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Does Money Buy Enough Happiness: Investigating the Relationship Between Income and Suicide Rates

Addison Liang & Emily Su | Dr. Tat Chan, Advisor

Abstract

The number of suicides documented across the United States has been steadily increasing for several decades, despite there being a decrease globally. Our research explores the effect that household income may have on this counterintuitive relationship by using data from the U.S. Census Bureau and the Centers for Disease Control and Prevention's National Center for Health Statistics from 2010 - 2019. Our Fixed Effects regression model will identify causal relationships within our panel data set and illustrate how suicide rates fluctuate with household income and demographics. We predict that median household income will have a negative association with the average number of suicides across United States counties. This analysis prompts further questions of how policymakers and activists can address the causes of the increasing number of suicides within the United States.

I. Background

According to the Centers for Disease Control and Prevention, suicide rates have increased by 30 percent from 2000 - 2018. Though there was a decline in suicide rates in 2019 and 2020, suicide was still the second leading cause of death for those aged 10-14 and 25-34 in 2020 (CDC 2022). For these reasons, suicide has become a leading public health concern that affects the whole population, with some groups seeing higher suicide rates than others. Of the possible contributing factors, the effect of income on well-being has been well-researched in the 21st century, largely due to a heavier emphasis on understanding mental health and its contributors.

Literature Review

The existing academic research serves as a basis for our research in several ways. Näher et al. (2020) studied the association between suicide rates and socioeconomic status and social isolation. The researchers collected suicide data from German death records for the observed period of 1997 - 2020 and found that district suicide rates decreased by 0.39 percent for every percentage point that income increased. Their findings also showed that the inverse relationship between socioeconomic status and suicide rates were partially confirmed by unemployment and income effects. The resulting associations between socioeconomic status and social isolation is certainly influential in understanding the relationship between socioeconomic levels

and suicide rates. However, it is focused on data collected in Germany, and the findings cannot be generalized to other countries due to geographic, demographic, social, and economic differences, among several others.

Killingsworth (2021) explored the relationship between earnings and well-being by using data from an online platform that collected information from 33,391 employed, working-age adults. The platform, trackyourhappiness.org, evaluated how the respondents felt at any given time and collected self-reported household income. The researcher found that larger incomes were associated with more positive well-being, and that there was a clearly linear relationship between $\log(\text{income})$ and experienced well-being. Furthermore, this positive linear relationship continued past income levels of \$75,000, which contradicts precedent studies that found that the relationship plateaued past this point. A few reasons for this are that the scale used to measure well-being was more comprehensive and non-dichotomous, and that the online platform which collected information on well-being recorded information in real-time, as opposed to after a few hours or days. However, because the analyzed data was dependent on participants that chose to opt-in to the online platform, the data collected was inherently unrepresentative of the larger United States population. Additionally, self-reported information can encourage participants to answer questions in a way that may be more socially acceptable, even if not completely honest.

Finally, Koivumaa-Honkanen et al. (2003) researched the relationship between self-reported unhappiness and suicide by sampling a group of 29,067 Finnish adults. The researchers' conclusions suggest that the risk of suicide increased with self-reported unhappiness. There were also associations with unhappiness and older age, male gender, illnesses, alcohol consumption, and more. While this research is not focused on adults in the United States, the strong association between self-reported unhappiness and subsequent suicides, combined with the extensive body of literature exploring the relationship between income and well-being, suggest that exploring how income affects suicide rates could result in beneficial findings.

Increasing Suicide Rates

Against the backdrop of a global decline in suicide rates, largely driven by countries like China and India (Newman 2019), the rising suicide rates in the U.S. have begun to draw more attention from researchers who hope to better understand why this trend is occurring.

As such, this paper is focused on the effect that median household income levels have on suicide rates. As compared to some of the past research done in this area of interest, our research has a few key differences. First, our paper will utilize data collected by the U.S. Census Bureau and the CDC Wonder Database. Especially by using information provided by the census, which U.S. residents are legally bound to answer, the data compiled is more reflective of the U.S. population as compared to data collected solely from voluntary participants. Additionally, the data collected by the CDC is based on the death certificates for U.S. residents, which allows us to avoid the pitfalls of working with self-reported data. Another major differentiator of this research is that it is focused on U.S. residents and their income and suicide rates. As mentioned before, suicide rates within the United States are increasing steadily – this worrying trend encourages researchers to home in on the suicide rates seen within the United States, especially within the last decade.

