018kff | -.1181719 | .3346187 | -0.35 | 0.726 | -.7989588 | .562615 |
| medianannualincome2017 | -.0001294 | .0000998 | -1.30 | 0.203 | -.0003324 | .0000735 |
| hs2018 | 13.67442 | 35.24003 | 0.39 | 0.700 | -58.02195 | 85.3708 |
| west | 5.856121 | 1.214924 | 4.82 | 0.000 | 3.384338 | 8.327903 |
| south | 1.296081 | 1.319033 | 0.98 | 0.333 | -1.387511 | 3.979674 |
| midwest | -.1325212 | 1.009734 | -0.13 | 0.896 | -2.186841 | 1.921799 |
| northeast | 0 | (omitted) | | | | |
| black | -15.78194 | 6.300565 | -2.50 | 0.017 | -28.60054 | -2.963348 |
| hispanic | -6.167272 | 6.489573 | -0.95 | 0.349 | -19.37041 | 7.035864 |
| asian | -25.76214 | 24.12569 | -1.07 | 0.293 | -74.84622 | 23.32194 |
| nativeamericanalaskiannative | 27.15815 | 20.31695 | 1.34 | 0.190 | -14.177 | 68.4933 |
| nativehawaiianpacificislander | 43.70535 | 70.88541 | 0.62 | 0.542 | -100.5121 | 187.9228 |
| other | -14.28381 | 43.21629 | -0.33 | 0.743 | -102.208 | 73.64039 |
| depression18 | 35.50554 | 51.4399 | 0.69 | 0.495 | -69.14973 | 140.1608 |
| substanceabuse2018 | 19.11284 | 34.58695 | 0.55 | 0.584 | -51.25483 | 89.48051 |
| _cons | 12.53957 | 36.30227 | 0.35 | 0.732 | -61.31797 | 86.3971 |

Other important determinants of suicide mortality include ethnicity variables and regional variables. This paper finds that the Western states have significantly higher levels of suicide mortality than Northeastern states (*p-value* < 0.01). This paper also finds that relative to the White population, the Black population has significantly lower levels of sucide mortality (*p-value* < 0.05). The variable Northeast was omitted from the regression due to perfect collinearity.

**Diagnostic Tests:**

Throughout this study, we made multiple assumptions regarding the errors within

the residuals. In this section, we will test the no heteroskedasticity, no multicollinearity, omitted variables bias, and normal residuals assumptions.

1. **Breusch-Pagan Test (Satisfied)**

Table 3 below shows the regression results of a Breusch-Pagan test. Models that suffer from heteroskedasticity (i.e. when the residuals have unequal spread) can produce unreliable estimated t-values. In order to test for heteroskedasticity, we conducted a Breusch-Pagan test. The null hypothesis ($H_0$) is that the model is homoskedastic and the alternative hypothesis ($H_A$) is that the model suffers from heteroskedasticity.

Table 3. Breusch-Pagan Test Results

```
. regress s1s minwage20 uninsured2018 poverty2018kff medianannualincome2017 west
>  south midwest northeast black hispanic asian americanindianalaskanative nativ
> ehawaiianotherpacificisland other hs2018 substanceabuse2018 depression2018
note: northeast omitted because of collinearity
```

| Source | SS | df | MS | Number of obs | = | 50 |
|---|---|---|---|---|---|---|
| | | | | F(16, 33) | = | 0.85 |
| Model | 132.154351 | 16 | 8.25964692 | Prob > F | = | 0.6267 |
| Residual | 321.206493 | 33 | 9.7335301 | R-squared | = | 0.2915 |
| | | | | Adj R-squared | = | -0.0520 |
| Total | 453.360844 | 49 | 9.25226212 | Root MSE | = | 3.1199 |

