Conditions behind an Epidemic: Investigating Wage Growth and Opioids in West Virginia

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Abstract

This paper seeks to examine the relationship between economic conditions and opioid mortality in West Virginia. Due to the recent nature of the crisis, there is not an abundance of research regarding potential factors behind the rapid worsening of this crisis. I hypothesize that stagnant economic conditions, in particular employment and wages, are correlated with higher opioid mortality in West Virginia counties because of the prevalence of the coal industry and heightened mental health issues as a result of lack of economic opportunity. The findings indicate that employment and wages alone cannot significantly explain levels of opioid mortality in the state. Potential issues with the data as well as an overall lack of conclusion regarding substantial factors behind the crisis warrant continued research on the issue.
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I. Introduction

The opioid crisis has received much national attention in recent years and for good reason. The leading cause of accidental death in the United States is drug overdose, and opioid overdoses make up an alarming portion of these deaths (American Society of Addiction Medicine 2016). The sudden onset of this crisis is additionally worrisome. The prescribed number of painkillers was four times as much in 2010 as it was in 1999, and admissions into substance abuse facilities have increased six-fold in the same period of time. The number of opioid prescriptions in 2012 was enough for every individual American to have a bottle of pills. The implications for this crisis extend even further—four out of five heroin users began by abusing prescribed painkillers. The magnitude of this crisis in West Virginia is arguably the worst in the nation, with the highest rate of national drug overdoses in 2016, with 52 deaths per 100,000 people (Center for Disease Control and Prevention 2017). While the human implications of this crisis are concerning enough on their own, the economic effects add to the urgent need for remedy. An economist at West Virginia University estimated that the opioid crisis had cost the state almost $1 billion in the form of productivity loss due to fatalities and addiction as well as resources used to address the issue (WVUToday 2017). While various strategies have been proposed and some implemented to address this crisis, policymakers are still working to come up with solutions to prevent future addiction and opioid-related deaths and to fix communities torn apart by the epidemic. For this reason, research on the underlying causes of the epidemic within specific regions is especially important for targeted policy solutions. Therefore, I will be addressing the following question: “Is stagnant wage growth a reliable predictor of opioid overdose death concentration in West Virginia counties?” I hypothesize that stagnant wage growth within West Virginia counties is correlated with higher rates of opioid deaths for two reasons. First, I believe the mental health effects of such economic stagnation can increase rates of addiction in communities. Second, the high rates of disability associated with the dying coal industry likely result in greater opioid prescription. Since the coal industry has garnered national attention for lack of growth, it would seem plausible that negative economic conditions would then be correlated with higher opioid mortality due in part to the prevalence of this industry in certain communities.

Due to the relatively recent nature of the epidemic, there is not much scholarship on how economic conditions affect the rate of opioid overdose deaths. While most existing papers do find varying degrees of correlation between economic variables such as unemployment and median income and these deaths, there is disagreement over how much causality can be attributed to such conditions. Questions of reverse causation exist, as opioid addiction itself can have devastating effects on a community and negatively affect the economy. Some researchers also point out that if economic conditions are a major cause of the crisis, then rates of overdose deaths should be higher for minorities who are generally more affected by economic conditions (Hollingsworth, Ruhm, and Simon 2017). However, this is not the case. These points of uncertainty merit further, more focused research on the topic.

Existing scholarship additionally supports the mental health branch of my hypothesis. There is evidence that poor economic conditions and an increase in mental health issues are correlated (Charles and Decicca 2008). Additionally, there are papers that indicate some prescription
opiates can be used to effectively treat these mental health issues, so there seems to be a foundation to the theory that those affected by poor economic conditions such as stagnant wages turn to opioids to cope with them (Stanciu, Glass, and Penders 2017).