II. Hypothesis

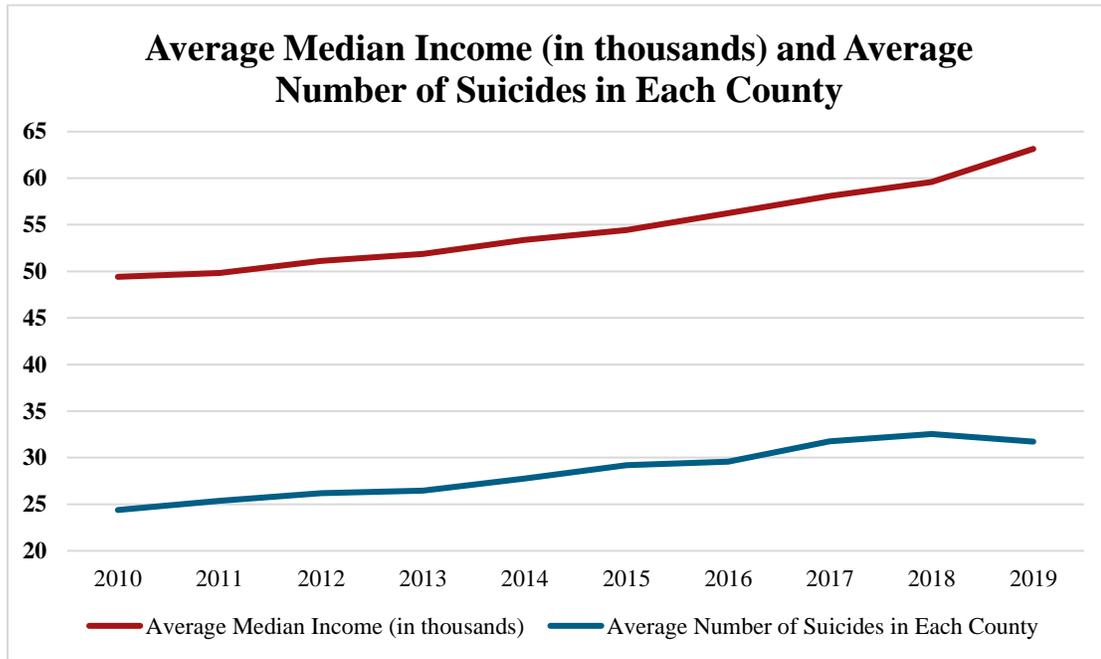
We hypothesize that suicide rates may be negatively correlated with median household income. Individuals with higher incomes have a greater ability to afford mental health resources, especially in times of need. Moreover, past studies have shown associations between financial uncertainty and short-term suicide risk (Vandoros et al. 2018). Individuals with higher incomes may also have greater educational attainment, which could also have a negative correlation with average suicide rates across the United States.

Our regression model will explore these phenomena by testing the effects of median household income and average educational attainment on suicide rates across counties within the United States. We believe that these findings will be valuable to mental health advocates seeking to implement suicide prevention policies, as well as leaders within the public health sector looking to align legislative policies with the needs of the public. Finally, we believe that this study could be beneficial to the greater public; with more media and social attention being turned to the mental health space, the findings within this study could increase awareness and encourage further research in understanding the causes of suicide risks within the United States population.

III. Data

The panel data we collected were from two main data sources, the CDC Wonder Database and the US Census Bureau. All data was observed across 10 years, from 2010 - 2019. Census data is collected once every 10 years and covers nine census divisions that lie within four census regions. Our data was collected based on counties, which according to the Census are the “primary legal divisions of most states” (Bureau 2021). In any given year, there are typically over 3,100 counties; after every federal decennial census, all election district boundaries are to be redrawn. However, redistricting can occur more often than this based on the states’ own constitutional provisions (Williams 2021). As such, the number of counties varied by year within our compiled dataset.