| s1s | Coef. | Std. Err. | t | P>\|t\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| minwage20 | -.3314133 | .3494955 | -0.95 | 0.350 | -1.042467 | .3796408 |
| uninsured2018 | -.2352762 | .2337332 | -1.01 | 0.321 | -.71081 | .2402576 |
| poverty2018~f | .2002321 | .5349982 | 0.37 | 0.711 | -.8882298 | 1.288694 |
| medianan~2017 | .0000766 | .0001752 | 0.44 | 0.665 | -.0002797 | .000433 |
| west | -2.365749 | 2.087864 | -1.13 | 0.265 | -6.61354 | 1.882042 |
| south | -1.128612 | 2.069364 | -0.55 | 0.589 | -5.338764 | 3.081541 |
| midwest | .8840722 | 1.728353 | 0.51 | 0.612 | -2.632288 | 4.400432 |
| northeast | 0 | (omitted) | | | | |
| black | 1.724695 | 9.572344 | 0.18 | 0.858 | -17.75039 | 21.19978 |
| hispanic | 16.71473 | 8.52798 | 1.96 | 0.058 | -.6355712 | 34.06504 |
| asian | -62.87378 | 41.07252 | -1.53 | 0.135 | -146.4364 | 20.68888 |
| americanind~e | -37.19578 | 32.73189 | -1.14 | 0.264 | -103.7893 | 29.39774 |
| nativehawai~d | 43.89799 | 127.7347 | 0.34 | 0.733 | -215.9803 | 303.7762 |
| other | 108.1719 | 73.627 | 1.47 | 0.151 | -41.62337 | 257.9671 |
| hs2018 | -16.38407 | 21.78164 | -0.75 | 0.457 | -60.69915 | 27.93101 |
| substanc~2018 | 29.36436 | 58.53955 | 0.50 | 0.619 | -89.73526 | 148.464 |
| depressi~2018 | 39.73944 | 82.32838 | 0.48 | 0.632 | -127.7589 | 207.2378 |
| _cons | -2.198448 | 20.0582 | -0.11 | 0.913 | -43.00717 | 38.61027 |

Table 3 above shows this regression has a p-value of 0.63 which is not statistically significant (*p-value* > 0.10). Therefore, we would fail to reject $H_0$, concluding that there is no evidence to suggest the model suffers from heteroskedasticity.

**2. Variance Inflation Factor (VIF) Test (Failed)**

The VIF test checks for whether there is multicollinearity within the model. If

the model suffers from multicollinearity (i.e. a near perfect linear relationship between two or more variables), the regression estimates and standard errors for coefficients would be unstable and potentially inflated. If a variable has a VIF greater than 10, then the variable could be considered as a linear combination of other independent variables.

Table 4. VIF Test Results

```
. vif
```

| Variable | VIF | 1/VIF |
|---|---|---|
| asian | 28.36 | 0.035261 |
| nativehawa~d | 17.31 | 0.057775 |
| other | 17.31 | 0.057781 |
| mediana~2017 | 15.01 | 0.066639 |
| poverty201~f | 12.32 | 0.081139 |
| south | 4.79 | 0.208914 |
| americanin~e | 4.58 | 0.218424 |
| west | 4.31 | 0.232108 |
| black | 4.13 | 0.242205 |
| hispanic | 4.09 | 0.244750 |
| hs2018 | 3.65 | 0.273921 |
| uninsur~2018 | 3.51 | 0.285003 |
| depress~2018 | 2.99 | 0.334904 |
| midwest | 2.80 | 0.357282 |
| minwage20 | 2.54 | 0.393222 |
| substan~2018 | 2.06 | 0.484548 |
| Mean VIF | 8.11 | |

Table 4 above shows the results of a VIF test run on the regression of the original empirical model. As Table 4 describes, the variables *Asian, Native Hawaiian/Pacific Islander, Other, Median Income,* and *Poverty* have a VIF greater than 10. This is most likely due to statistical and rounding errors when calculating the *Race* variable

percentages, as the *Race* variables should be perfectly correlated. Additionally, the *Median Income* and *Poverty* variables are negatively highly correlated because as the median income increases, poverty tends to decrease. To correct the multicollinearity issues described in the VIF test, we will run a regression in Alternative Specifications with the *Native Hawaiian/Pacific Islander, Native American/ Native Alaskan,* and *Other* variables collapsed into one single variable.

