



SURVEY OF THE OPIOID CRISIS IN TENNESSEE

By Hersheyth Aggarwal



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ECONOMIC HONORS THESIS
Advisor: Prof Goodman-Bacon

INTRODUCTION

Addiction to prescription pain relievers such as oxycontin, synthetic opioids such as fentanyl, and illicit opioids such as heroin, is one of the most critical health issues in America. Since 2001, the opioid epidemic has cost the U.S one trillion dollars, mainly in lost earnings, lost productivity, and healthcare costs (Rhyan, 2018). The highest overdose rates are in Appalachian counties, the Rust Belt, and New England. Tennessee is one of hardest hit states in the opioid epidemic. According to the CDC, Tennessee has the third highest opioid prescribing rates among all states at 107.5 prescriptions per 100 people (Center for Disease Control, 2017).

The opioid epidemic has devastating effects on every county in Tennessee, urban or rural, small or big, poor or affluent. It leads to higher healthcare expenditures, death of thousands of addicts, reduced productivity of addicts, drug related crimes, children in foster homes, and babies born with symptoms of opioid withdrawal (Figure 1) (Melton, 2017). The crisis is not just a health issue, it interacts with criminal justice policy. Furthermore, politicians believe that Medicaid plays a role in opioid abuse so Medicaid fraud agents from the Tennessee Bureau of Investigation are relied upon to play a substantial role in limiting the supply of Opioid prescriptions. The spread of opioid abuse in Tennessee, both geographically and over time, has implications for a wide range of policies.

This paper surveys the evolution of the opioid epidemic in Tennessee using several sources of criminal justice data. I combine data from various police departments with information from the Tennessee Bureau of Investigation's Medicaid fraud Unit to compare drug incidents across Tennessee counties. Additionally, this paper identifies some key factors that lead to opioid incidents.

HISTORY OF THE OPIOID EPIDEMIC

The opioid crisis began in the 1990's with many new painkillers entering in the market as medicines for relieving pain. OxyContin, a drug whose active component oxycodone has been classified as "highly addictive" since the 1960s, was approved by Food and Drug Administration (FDA) for prescription use in 1995. The use of these new prescription opioids grew quickly after the Joint Commission for Health, an organization that sets treatment standards, encouraged doctors and hospitals to use them for pain management. Several pharmaceutical companies either feigned ignorance about the negative effects of these drugs or plead guilty to downplaying the possibility of addiction (Moghe, 2016). But the damage has already been done.

These issues are particularly severe in Tennessee. Based on false pharmaceutical reports, Tennessee passed the Intractable Pain Act in 2001. This law made it difficult to investigate physicians for prescribing drugs such as OxyContin for intractable pain. The Tennessee legislature eventually repealed the act in 2015 citing that they had been misinformed by pharmaceutical companies in 2001 (Harris, 2015). However, the opioid crisis is still severe in Tennessee. In 2015, Tennessee had one of the highest age adjusted mortality rates for drug overdoses (Center of Disease Control, 2017). The Sycamore institute reports that Tennessee has the third highest opioid prescribing rate in the county, 1.4 opioid prescription for every child, adult, and senior citizen in Tennessee (Melton, 2017).

Understanding trends in opioid abuse in Tennessee is a crucial first step toward understanding its underlying causes and judging the relative effectiveness of potential solutions.

Data

I studied the number of drug related incidents by county from 2001 – 2016, data provided by Tennessee Crime Online Statistics Website. An incident is any circumstance that is reported by a police officer after a stop, arrest or investigation. A drug-related “incident” occurs whenever a police officer makes an arrest, or a stop involving the seizure of drugs. The person involved in the incident does not need to be charged with a drug related crime. A drug related incident is a broader measure than arrests since the officer could just have made a stop or be investigating someone. Thus, there are more incidents than crimes. The crime statistics list the number of drug related incidents by drug type. The TBI states that “This measure counts the number of incidents with one or more seized drugs submitted to the system. This value is typically lower than the number of drug reports, as multiple drugs may be seized as part of a single incident” (Tennessee Bureau of Investigation, 2017). I compared the three major regions of Tennessee: East, Middle, and West. To study urban areas, I examined the counties with Tennessee’s most populous cities: Nashville, Memphis, Knoxville, and Chattanooga.

To study enforcement through the Tennessee’s Medicaid program, I gathered press releases on criminal cases from the Medicaid Fraud Unit. The Medicaid fraud unit is responsible for investigating providers and patients for many different types of crimes. The main types of crime include abuse related crime, billing fraud, prescription fraud, and others. Many of the press releases are from TBI’s Newsroom website. However, most of the press releases are from a notebook of old cases that I received access to at the TBI headquarters. Each press release lists the guilty persons, the crime committed, the date, and the location of the crime. I created a dataset which lists the year and county in which each incident occurs as well as the type of provider charged, and the type of crime committed.

To study factors that lead to opioid incidents. I obtained data on the number of primary care physicians and Medicare cost per person in 2016 in each county from the Robert Johnson Foundation's website Countyhealthrankings (Robert Johnson Foundation, 2017). I also used data from the CDC on opioid prescription rates for each county in 2016 as well (Center for Disease Control, 2017). Poverty rates for each county were collected from Indexmundi, which lists the average poverty rate of each county between 2009-2013. Indexmundi derives its data from the American Community Survey (Indexmundi, 2017).

Results

Rates of Opioid Related Incidents in Tennessee

Figure 2 shows how opioid related incidents are increasing in Tennessee's four major counties over time. Furthermore, I have compared drug abuse incident rates between Tennessee's three regions East, Middle, and West to determine which regions in the state need the most resources. Although opioid incident rates are increasing in all the regions, Figure 3 indicates that Opioid Incident rates are always higher in East Tennessee than Middle and West Tennessee. To determine whether the opioid incident rates are significantly higher in the east, a paired T-test for sample means was used. Indeed, East Tennessee had higher incident rates as compared to West Tennessee (p-value = 0.00074) and Middle Tennessee (p-value = .02254) (Table 1). Possibly, more resources should be devoted to curbing opioid abuse in the east in relation to other regions. Next, I compared the growth rates in opioid abuse for different regions. Figure 4 shows that opioid incident rates are increasing at a slightly faster rate in Middle Tennessee and East Tennessee(

13.57% and 13.69% respectively) compared to East Tennessee (12.16%). Likely, since opioid abuse is already significantly higher in East Tennessee, it has more room to increase in the other regions.