Figure 1: Average Median Income and Average Number of Suicides in Each US County Over Time



Suicides and Median Income

Suicide data was obtained through the Centers for Disease Control and Prevention, National Center for Health Statistics, which defines suicide as death that was caused by intentional self-harm (CDC 2022). The data also includes crude rates and age-adjusted rates, which represent the number of deaths reported each year per 100,000 population and the crude rate that would have been calculated if the population had a “standard” age distribution, respectively. There were 11,092 points of suicide data and 5,611 points of crude and age-adjusted rates. Data was not available for all requested years, largely due to county line boundary changes between 2010 and 2019. Crude and age-adjusted rates were deemed “Unreliable” when the rate calculated included a numerator of 20 or less.

Our source of median household income was the US Census Bureau. The data was collected by year, by county, from 2010 to 2019, and for each year, there were just over 3,190 points of median household income data collected. We also included the poverty estimate, determined by a set of money income thresholds that vary by family size and composition, set by

the Census Bureau. Poverty thresholds are adjusted for inflation using the Consumer Price Index, but do not vary geographically. Additionally, the income threshold does not account for taxes, capital gains, or noncash benefits, like Medicaid, food stamps, or public housing.

The full data set includes only information that is complete. For instance, if we had information on the number of suicides that occurred in a county, but not median income, that county was not included in the final data set for that year. Below are descriptive statistics for both the suicide and median income data sets.

Figure 2: Suicide and Median Income Data

<i>Suicides</i>	
Mean	35.56
Standard Error	0.50
Minimum	10
Maximum	507

Figure 3: Suicide and Median Income Data

<i>Median Income</i>	
Mean	54961.92
Standard Error	163.59
Minimum	25205
Maximum	151806

Figure 1 illustrates median income and suicide data overlaid over 2010 - 2019. From 2010 - 2017, both mean income and the number of suicides followed similar increasing trends.

Demographics

Our source of demographic data was the US Census Bureau from 2010 - 2019. The census data encompassed population estimates by age, sex, race, and Hispanic origin. In the end, we chose to include the total percentage of male and female respondents to study how gender could play a role in the overall research.

Figure 4: US Gender Demographics

	<i>% Male</i>	<i>% Female</i>
2010	0.444	0.460
2011	0.445	0.461
2012	0.448	0.464
2013	0.451	0.467
2014	0.452	0.466
2015	0.454	0.469
2016	0.458	0.472
2017	0.460	0.473
2018	0.463	0.476
2019	0.465	0.478

According to the Census Bureau’s Race Summary File Methodology, a specified race response is a response of at least one of the Office of Management and Budget’s (OMB) five race categories: White; Black or African American;

American Indian and Alaska Native; Asian; Native Hawaiian and Other Pacific Islander. As such, we chose to work with these race categories and removed non-specified race responses of “Some other race.”

Like the suicide and income data, this data set only includes data points if all information is complete. Below Figure 3 shows percentage breakdowns of the reported gender groups relative to the total population of each given year between 2010 and 2019; because of non-responses the sum of male and female does not equal 100 percent, but we do not believe this affects our analysis. Below is the percentage breakdown of the chosen racial groups relative to the total population of each given year between 2010 - 2019.

Education

Our source of education data was US Census Bureau from 2010 to 2019. We chose to focus on the percentage of the population who has earned a bachelor’s degree or higher. Like the other data sets, this data set only includes data if all information is available. Below in Figure 5 are the descriptive statistics of university graduates for all counties within all states between 2010 and 2019.