### 3. Skewness-Kurtosis All Normality Test (Satisfied)

Normality of residuals is required for valid hypothesis testing to ensure that the p-values for t-tests and F-tests will be valid. To test the normality of the residuals, the Skewness-Kurtosis All Normality test is employed. The null hypothesis ($H_0$) is that the model has normal residuals and the alternative hypothesis ($H_A$) is that the model does not have normal residuals.

Table 5. Skewness-Kurtosis All Normality Test Results

```
. sktest suiciderate18

Skewness and kurtosis tests for normality
                                                    ——— Joint test ———
    Variable |       Obs   Pr(skewness)   Pr(kurtosis)   Adj chi2(2)  Prob>chi2
-------------+------------------------------------------------------------------
suiciderate18 |        50         0.5721         0.2760          1.58     0.4541
```

Table 7 above analyzes the dependent variable, *Suicide Mortality*, and finds a p-value of 0.4541 which is not statistically significant (*p-value* > 0.10). Therefore, we

fail to reject $H_0$ and conclude that the test is satisfied.

4. **Ramsey Regression Equation Specification Error Test (RESET)(Satisfied)**

RESET tests whether non-linear combinations of the fitted values help explain the dependent variable. If this is the case, the model may not be correctly specified and the data generating process may be better approximated using another non-linear functional form. The null hypothesis ($H_0$) is that the model is correctly specified and the alternative hypothesis ($H_A$) is that the model is not correctly specified.

Table 6. RESET Results

```
. ovtest

Ramsey RESET test using powers of the fitted values of suiciderate18
       Ho:  model has no omitted variables
                  F(3, 33) =      1.29
                  Prob > F =      0.2951
```

Table 6 above shows that the p-value for this test is 0.2951 which is not statistically significant (*p-value* > 0.10). Therefore, we fail to reject $H_0$ and conclude that there is no evidence that this model is incorrectly specified.

***Alternative Specifications:***

The results presented in Table 2 may have unstable and inflated coefficients due to

the degree of multicollinearity found during the VIF test in Table 4. Thus, the model is re-run with the variables *Native Hawaiian/Pacific Islander*, *Native American/Native Alaskan*, and *Other* collapsed into a new variable, *Other Total*.

Table 7. Alternative Regression Results

```
. regress suiciderate18 minwage20 uninsured2018 medianannualincome2017 west south midwest
>  northeast black hispanic asian othertotal hs2018 substanceabuse2018 depression2018
note: northeast omitted because of collinearity
```

| Source | SS | df | MS | Number of obs | = | 50 |
|---|---|---|---|---|---|---|
| | | | | F(13, 36) | = | 21.35 |
| Model | 882.876702 | 13 | 67.9135925 | Prob > F | = | 0.0000 |
| Residual | 114.528308 | 36 | 3.1813419 | R-squared | = | 0.8852 |
| | | | | Adj R-squared | = | 0.8437 |
| Total | 997.40501 | 49 | 20.3552043 | Root MSE | = | 1.7836 |