One important fact is that opioid related incidents are increasing in all three regions of Tennessee (Figure 2). Also, opioid incidents are increasing at a higher rate than non- opioid incidents as drug as shown in Figure 3. Therefore, the changes in opioid incidents do not just reflect underlying changes in drug incidents; they have increased independently. Since opioid incidents increased at a higher rate than other drug incidents, perhaps more resources should be devoted to combat opioid abuse relative to other drugs.

Medicaid Fraud Cases

The summary statistics regarding the Medicaid Fraud cases indicate that most opioid abuse may not involve TennCare. In twelve years, only forty-nine cases pertaining to controlled substance fraud were released to the public (Table 2). However, the total number of prescription opioid incidents between 2005-2017 were 73,734 (Tennessee Bureau of Investigation 2017). It is likely that more people have been prosecuted, however since only a few cases were publicized, perhaps criminals are not significantly deterred from performing crimes in the future. East Tennessee has the most total cases (78), while Middle Tennessee has the least prosecution by a wide margin (36). More enforcement or publicization of the crimes may be needed in Middle Tennessee. There is also a significant drop in cases between 2008 and 2013. Since only two cases were found in 2009 and none in 2008, perhaps some data was missing from the TBI's collection that

I was given access to. Still, only seventeen cases were recorded between 2010-2013 and figure 2 shows that Opioid incident rates were increasing in most of Tennessee's major counties during this time.

For the most part, only cases regarding providers were publicized. Only two cases mentioned patients engaging in fraudulent behavior. This is to be expected since the TBI's Medicaid Fraud Unit investigates providers mainly based on referrals from other police departments. Another department will only refer the case to the TBI if it needs assistance in the investigation and most likely, it is more difficult to investigate providers than patients. Caregivers in nursing homes had the most cases since most of the cases publicized by the unit are abuse cases. Physicians had the second highest number of cases at 28. While this is greater than the other types of providers, nurses and business owners, in a twelve-year period only twenty-eight physicians were publicized as being prosecuted for fraudulent behavior. Therefore, only a few physicians may be deterred from committing these crimes in the future.

Opioid Incidents Model

$$\text{Opioids Incident Rate 2016} = \beta_0 + \beta_1(\text{poverty rate}) + \beta_2(\text{Primary care Physicians per 10,000}) + \beta_3(\text{Population}) + \beta_4(\text{prescription rates}) + \beta_5(\text{Healthcare cost}) + \epsilon$$

To determine what factors, influence the opioid incident rate in a county, I obtained data on poverty rates, number of primary care physicians, prescription rates, and healthcare costs for each Tennessee county and compared it to the opioid incident rates. More physicians in a county may lead to a greater supply of opioids. Similarly, opioid prescription rates also measure supply of opioids in each county and thus could be a factor in predicting the incident rate. Poverty rates may also predict the opioid incident rate since low income or unemployed individuals may be

more susceptible to an addiction to opioids. Places with a higher healthcare cost may dissuade individuals from purchasing plans that cover opioid prescriptions with a low deductible.

Healthcare cost was measured using the mean cost of Medicare per person in the county.

Population may also be a factor since urban or rural counties may have different rates of opioid abuse.

After performing a linear regression in excel with these factors, it was discovered that only poverty rates were a significant factor in predicting that opioid incident rate with a p-value of 0.0031 (Table 3). Perhaps drug enforcement should be emphasized in counties with higher poverty rates. Shockingly, not even opioid prescription rates were a significant predictor of opioid incidents. This illustrates that most opioid incidents are not from prescription opioids but from more dangerous substances such as heroin and fentanyl.

Substitution Effect in Opioids Consumption

As the Tennessee legislature cracks down on prescription abuse by repealing the Intractable Pain Act and creating a Controlled Substance Drug Monitoring database, people are switching from prescription drugs to heroin and fentanyl since prescription drugs are now harder to obtain (Melton, 2017). Figure 6 shows that in Davidson County and Shelby County opioids incidents have stabilized and somewhat reduced while heroin consumption has skyrocketed. The substitution effect between heroin and prescription opioids becomes apparent after the reformulation of OxyContin in 2010. In 2010 OxyContin pills were reformulated so that if they were divided or sub-divided to be abused, the drug would become inactive. Therefore, addicts switched from prescription medicines to heroin and fentanyl (Powell, 2017). Deaths are more common with these

illegal substances. So, these supply-side interventions are causing unintended consequences as well. Tennessee has succeeded in limiting the supply of prescription opioids with the help of physicians but has not been able to curtail opioids demand. Demand can be reduced with rehabilitation treatments and behavioral health interventions (Berlind, 2017). Therapy in combination with certain medicines such as methadone and buprenorphine are effective in curbing addiction; however, many counties lack these treatment centers. City of Memphis has three of the twelve clinics licensed for methadone treatment. The whole of Tennessee State, east of Nashville has only three clinics (Melton, 2017). Clearly, the severity of the crisis and the resources used to combat it vary widely from region to region.

DISCUSSION: TENNESSEE’S RESPONSE TO THE OPIOID EPIDEMIC

The state of Tennessee has launched systematic procedures to combat the menace of opioid epidemic. The state is working with physicians to reduce opioid prescriptions, providing clinics for treatment and enforcing law as needed.

Controlled Substance Monitoring Database

The opioid epidemic started with the addictive nature of prescription pain killers, therefore one response should be to reduce prescription of these pain killers by physicians. Tennessee has developed Controlled Substance Monitoring Database (CSMD). Under the Tennessee Prescription safety act (effective Jan 1, 2013), all practitioners are required to check the CSMD prior to prescribing opioids, benzodiazepines and many others for a course of treatment that lasts more than seven days. The law specifically targets pain clinics and requires any practitioner who

provides services at a registered pain management clinic to document the reason for the prescribed quantity in the patient's record. Physicians are required to enter every prescription of opioids in this database. Physicians and pharmacist also must query the database to make sure that no other prescription has been filled for the patient in immediate past (Williams, 2013). This is to make sure that patient is not shopping for drugs at several clinics or pharmacies. Physicians have been educated and now know more about the brain's reaction to these opioids and their addictive nature. Physicians have significantly curtailed potent prescriptions. Estimates are that Tennessee has seen 20% reduction in opioid prescription since its peak (Figure 7) (Center Disease Control, 2017). Unfortunately, in absence of the availability of prescription opioids, the substitution effect described above indicates that addicts are using illegal drugs such as heroin and fentanyl. Fentanyl is a synthetic opioid, 50 times stronger than heroin. Overdose of fentanyl is a leading cause of death.