Figure 5: Percent of US Population with a Bachelor’s Degree or Higher

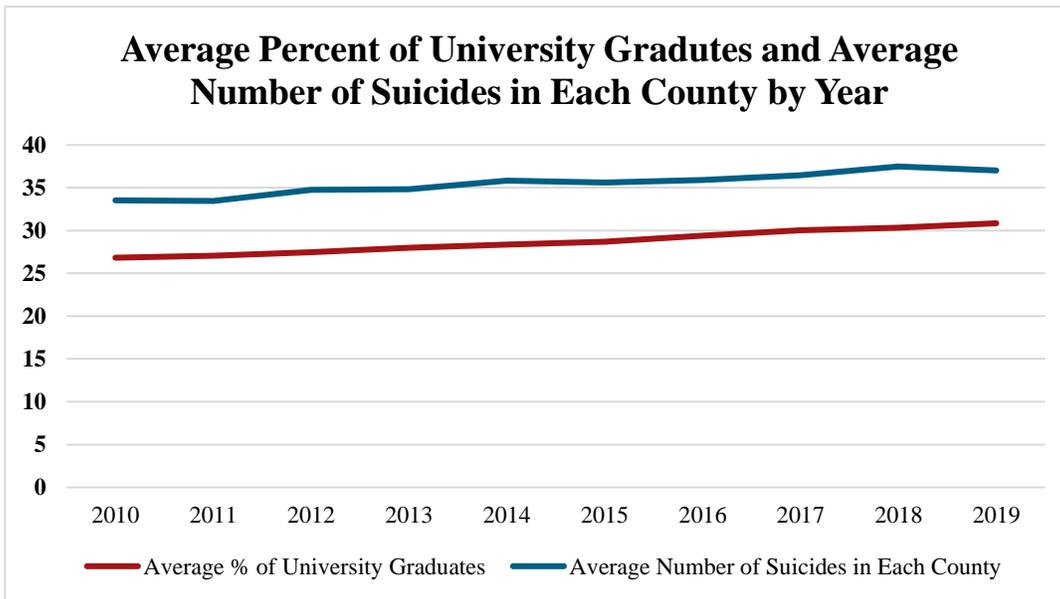
<i>Education</i>	
Mean	0.2874
Standard Error	0.0013
Minimum	0.0730
Maximum	0.7620

Illustrated on the following page in Figure 7 is the average number of suicides by year across all counties plotted with the average number of university graduates across all counties.

Figure 6: US Race Demographics

	<i>% White</i>	<i>% Black or AA</i>	<i>% AIAN</i>	<i>% Asian</i>	<i>% NHPI</i>	<i>% Hispanic</i>
2010	0.776	0.089	0.010	0.016	0.001	0.057
2011	0.779	0.090	0.010	0.016	0.001	0.058
2012	0.779	0.091	0.010	0.017	0.001	0.061
2013	0.786	0.092	0.010	0.017	0.001	0.063
2014	0.783	0.092	0.011	0.018	0.001	0.063
2015	0.786	0.094	0.011	0.018	0.001	0.066
2016	0.793	0.093	0.011	0.018	0.001	0.069
2017	0.797	0.092	0.011	0.018	0.001	0.070
2018	0.800	0.095	0.010	0.019	0.001	0.073
2019	0.799	0.096	0.012	0.019	0.001	0.075

Figure 7: Educational Attainment and Average Number of Suicides in Each US County Over Time



IV. Methodology

To test our hypothesis, we ran a series of different regressions utilizing suicide rate by county as the dependent variable. Our analysis primarily sought to evaluate the relationship between suicide rate and median household income, but we also included poverty rate, defined as the number of people below the poverty threshold in each county per 100,000,

racial demographics, and education rates as additional independent variables. To minimize collinearity, we excluded male and white demographic data from our analysis, meaning that white male suicide rates are our reference for each regression.

We ran three main types of regressions to test our hypothesis. First, as a preliminary test, we performed a multiple linear regression including

suicide rate, median income, poverty rate, demographic characteristics, and college education rates to determine if there was a relationship between our independent and dependent variables. This analysis excluded data regarding county and year. Then, we constructed a Fixed Effects Model to try and identify any causal relationship between variables to examine how suicide rates changed with income and demographic factors across US counties from 2010-2019. Since we collected panel data, we used an Ordinary Least Squares (OLS) regression to evaluate our hypothesis. Finally, we created an OLS Fixed Effects Model with interaction terms to further our understanding of the relationship between suicide rates, median income, poverty rates, demographic characteristics, and percent of college educated population. In these Fixed Effects Models, we control for county and year differences since systematic differences across counties and years are not included as independent variables and could thus bias our results. These unobserved factors are accounted for by the Fixed Effect Models and allow us to determine the causal effect of income and education on suicides.