| suiciderate18 | Coef. | Std. Err. | t | P>\|t\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| minwage20 | -.4166529 | .1855132 | -2.25 | 0.031 | -.7928911 | -.0404148 |
| uninsured2018 | .1763649 | .1250282 | 1.41 | 0.167 | -.077204 | .4299338 |
| medianannualincome2017 | -.0000587 | .0000496 | -1.18 | 0.244 | -.0001594 | .0000419 |
| west | 6.1339 | 1.155251 | 5.31 | 0.000 | 3.790942 | 8.476857 |
| south | 1.003402 | 1.157325 | 0.87 | 0.392 | -1.343761 | 3.350566 |
| midwest | .1658232 | .9431964 | 0.18 | 0.861 | -1.747068 | 2.078714 |
| northeast | 0 | (omitted) | | | | |
| black | -17.02616 | 4.507193 | -3.78 | 0.001 | -26.16717 | -7.885148 |
| hispanic | -6.713546 | 3.935461 | -1.71 | 0.097 | -14.69503 | 1.26794 |
| asian | -35.10423 | 8.180294 | -4.29 | 0.000 | -51.69464 | -18.51382 |
| othertotal | 17.162 | 8.575057 | 2.00 | 0.053 | -.2290205 | 34.55302 |
| hs2018 | 11.51951 | 12.29866 | 0.94 | 0.355 | -13.42332 | 36.46234 |
| substanceabuse2018 | 27.60653 | 31.88991 | 0.87 | 0.392 | -37.06921 | 92.28227 |
| depression2018 | 18.36804 | 40.51834 | 0.45 | 0.653 | -63.80697 | 100.543 |
| _cons | 16.58496 | 8.51796 | 1.95 | 0.059 | -.6902643 | 33.86018 |

Table 8. VIF Test 2

```
. vif
```

| Variable | VIF | 1/VIF |
|---|---|---|
| mediana~2017 | 10.59 | 0.094388 |
| poverty201~f | 9.64 | 0.103773 |
| south | 4.60 | 0.217518 |
| black | 4.11 | 0.243602 |
| west | 4.06 | 0.246217 |
| hispanic | 4.03 | 0.248333 |
| othertotal | 3.79 | 0.263655 |
| hs2018 | 3.62 | 0.276539 |
| asian | 3.53 | 0.283144 |
| uninsur~2018 | 3.38 | 0.296003 |
| midwest | 2.61 | 0.383145 |
| minwage20 | 2.41 | 0.415387 |
| depress~2018 | 2.23 | 0.447538 |
| substan~2018 | 1.97 | 0.506427 |
| Mean VIF | 4.33 | |

Table 7 and 8 above shows the multiple linear regression analysis as well as the VIF test of the independent variables on *Suicide Mortality* with the new independent variable, *Other Total.* The VIF variables are now all less than 10 with the exception of *Median Income*. However, *Median Income's* VIF is close to 10 and the Mean VIF is well below 10, therefore we will leave the variable in.

Regression results in Table 7 above still show a negative relationship between minimum wage and suicide mortality. However, in this model, suicide mortality decreases by approximately 0.42 people per 100,000 and it's significance level has

decreased (*p-value* < 0.05).

Western states have significantly higher levels of suicide mortality relative to Northeastern states, which is identical with the results in Table 2 (*p-value* < 0.01). Furthermore, the Black population still has significantly lower levels of suicide mortality; the significance level has decreased (*p-value* < 0.01).

Table 7 also finds that both the Asian population (*p-value* < 0.01) and the Hispanic population (*p-value* < 0.10) have significantly lower levels of suicide mortality relative to the White population. This paper also finds that the *Other Total* variable has statistically higher levels of suicide mortaltiy relative to the White population (*p-value* < 0.10).

Lastly, the goodness of fit increased to 0.8852 which indicates that more of the variance in suicide mortality can be attributed to the explanatory variables in the regression in Table 7 (R-squared = 0.8852). The increase in significance of the race variables as well as the increase in the R-squared values may be a result of decreasing the number of explanatory variables. This regression gives us confidence that empirical results are not sensitive to combining *Race* variables.

**Conclusions and Policy Implications**

Empirical results show that minimum wage rates are an important determinant in suicide mortality. This result is consistent with Kauffmen et. al (2019) and Gertner et. al (2019) that found decreases in suicide mortality for every one dollar increase in minimum wage in both their difference-in-differences model. Therefore, increasing the

minimum wage should be a priority for state governments and public health officials. Such policy interventions may include an increase to the federal mandated minimum wage and incentivising companies to pay above minimum wage.