Access to Treatment

Opioid addiction is a chronic illness of brain and needs long-term care and management. Physicians are treating addiction with behavioral emphasis on

- Health and well-being of patients
- Prevent substance addiction in the first place
- Provide treatment, and
- Provide means for recovery.

Medication-assisted treatment (MAT) is a combination of therapy and addiction medication. MAT is controversial among policy makers. The detractors of MAT do not want state to spend scarce

resources to inject methadone and or buprenorphine into addicts. They are afraid that this approach would result in society having new methadone addicts on its hands. These advocates want addicts to stop using opioids immediately rather than gradually (Melton, 2017).

Prevention

Prevention efforts will get real boost from greater sharing of data and collaboration among law enforcement, public health and other officials. A comprehensive plan should be developed that answers concerns of each stock holder- public and private entities that have created the problem in the first place and those that are paying for the prevention and treatment of opioids (Berlind, 2017). University of Tennessee Health Sciences is taking a lead in creating a new program for new physicians to be trained in addiction medicine. This is in response to the absence of sufficient qualified physicians in the field of addiction medicine.

1. CONCLUSION

Opioid addiction which includes prescription pain relievers, heroin and synthetic opioids such as fentanyl, is one of the biggest health issues in America. Opioid abuse is especially severe in Tennessee compared to other states. By analyzing drug incident rates in TN between 2001-2015, it was discovered that opioid incidents have been increasing in every region and major county. These increases are alarming since opioid incidents have been increasing at a faster rate than non-opioid incidents in every region (East, Middle, West). To limit prescription opioid abuse, the Tennessee Controlled Substance database came into existence in 2013, which requires doctors to document their opioid prescriptions. This act along with the repeal of the intractable pain act and

the Oxycontin Reformulation of 2010 may have successfully caused opioid prescription rates to fall by 20%. However, an unintended consequence of this is an increase in heroin use since heroin is now easier to obtain than prescription opioids. Many factors can potentially lead to opioid incidents. The most significant one was poverty rates. There is a strong relationship between poverty rates and opioid incident rates in TN counties. Surprisingly, opioid prescription rates are not a significant factor in determining opioid incident rates, illustrating that most incidents involve non-prescription opioid such as heroin. The TBI is spending a lot of resources disrupting the supply chain of these drugs, however it is difficult for them to publicize enough cases to deter future criminals. Perhaps, more enforcement is needed along with measures that lower the demand for opioids such as rehabilitation treatments in order for Tennessee to successfully deal with this crisis.

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Figure 1. Opioids Increasing Cost Burden On Individual and Society