V. Findings

The results of our analysis highlight an unexpected relationship between suicide rates and median income in the US. While the results of the multiple linear regression, which do not consider the effect of county or year, after accounting for county and year fixed effects, we find a significant, positive correlation between these two variables and suicide rates.

Multiple Linear Regression

Findings from our preliminary multiple linear regression (Figure 8) support our hypothesis. From our data, there is a highly significant, negative relationship between median income and suicide rates: on average, a \$100,000 increase in median income in a county corresponds with 9 fewer suicides per 100,000 residents. This regression also indicated there is a highly significant and negative relationship between college education and suicide rates, as predicted by our hypothesis. A one percent increase in the percent of college-educated population in a county corresponds with 6 fewer suicides per 100,000 residents. Both results are consistent with our hypothesis.

Figure 8: Multiple Linear Regression

	<i>Estimate</i>	<i>Std. Error</i>	<i>T-value</i>	<i>P-value</i>	
Intercept	24.89000	0.93540	26.6080	< 2.0e-16	***
Median Income	-0.00009	0.00001	-10.7820	< 2.0e-16	***
Poverty Rate	-21.50000	2.34000	-9.1910	< 2.0e-16	***
% Female Population	3.82900	1.21900	3.1400	0.00170	**
% Black Population	-9.30500	0.56710	-16.4070	< 2.0e-16	***
% AIAN Population	19.75000	1.59800	12.3610	< 2.0e-16	***
% Asian Population	-52.90000	3.30500	-16.0060	< 2.0e-16	***
% NHPI Population	198.80000	13.12000	15.1490	< 2.0e-16	***
% College Educated	-5.98800	0.82790	-7.2320	5.3e-13	***

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
 Residual standard error: 4.441 on 6487 degrees of freedom
 Multiple R-squared: 0.269 | Adjusted R-squared: 0.2681
 F-statistic: 298.4 on 8 and 6487 DF | p-value: < 2.2e-16

Figure 9: Fixed Effect Model Excluding Education

	<i>Estimate</i>	<i>Std. Error</i>	<i>T-value</i>	<i>P-value</i>	
Median Income	0.000126	0.00001	9.9584	< 2.0e-16	***
Poverty Rate	-1.808900	3.46280	-0.5224	0.60143	
% Female Population	12.011000	4.00870	2.9963	0.00274	**
% Black Population	-2.102700	4.84420	-0.4341	0.66425	
% AIAN Population	95.781000	26.71800	3.5849	0.00034	***
% Asian Population	39.047000	18.92300	-2.0635	0.03910	*
% NHPI Population	-5.98800	0.82790	-7.2320	5.3e-13	***

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
 Total Sum of Squares: 59898 | Residual Sum of Squares: 55240
 R-Squared: 0.077771 | Adj. R-Squared: -0.039008
 F-statistic: 34.7255 on 14 and 5765 DF | p-value: < 2.22e-16

Fixed Effect Model

After accounting for county and year fixed effects, the coefficient of the median income estimate becomes positive and remains highly significant. We ran multiple different regressions (Figures 9, 10, 11) and all depicted the same effect indicating the relationship between median income, suicide rate, and educational attainment is more complex than we first thought, since the Fixed Effect Models are more reliable than the Multiple Linear Regression as they control for more unobserved factors.

The results from Fixed Effect Model excluding educational attainment data (Figure 9) indicate that a \$100,000 increase in median income corresponds to a 12.6 increase in suicide rate. The percent of female population in counties is also significantly positively correlated with suicide rates; a one percent increase in female population corresponds to an increase of 12.0 in suicide rate. This contradicts precedent research suggesting that male gender is more strongly associated with suicide, but there could be a few explanations for this discrepancy. First, the gender data we were working with did not sum up to 100 percent, and this difference could have impacted our final findings. Some racial

demographics are also significant; a county with one percent more American Indian and Alaska Native population, compared to White population, would have 95.8 additional suicides. Similarly, a one percent increase in Asian population corresponds to an increase in suicide rate of 39.0, though this relationship is only weakly significant. The percent of Native Hawaiian and Pacific Islander population is negatively correlated with suicide rate, and one percent increase in Native Hawaiian and Pacific Islander population correlates with 6.0 fewer suicides per 100,000. Poverty rate and the percentage of Black population were not significant in this analysis.