My research will address two important gaps in existing scholarship. First, most existing research looks primarily at the unemployment rate and median income to measure the condition of the economy. While unemployment is inherently tied to wages, there are few papers looking at wage stagnation specifically within these regions. For states like West Virginia that have a major industry that is dying, wage stagnation may measure economic sentiment better than median income differences between counties. By looking at wage growth alongside employment numbers in the region, I can investigate the effect of an indicator that is often left out. In a related manner, looking specifically at West Virginia allows another look at the relationship between economic variables and opioid overdose deaths by considering the role of the coal industry. Within this industry there may be an explanation for economic conditions and stagnant wages being correlated without economic conditions being a primary cause of the epidemic. This is because the coal industry likely has stagnant wages, and opioids are highly prescribed there because of high rates of workplace injury, leading to higher rates of addiction and overdose deaths.

II. Literature Review

Though a good volume of research has been conducted to discern the relationship between economic conditions and alcohol or tobacco use, there is not much scholarship on economic factors as they relate to opioid overdose deaths. One of the reasons for this may be the recent nature of national attention on the epidemic, so I assume that more research will follow. Most of the current literature exists in one of the following forms: regressing opioid overdose deaths on several macroeconomic variables at the state or county level, focusing solely on recessions and drug use at large, or performing a case study of a specific region or locality incorporating various measures of the state of the economy. Below I will address what literature currently exists on the issue and how this research will add to that body in order to better educate policymakers on underlying conditions behind the opioid epidemic as they seek solutions to help those afflicted and prevent further abuse.

One paper identifies a correlation between negative economic conditions such as high unemployment and/or a recession and higher rates of mental health issues (Charles and Decicca 2008). This holds especially true for low-income people and African-Americans. The findings in this study suggest that it is rational to suppose stagnant wage growth and accompanying lack of economic opportunity can form the basis of an environment in which mental health issues are exacerbated. Other studies support this finding, observing a connection between psychological disorders and economically hard times that primarily affect the unemployed, low-income, and less-educated population(s) (Zivin, Paczkowski, and Galea 2011). Since West Virginia has many inhabitants fitting this demographic profile, this finding is particularly significant to this paper.

While it appears that there is evidence linking economic conditions with the advent or exacerbation of mental health issues, what limited scholarship there is on the topic suggests that opioids can be used to better mental health conditions such as depression. One study trying to
 discern if buprenorphine could be used to treat various types of depression found that prescription opioids can give positive results in those dealing with mental health issues (Stanciu, Glass, and Penders 2017). The results were not insubstantial, with major improvements shown over a range of different types of depression within the test group. Despite much research still to be done on this subject, there definitely seems to be foundation for the idea that opioid abuse increases along with the prevalence of mental health issues. The aforementioned findings provide the basis for the hypothesis that stagnant wage growth is correlated with higher rates of opioid overdose deaths, as it seems that economic conditions can affect mental health and opioids can be used to effectively lessen the effects of such disorders.

Most major studies on economic conditions and opioid abuse come to the conclusion that such conditions at least partially contribute to a rise in opioid overdose deaths. One such study found that as county unemployment rates increase by one percent, the opioid death rate per 100,000 people rises by 3.6% (Hollingsworth, Ruhm, and Simon 2017). The study finds that this increase is primarily driven by whites and offers mental health as a potential reason for it. However, the study mentions a potential issue with the economic hypothesis—if minorities are generally the most negatively affected by economic hard times, one might expect to see an increase in opioid abuse in minority populations equal to or greater than that of whites, but the opposite is the case. Another study looked at various indicators of the state of the economy and found that the only one consistently correlated with opioid overdose death rates was median house prices (Brown and Wehby 2017).

As mentioned earlier in the section, many papers look at the effects of economic conditions on substance abuse in general. While there is a good deal of scholarship concerning the relationship between the economy and alcohol and/or tobacco use, there isn’t as much on the economy and drug use, likely because of the lack of availability of data (Carpenter, McClellan, and Rees 2017). While the Carpenter, . study found mixed results when looking at the unemployment rate and overall drug use, it was positively correlated with analgesic use. As reflected in other studies, this increase was primarily in less-educated white males. The paper posits stress as a potential reason for this phenomenon. Another study found no evidence for substance abuse treatment facility admissions increasing during recessions, but that opioid use itself does increase (Cantor, Horn, and Maclean 2013).