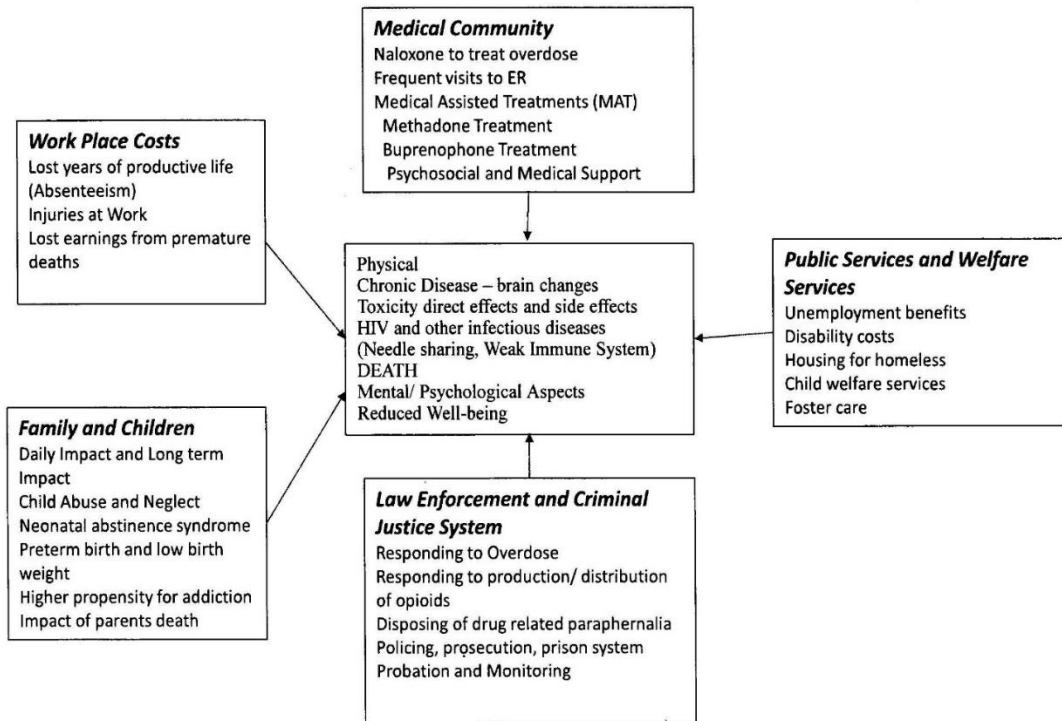
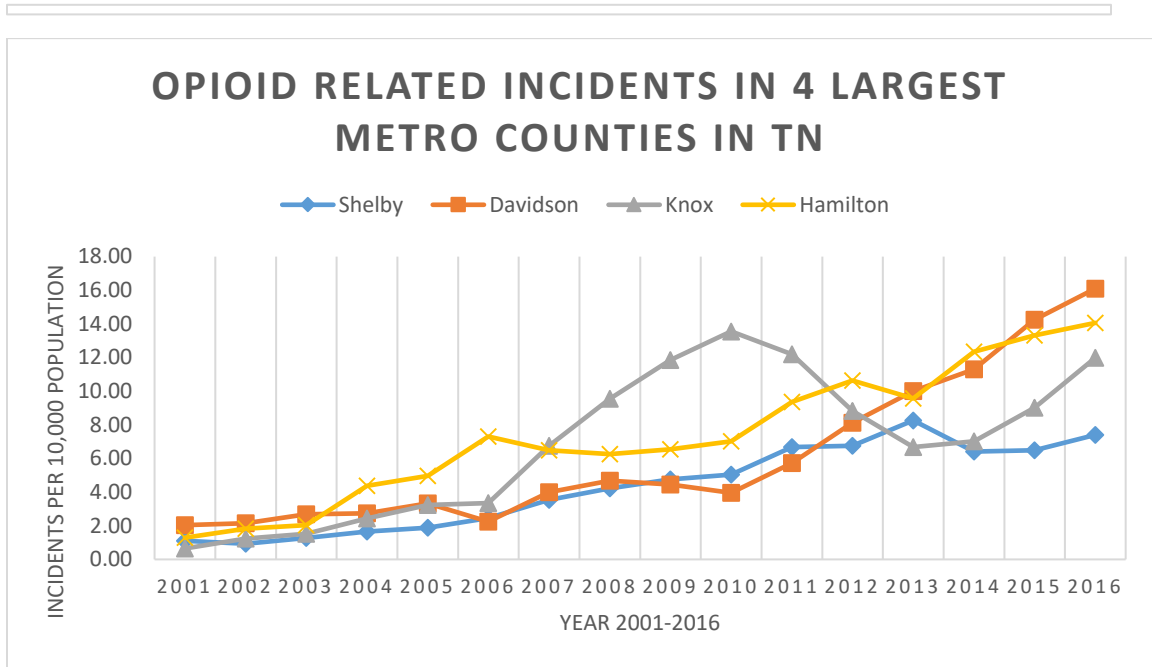
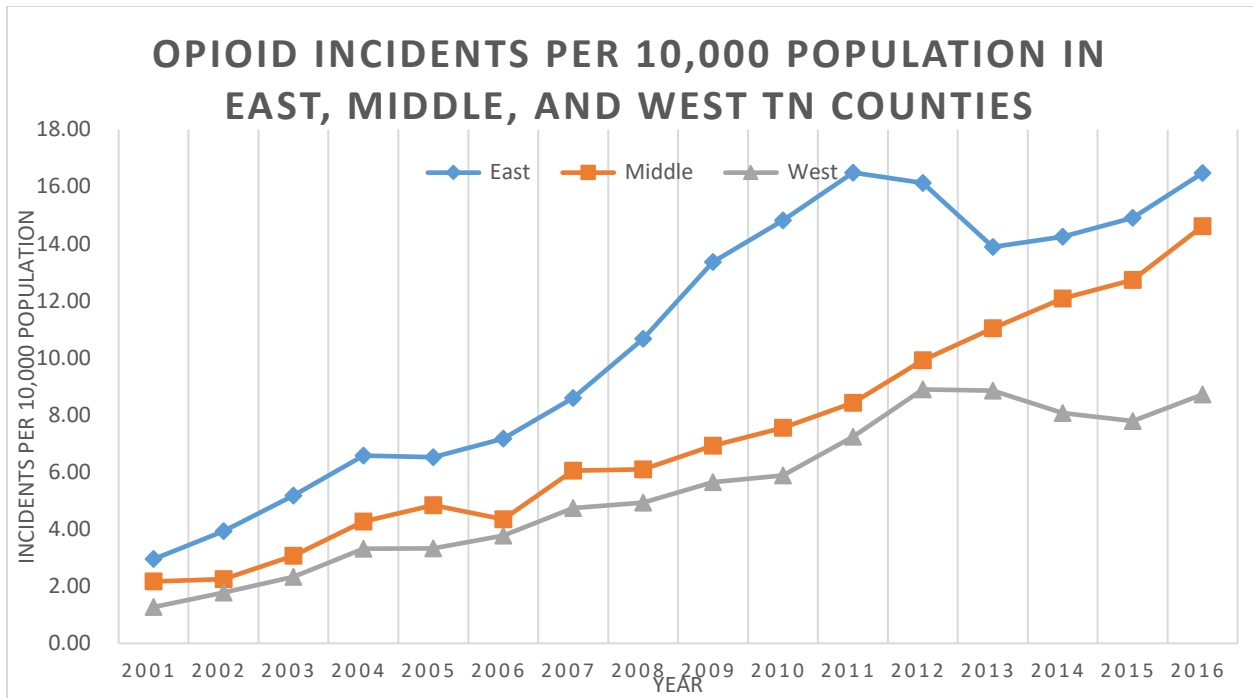


FIGURE 2 (GROWTH OF OPIOIDS RELATED INCIDENTS)



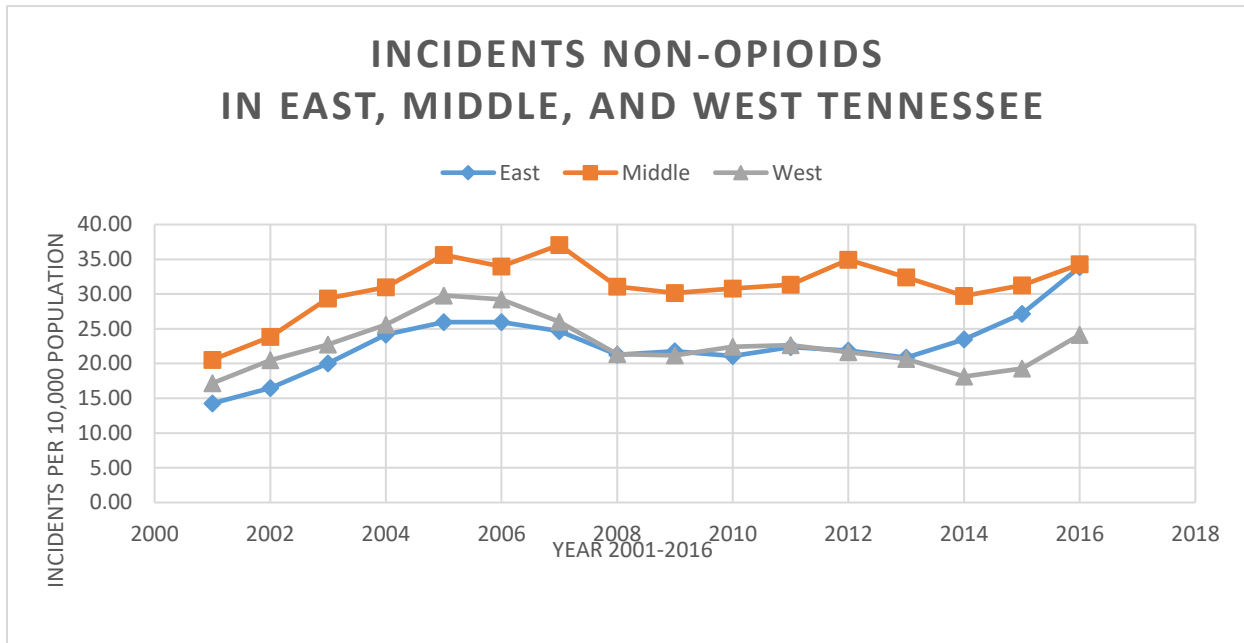
Notes: Shelby County is Memphis TN. Davidson County is Nashville TN. Knox County is Knoxville, TN. Hamilton County is Chattanooga, TN. The Tennessee Bureau of Investigation’s data listed incidents by individual drug types. So the total number of opioid incidents was calculated by adding up the drug incidents for of the following drugs: fentanyl, carefentanil, heroin, morphine, opium, and other narcotics. Population estimates are from the U.S Census Bureau’s population estimates.