We also created a Fixed Effect Model excluding educational attainment data using the natural log of suicide rate, median income, poverty rate, and demographic characteristics to better understand elasticity between our independent and dependent variables (Figure 10) and to perform a robustness check. From this regression, a one percent increase in median income increases suicide rate by 0.413%. Though weakly significant, poverty rate also has a positive correlation with suicide rate: a one percent increase in poverty rate corresponds to a

Figure 10: Logarithmic Fixed Effect Model Excluding Education

	<i>Estimate</i>	<i>Std. Error</i>	<i>T-value</i>	<i>P-value</i>	
ln(Median Income)	0.413003	0.04866	8.4883	< 2.0e-16	***
ln(Poverty Rate)	0.048322	0.02937	1.6456	0.09990	.
ln(% Female Population)	-0.001563	0.09896	-0.0158	0.98740	
ln(% Black Population)	0.050052	0.02044	2.4488	0.01436	*
ln(% AIAN Population)	0.111977	0.04371	2.5616	0.01044	*
ln(% Asian Population)	0.011642	0.02828	0.4117	0.68058	
ln(% NHPI Population)	0.054891	0.02746	1.9988	0.04567	*

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
 Total Sum of Squares: 253.21 | Residual Sum of Squares: 235.67
 R-Squared: 0.06928 | Adj. R-Squared: -0.09669
 F-statistic: 72.2145 on 7 and 6791 DF | p-value: < 2.22e-16

Figure 11: Fixed Effect Model Including Education

	<i>Estimate</i>	<i>Std. Error</i>	<i>T-value</i>	<i>P-value</i>	
Median Income	0.000099	0.00001	6.9538	3.6e-12	***
Poverty Rate	-3.493700	3.53250	-0.9890	0.32271	
% Female Population	10.908000	4.41450	2.4710	0.01350	*
% Black Population	-1.438100	4.74960	-0.3028	0.76208	
% AIAN Population	82.143000	26.10200	3.1470	0.00166	**
% Asian Population	40.873000	17.80000	-2.2963	0.02170	*
% NHPI Population	362.990000	252.17000	1.4395	0.15007	
% College Educated	10.063000	2.68000	3.7547	0.00018	***

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
 Total Sum of Squares: 59898 | Residual Sum of Squares: 56140
 R-Squared: 0.062746 | Adj. R-Squared: -0.054837
 F-statistic: 48.2935 on 8 and 5771 DF | p-value: < 2.22e-16

0.048% increase in suicide rates. The percent of American Indian and Alaska Native population is also still positively correlated with suicide rates. A one percent increase in American Indian and Alaska Native population demographics increased suicide rates by 0.112% compared to the White population. In the logarithmic model, the percent of Black population becomes weakly

significant while the percent of Asian population is no longer significant, and the coefficient of Native Hawaiian and Pacific Islander becomes positive under the logarithmic model. These results indicate that it is unknown if there is a significant difference in suicide rates between Black, Asian, and Native Hawaiian and Pacific Islander populations and the White population.

The Fixed Effect Model including educational attainment (Figure 11) also found a highly significant, positive relationship between median income and suicide rate. From this regression, a \$100,000 increase in median income for a county would correlate to 9.9 more suicides per 100,000 people. Findings also show the percent of people with a bachelor's degree or higher have positive, significant relationship with suicide rates, with a 1% increase in the percent of college educated population corresponding to 10 additional suicides. The percent of American Indian and Alaska Native population also remained positively correlated with suicide rates and significant.

Interaction Terms

Finally, we created a Fixed Effect Model that includes an interaction term to provide more insight on the relationship between the median income and education independent variables. The results are consistent with our prior analyses: in this regression (Figure 12), both median income and college education are highly significant and positively correlated with suicide rates. The coefficient of the interaction term is also

significant but negative, meaning that if median income is significantly higher, the positive relationship between suicide rate and education rate is weaker (though still positive). If median income in a county increases by \$10,000, then the slope of the relationship between the percent of college educated population and suicide rates decreases by 4.53, which is reasonable given that counties with higher median incomes are likely to have a higher percent of college graduates. Therefore, the impact of educational attainment is reduced when there is higher median income.