Despite most of the literature indicating a connection between economic conditions and opioid overdose deaths, not every paper agreed. One paper challenged the hypothesis that the environment surrounding the addicts and the economic conditions pre-addiction are the primary causes of such deaths. He argues, as mentioned above, that if economic conditions were to blame, minorities would also be affected, and other countries may be experiencing a similar phenomenon (Ruhm 2018). The author presents evidence of reverse causation, that economic causes are overstated and may be more effects of drug use. He ultimately attributes eight percent of opioid overdose deaths to changes in the economy, ruling that economic causes fail to fully or even mostly explain the epidemic.

In this paper I am seeking to add to this body of research by narrowing the study to a state having experienced a unique decline of one of its major industries over recent decades, therefore susceptible to high rates of workplace injury, and that is commonly characterized as possessing a
notable lack of economic opportunity at large. Most policy-making in response to the opioid crisis will take place at the state and local level, so understanding the context for a crisis in one area is particularly important.

III. Data and Empirical Approach

I am using data from two primary sources. First, I am getting my data on opioid mortality rates in West Virginia counties from the National Center for Health Statistics (NCHS) in the Center for Disease Control and Prevention (CDC). I am authorized to access these data after reading and agreeing to the requirements of the Date Use Agreement for Vital Statistics Data Files. The data include the number of people in each West Virginia county since 1999 who had some variety of opioid listed as the cause of death on their death certificate. The data are further broken down by type of opioid (prescription, heroin, etc.), but the only measure used in this analysis is the overall opioid death count. This is because, while I’m most interested in prescription opioid abuse, heroin addicts often start off by abusing prescription drugs and later turn to heroin. Therefore, even though prescription drug overdose isn’t listed on the death certificate of many such addicted peoples who died of opioid overdose, only including prescription opioids would understate the role of prescription opioids in many of these deaths. I am converting the number of opioid deaths by county each year to number of opioid deaths per 100,000 people to correct for population differences.

Secondly, I am getting my county-level employment and wage data from the Quarterly Census of Employment and Wages at the Bureau of Labor Statistics. From this data I am using both percentage change in total covered employment, meaning workers covered under unemployment insurance, and the percentage change in average weekly wage from first quarter 2001 to second quarter 2017. These two measures am using as independent variables together in one regression.

I analyzed the correlation between economics conditions and opioid overdose deaths in West Virginia by running a simple regression in Stata. I first regressed the opioid mortality data from the CDC on both one-year employment percentage change and one-year weekly wages percentage change data from the BLS (2 independent variables). I included dummy variables for both year and county in my regression.

\[
\text{Opioid Mortality per 100,000}_{ic} = \beta_0 + \beta_1 \text{Employment Change}_{ic} + \beta_2 \text{Average Weekly Wage}_{ic} + \beta_3 \text{Year}_i + \beta_4 \text{County}_{c} + \epsilon_{ic}
\]

V. Results

In order to further explore the variables in the regression, I included two figures to better visualize the relationship between our independent variables and opioid mortality. First, a correlation matrix shows general trends (or lack thereof) between variables in Figure I. Two scatterplots isolating both independent variables with opioid mortality are featured in Figure II. Figure I shows that employment gain/loss and average weekly wage gain/loss are positively correlated, confirming an assumption going into the regression. Figure II appears to show a slightly tighter relationship between total employment gain/loss and opioid mortality when
compared to average weekly wage gain/loss, but really reveals no obvious trend between our dependent variable and either of our independent variables.

Figure I. Correlation Matrix between Variables

Figure II. Scatterplot Depicting Relationship between Opioid Mortality and Employment and Average Weekly Wages Respectively

Table I below shows the results of the regression run in Stata. The output is my own, so sources are not needed. The below table includes p-values in parentheses, the adjusted R-squared value for the regression, and F statistic. The coefficients on the two independent variables are negative
as one might expect, meaning opioid deaths increase as total employment decreases from year to year and average weekly wages decline.