FIGURE 3 (OPIOIDS INCIDENTS IN EAST, MIDDLE, AND WEST TENNESSEE)

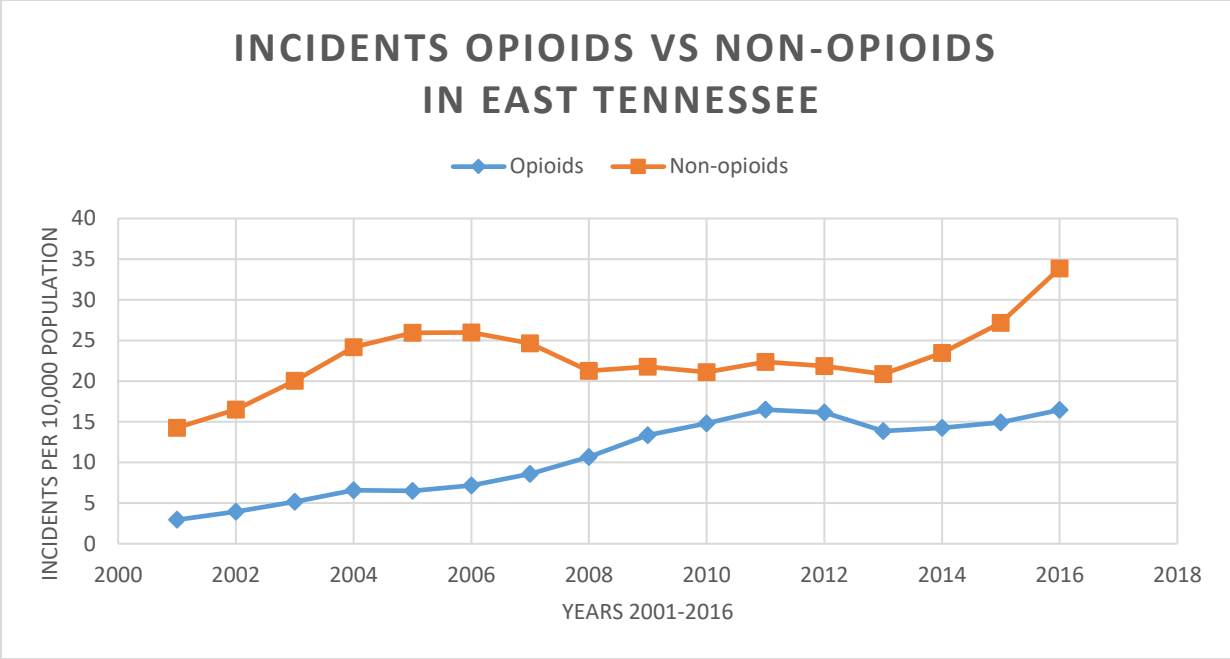


Notes: Opioid incidents in each region were calculated by taking the sum of all the opioid incidents in each county for that region. The Tennessee Bureau of Investigation’s database lists the counties that are in each region. This total number of opioid incidents was then divided by the total population of the region to yield the incidents per population. Opioid incidents were calculated in the same manner as Figure 2.

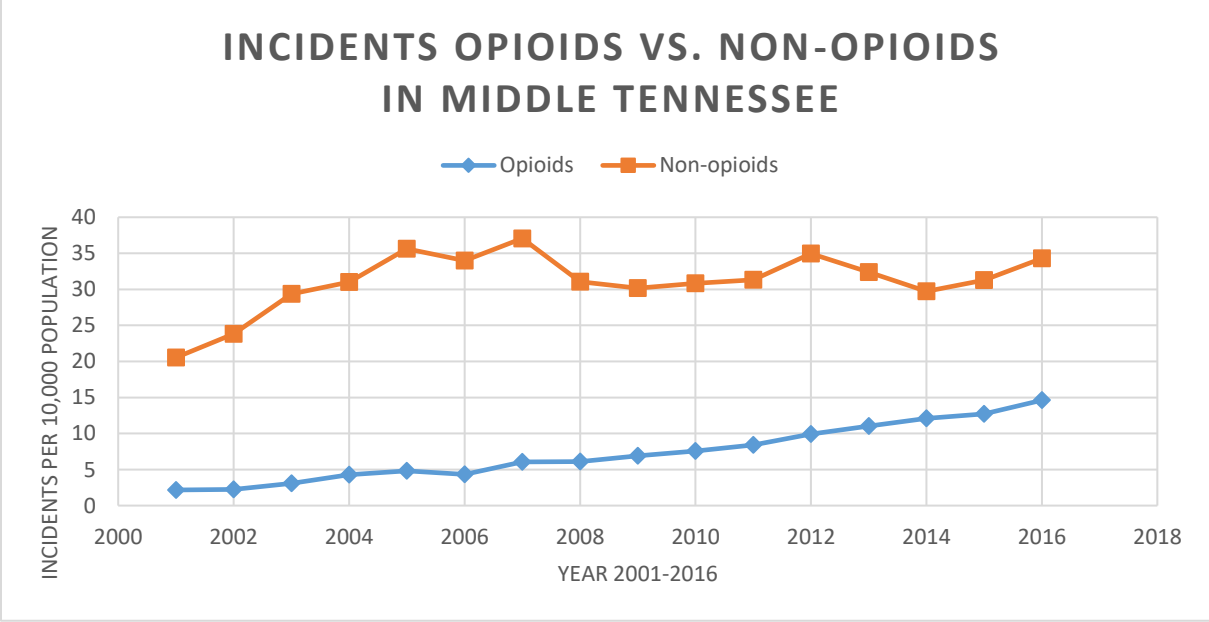
Figure 4 Comparison between Opioid Incidents and Non Opioid Drug Related Incidents