VI. Discussion

In all Fixed Effect regressions, the income estimate was highly significant, meaning we can reliably infer that there is a positive correlation between income and suicide rates across the US. From our analysis, educational attainment is also highly significant and positively correlated with suicide rates. The estimate for percent of American Indian and Alaska Native population was positive and significant in all regressions as well, indicating

Figure 12: Fixed Effect Model Including Education and Interaction Terms

	<i>Estimate</i>	<i>Std. Error</i>	<i>T-value</i>	<i>P-value</i>	
Median Income	0.000261	0.00002	10.6382	< 2.2e-16	***
Poverty Rate	5.173000	3.67290	1.4084	0.15907	
% Female Population	6.233400	4.42800	1.4077	0.15927	
% Black Population	-1.991100	4.72390	-0.4215	0.67340	
% AIAN Population	75.881000	25.97000	2.9219	0.00349	**
% Asian Population	20.857000	19.27800	1.0819	0.27934	
% NHPI Population	300.170000	250.89000	1.1964	0.23160	
% College Educated	34.891000	4.06640	8.5804	< 2.2e-16	***
Income * Education Interaction	-0.000453	0.00006	-8.0844	7.5e-16	***

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
 Total Sum of Squares: 59898 | Residual Sum of Squares: 55511
 R-Squared: 0.073243 | Adj. R-Squared: -0.043204
 F-statistic: 50.6682 on 9 and 5770 DF | p-value: < 2.22e-16

that suicide rates for American Indian and Alaska Native are higher than that of the White population in counties. In robustness checks, most of the demographic variables had mixed results and were occasionally significant with both positive and negative correlations. Therefore, the relationship between gender and most races on suicide rates is uncertain, as our analysis did not consistently indicate these demographics were more or less likely to commit suicide when compared to our reference population of White males. The R-squared and adjusted R-squared values are low for our regressions, indicating that while our independent variables are significant, they only explain a small amount of variation in suicide rates across US counties over time. While the findings from the Multiple Linear Regression, which do not account for changes in county and year, support the notion that more money, proxied by higher median income, reduces suicide risk, the Fixed Effect Models indicate otherwise. The negative coefficient of the MLR model reflects geographic differences in suicide rates but does not pin down causality. Without accounting for county and year differences, we find that poorer counties have higher suicide rates than richer counties. The driving factors for these differences remains unknown in this model and could be caused by a variety of unobserved political, social, cultural, or religious factors. The Fixed Effect models better account for these unobserved factors and find that, within counties, higher income and education rates correspond with higher suicide rates.

Hypothesis Revisited

Originally, we hypothesized that higher income and educational attainment rates would correspond with lower suicide rates. With additional income, individuals struggling with depression or suicidal thoughts could afford treatment, therefore reducing suicide risk. Additionally, financial distress is noted as a motivation for suicide attempts, so those with higher income would not have this stressor. We also assumed that people with college educations would be more likely to recognize warning signs of suicidal ideation and seek help. While the results from our preliminary model supported this hypothesis, after creating a Fixed Effect model to

account for county and year differences we found the opposite to be true. The Fixed Effect regressions are better able to control for unobserved factors influencing the relationship between variables, so we can reliably reject our hypothesis. These results prove highly interesting and provide new insight on the relationship between money, education, and suicide.

Interpreting Our Findings

Understanding the motivation for suicide is challenging as most research comes relies on self-reported data, but most medical professionals agree that feelings of intense hopelessness, intense need for perfectionism, and a sense of defeat are common emotions experienced by those who have attempted or are considering attempting suicide (Moselli et al. 2021). A 2014 study found that high school students with high socioeconomic backgrounds were more likely to exhibit perfectionistic tendencies (Lyman et al. 2014). Self-oriented perfectionism in adolescents also predicts anxiety and depression to a certain extent (Hewitt et al. 2002). Given both anxiety (Nepon et al. 2010) and depression (Rihmer 2007) are predictors for suicide risk, if perfectionistic tendencies exhibited in children still apply to adults of higher socioeconomic status, there is a possible explanation for the results of our analyses.