Table I. Opioid Deaths per 100,000 Regressed on One-Year Employment Gain/Loss and One-Year Average Weekly Wage Gain/Loss

<table>
<thead>
<tr>
<th></th>
<th>Opioid Mortality</th>
</tr>
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<tbody>
<tr>
<td>One-Year Employment Gain/Loss</td>
<td>-0.263 (0.212)</td>
</tr>
<tr>
<td>One-Year Average Weekly Wages Gain/Loss</td>
<td>-0.178 (0.314)</td>
</tr>
<tr>
<td>Constant</td>
<td>-8.061 (0.154)</td>
</tr>
</tbody>
</table>

Observations 880

Adjusted R-squared 0.514

F 10.67

p-values in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Though the sign of the coefficients previously shown in Table I does support my hypothesis, there seems to be a lack of statistical significance based on the p-values in parentheses below the beta coefficients that will be examined below. An initial look at the coefficients suggests that the magnitude of the effect of our independent variables on opioid mortality per 100,000 people seems reasonable—the employment coefficient suggests that for every one percent increase in employment, opioid mortality per 100,000 decreases by .263 per 100,000 people and so on for wages. However, neither of the coefficients for employment and wages appear to be statistically significant at any reasonable significance level based on their t statistics of -1.25 and -1.01, respectively. All three of our p-values seen in Table 1 (above) are too high to be significant at the 95%, 99%, 99.9%, etc. levels. This means that we fail to reject the null hypothesis that the coefficients are not zero at all reasonable significance levels.

Figure III depicts the relationship between predicted opioid mortality per 100,000 people based on the linear regression performed with the actual opioid mortality data from the CDC.
The Adjusted R-Squared in Table I of 0.514 suggests that our model explains 51.4 percent of the variance in the data. Since there are limitations to how much R-squared can actually tell us about the data, I further examined potential problems with the data. First, there appeared to be some heteroskedasticity in the residuals based on a scatterplot of these residuals in Stata. I used robust standard errors to attempt to correct for this issue. Further tests on the data such as the Ramsey Reset Test to detect possible omitted variables returned important findings. The p-value of 0.00 causes us to reject the null hypothesis that our model has no omitted variables. A specification error test confirms that more variables are needed in the model as a p-value of 0.00 causes us to reject the null hypothesis that there is no specification error in the model. Potential applications for these finding will be addressed in the conclusion.

VI. Conclusion

My hypothesis that stagnant wage growth and employment opportunities are correlated with higher rates of opioid mortality in West Virginia counties was neither confirmed nor rejected. While the coefficients on the employment and wage variables were negative as my hypothesis predicted, neither of these coefficients were statistically significant. It could be that the relationship between opioid mortality and economic factors is just hard to pin down. This is likely due in part to lack of observations, but tests for omitted variables and specification error indicated that more variables are needed to really discern the relationship. Though I hypothesized that stagnant economic conditions worsen the opioid crisis in part due to increasing rates of mental health problems, it could be that mental health conditions are still a factor in opioid
mortality rates, but economic conditions don’t fully explain changes in community mental health.

These results also provide support for Ruhm’s paper in which he argued that the effect of economic conditions on the opioid crisis is severely overstated and that economic causes cannot even mostly explain the cause of the crisis. Issues such as reverse causation, according to Ruhm, make economic conditions such as wages and unemployment look like larger factors than they really are (Ruhm 2018). Here finding a lack of statistical significance of either variable supports this idea.

My findings could provide considerations for policymakers when deciding how best to address the crisis in local communities. It suggests that purely economic solutions to revitalize struggling localities through training programs, job creation, etc. alone would not be an effective remedy because of the multitude of factors behind the issue that cannot be neatly captured in one or two economic variables. Policymakers might also consider additional enforcement laws, regulating medical providers prescribing addictive medication, and naloxone access laws to combat overdoses. Regardless of the variety of options policymakers consider, it is clear based on the available literature as well as my own findings that continual, more expansive studies and research into factors affecting the opioid crisis is necessary.
References