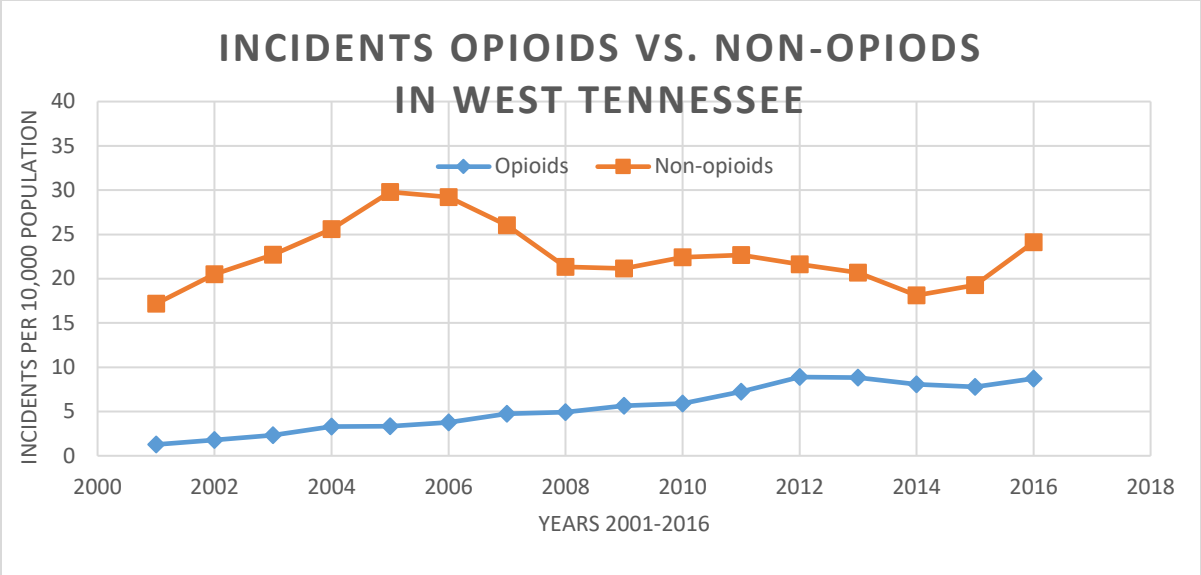
Notes: Incidents of non-opioid drugs were calculated by adding up all drug types that were not used to calculate opioid incident rate (fentanyl, carefentanyl, heroin, morphine, opium, and other narcotics) for each county. Then this total number of incidents was divided by the total population of the region to obtain incidents per population. Marijuana incidents were also excluded. The geometric mean growth of non-opioids are 5.93% (East), 3.48% (Middle) and 2.30% (West).



In East Tennessee, during 2001-2016, the growth of opioids incidents is 12.15% while for non-opioids the growth rate is significantly lower at 5.93%.



In Middle Tennessee, during 2001-2016, the growth of opioids incidents is 13.57% while for non-opioids the growth rate is significantly lower at 3.48%.



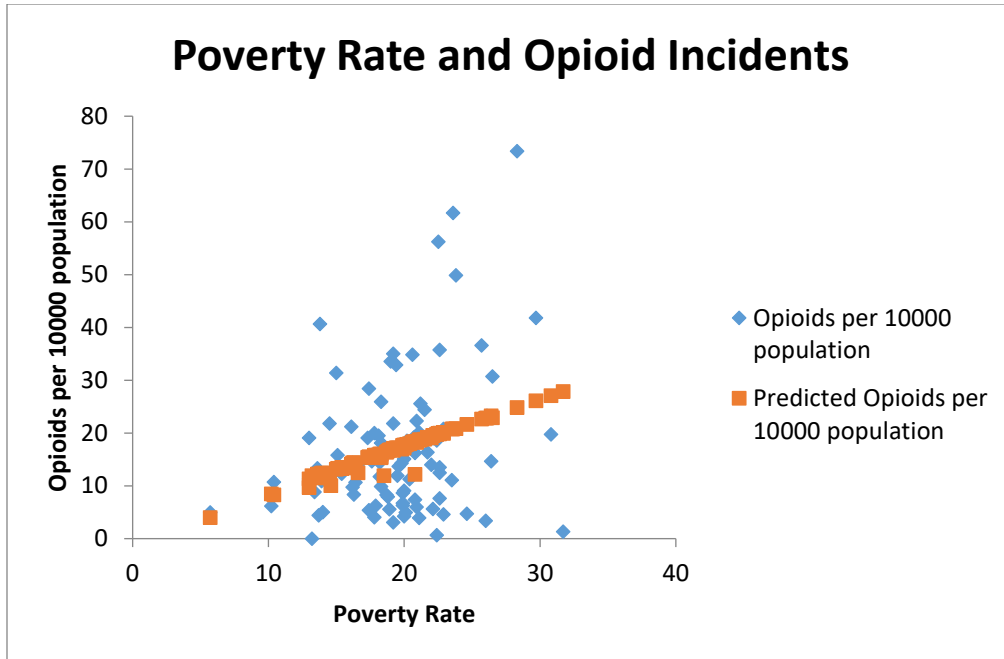
In West Tennessee, during 2001-2016, the growth of opioids incidents is 13.69% while for non-opioids the growth rate is significantly lower at 2.30%.