Additionally, in recent years, more literature has been published analyzing the relationship between intelligence and mental disorders like depression. Studies have more recently found that higher IQ is associated with a greater risk of receiving a depression diagnosis (Wraw et al. 2016), and that people with high IQs are at increased risk for psychological disorders (Karpinski et al. 2018). These papers support our findings that college education is associated with higher suicide risk since depression and psychological disorders are risk factors for suicide, under the assumption that on average, those who attend college have higher IQs.

Ultimately, our findings complicate efforts reducing suicide rates across the United States. While physician education in identifying depression early is associated with reductions in suicide (Mann et al. 2005), our analysis indicates that those with higher incomes who can more

easily seek treatment still have systematically higher suicide rates. Additionally, many suicide prevention programs rely on education and increasing awareness. However, the efficacy of these methods has not been widely studied (Mann et al. 2005), and the results of our analysis could indicate that education will not meaningfully decrease suicide rates, assuming that those with college degrees are more aware and educated on suicide prevention and risk factors.

Limitations

While this analysis provides a unique perspective into the associations between median household income, education, and suicide rates across counties within the United States, it would be beneficial to consider how the current research's limitations could be improved upon in the future.

The final data set utilized in this study only included counties with fully available information. For instance, if a county had suicide, demographics, and income data, but lacked education data, it was not included in the data set. While we were able to develop a deep understanding of those represented in our data, there was still a significant portion of the population who was left out. There are a few reasons why data could be missing, including under resourced counties that are unable to report on certain variables, or data continuity issues, such as counties that have their lines redrawn, becoming embedded in other counties and losing their individual statuses. Understanding the reasons behind missing data points could bolster the possible explanations of our findings.

Second, while we were able to pull the suicide data directly from the CDC, we recognize that the number of deaths by suicide may be underreported. This is due to the generally negative stigmas surrounding suicides across cultures, religions, nationalities, and other subgroups. As such, even though we found the data provided by the CDC to be the most reliable and objective, the findings of our research could be more or less extreme depending on this discrepancy.

Future Research

The research presented in this paper can be built upon by further exploring demographics and the cost of living. With demographics, future researchers could investigate education from a more multi-faceted perspective and analyze how studying different topics in universities, or how attending different types of universities can affect suicide rates. More broadly, demographic breakdowns within counties to explore how diversity across various communities could add or detract from the number of suicides. There have been many noted benefits of demographic diversity in various aspects of our livelihoods, and there could be a noteworthy relationship between that and suicides that policymakers should be aware of. Besides educational and racial diversity, religious affiliations would also be helpful to understanding the effects of diversity of thought and belief systems. Religious affiliations oftentimes shape individuals' views in more ways than one, and this could subsequently influence suicides as well.

It may also be worthwhile to explore the association between the cost of living and the number of suicides within the United States. Within cost of living, researchers could explore inflation rates and housing prices, as well taxes, healthcare, and other necessities. As this is a common denominator for the entire United States population, realizing the presence or absence of a relationship between the cost of living and suicide could be interesting for policymakers and activists.

Another area for potential further investigation is researching the relationship more specific income brackets and suicide rates. It could be the case that the positive relationship between median income and suicide rates only holds until a certain threshold.

Additionally, future researchers can explore if there is a relationship between the prevalence of feelings like hopelessness, perfectionism, and defeat across counties of different median incomes to try and explain our results further and potentially provide avenues for policymakers to address the rising suicide rates in the US.

Conclusion

Our findings complicate the notion that money can ‘buy’ happiness; under the assumption that happier people are less likely to commit suicide, our analysis shows a strong positive relationship between income and suicide rates across US counties over time. Higher college education rates are also positively correlated with suicide rates, though the relationship between race and gender on number of suicides requires further investigation, with the exception of the percent of American Indian and Alaska Native population, which was also found to have a positive relationship with suicide rates in comparison to the percent of White population in a county. Future studies can aim to identify relationships between other economic factors including cost of living on suicide rates as well as more comprehensive analyses on the impact of demographics on suicide rates. Overall, our results indicate increasing access to mental health resources and suicide awareness education programs are unlikely reduce the number of deaths by suicide, thus highlighting the complexity of addressing rising suicide rates across the US.

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