It is important to note that while there is a federal mandated minimum wage not every recipient qualifies. For example, tipped workers (e.g. restaurant servers) receive a starting federal minimum wage of as little as $2.13 an hour. Furthermore, several demographics earn a subminimum wage; full-time (i.e. college students) and student-learners (i.e. high school students) earn as little as 85% and 75% of the state minimum wage, respectively (Department of Labor). Disabled individuals are also entitled to a subminimum wage which is determined relative to employees of the same job. Other policy interventions may include mandating all minimum wage employees be entitled to the state minimum wage (or federal if no state minimum is adopted) and increasing the minimum wage required for tipped workers.

**Limitations**

The results of this study are not without limitations. First, this study used state-level data as opposed to individual-level data; studies using individual-level data would “provide additional opportunities to examine heterogeneous effects” (Gertner et. al, 2019, p.653). Furthermore, because this study was conducted at the state-level, gender data could not be factored into the regression analysis, though previous literature suggests that gender is an important determinant (Dow et. al, 2019, p. 10).

Though the model passed the RESET Test, it does not guarantee that the model is the best model, only that the model is adequate according to the RESET diagnostic.

Furthermore, while this study controlled for depression and substance abuse, there are several other mental illnesses that are not included in the model that could be possible confounding variables. The inclusion of other independent variables regarding mental illness and substance abuse may create a better model and increase R-squared.

While this model found that the Black, Asian, and Hispanic populations have statistically lower suicide mortality rates relative to the White population, there is evidence to suggest that female and minority suicide data have been "systematically under-reported" or "accidentally classified as accidents," which may have affected the results of this study. (Smith and Kawachi, 2015, p. 274). Additionally, while the model found that the *Other Total* variable had statistically higher rates of suicide mortalitity relative to the White population, because the variable grouped several other ethnicities, the model cannot discern which ethnicity is driving these results. Future studies with better data on racial groups, different genders, and the intersectionalities between the two can narrow down the true effect of minimum wage on suicide mortality.

References:


Ahern, J. Minimum wage policy protects against suicide in the USA. (2020). *J Epidemiol Community Health.* 74, 873-874.

American Foundation for Suicide Prevention. (2020, July 29) Suicide Statistics. https://afsp.org/suicide-statistics/.

Centers for Disease Control and Prevention (2020, April 21) Preventing Suicide, Violence Prevention, Injury Center. Retrieved October 7, 2020 from, https://www.cdc.gov/violenceprevention/suicide/fastfact.html.

Dow, W. et. al (2020). Can labor market policies reduce deaths of despair? *Journal of Health Economics.* 74, 1-19. https://doi.org/10.1016/j.jhealeco.2020.102372

Gertner et. al (2019). Association between state minimum wages and suicide rates in the U.S. *American Journal of Preventive Medicine.* 56(5), 648-654.

Hedegaard, H. et. al (2020). Increase in suicide mortality in the United States, 1999-2018. NCHS Data Brief, No. 362, 1-8.

Kauffman, J. et. al (2019) Effects of increased minimum wages by unemployment rate on suicide in the USA. *J Epidemiol Community Health.* 74(3), 219-224. doi:10.1136/jech-2019-212981

Smith, N. & Kawachi, I. (2014). State-level social capital and suicide mortality in the 50 U.S. states. *Social Science & Medicine.* 120(1), 269-277.

Thompson, R. et. al (2016). Substance use disorders and poverty as prospective predictiors of adult first-time suicide ideation or attempt in the United States. *Community Mental Health Journal.* 53, 324-333.

World Health Organization. (2019). Suicide. Retrieved October 7, 2020 from, https://www.who.int/news-room/fact-sheets/detail/suicide.