Summary of Geometric Growth Rates by Region

| Growth 2001-2016 | | | | | |
|------------------|-------------|---------|-------------|---------|-------------|
| East | | Middle | | West | |
| Opioids | Non-opioids | Opioids | Non-opioids | Opioids | Non-opioids |
| 12.15% | 5.93% | 13.57% | 3.48% | 13.69% | 2.30% |

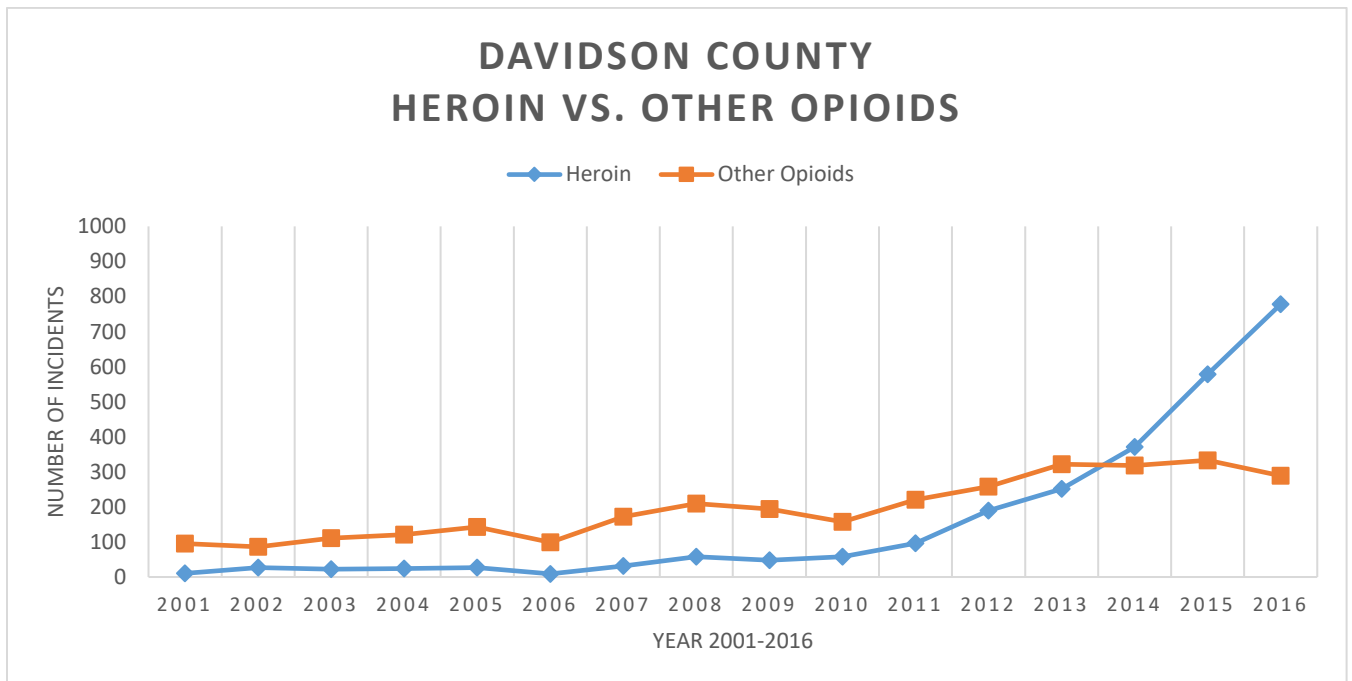
Notes: The growth rate was calculated by taking the geometric mean of all the yearly growth rates from 2001-2016.

FIGURE 5 RELATIONSHIP BETWEEN POVERTY RATE AND OPIOID INCIDENTS

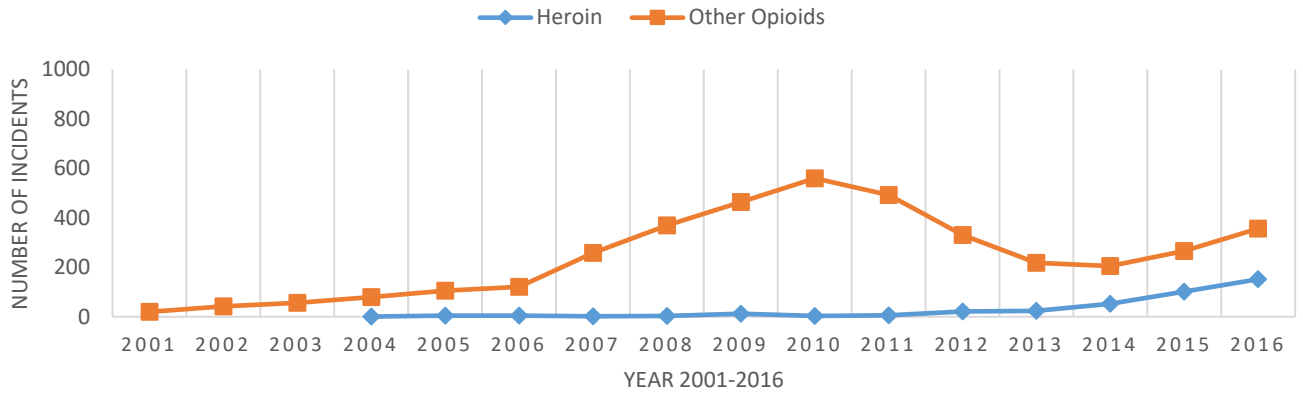


Notes: Poverty rates for each county was the independent variable and the opioid incidents per 10,000 population was the dependent variable in regression analysis. There are a total of 95 observations for each variable. A significant relationship exists between Opioids incident rate and poverty rate as shown in Table 3.

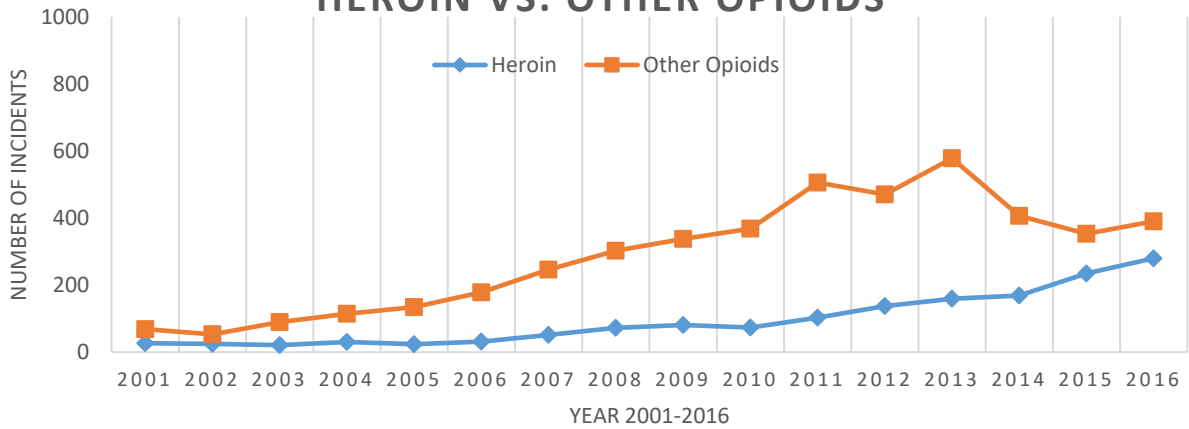
FIGURE 6 SUBSTITUTION OF NARCOTICS BY HEROIN IN MAJOR COUNTIES)



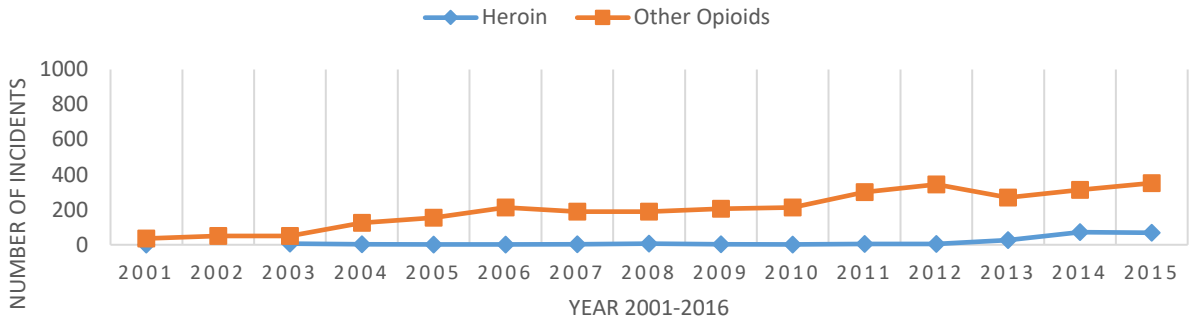
KNOX COUNTY HEROIN VS. OTHER OPIOIDS



SHELBY COUNTY HEROIN VS. OTHER OPIOIDS

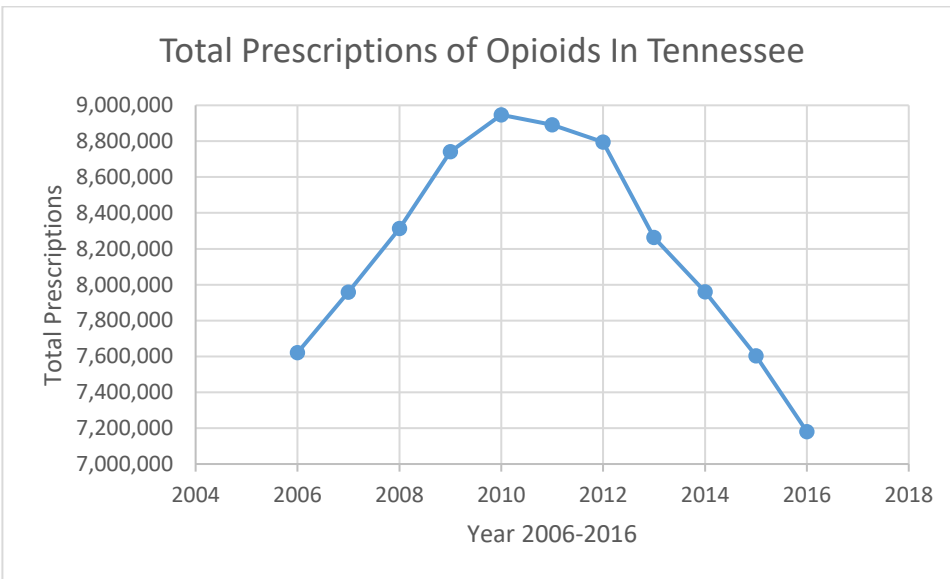


HAMILTON COUNTY HEROIN VS. OTHER OPIOIDS



Notes: These figures compare heroin incidents over time with other opioid incidents over time. Heroin incidents are listed in the Tennessee Bureau of Investigation's data. Other opioids were calculated adding up the following drug types (fentanyl, carefentanil, morphine, opium, and other narcotics) for each county. In every major county heroin is increasing after 2010 while other opioids are decreasing perhaps due to the Oxycontin reformulation and Controlled Substances Monitoring Database.

FIGURE 7 Opioid Prescription Rates Over time in TN



Notes: Data from the Center for Disease Control lists the total amount of prescriptions in Tennessee every year. The total number of prescriptions peaked in 2010 and are 20% lower in 2016. Prescriptions of Opioids peaked in 2010.

Table 1 Comparison of Opioids Incidents in East, Middle and West Tennessee

| Number of Incidents per 10,000 Population | | | | |
|---|--------|--------------|----------|-------------|
| t-Test: Paired Two Samples for Means | | | | |
| East | Middle | Observations | P-value | |
| 10.52 | 7.11 | 16 | 3.15E-05 | Significant |
| East | West | Observations | P-value | |
| 10.52 | 5.28 | 16 | 7.48E-07 | Significant |
| Middle | West | Observations | P-value | |
| 7.11 | 5.28 | 16 | 4.61E-04 | Significant |

Notes: To test whether there are significant differences between opioid incident rate in the three regions, a t-test for paired two samples was conducted between every region. The mean was calculated by adding up all the opioid incidents in the entire region and dividing it by the total population in the region. East Tennessee is shown to have a significantly higher opioid incident rate than the other regions.

Table 2 Fraud Case Summary

| | |
|--------------------------------|-----|
| Total Cases: | 173 |
| By type of case: | |
| Abuse | 58 |
| Controlled substance fraud | 43 |
| Theft of Controlled Substances | 6 |
| Unnecessary Procedures | 6 |
| Theft | 14 |
| Overbilling | 23 |
| Theft of Controlled Substances | 6 |
| Other | 23 |
| By Region | |
| East | 78 |
| Middle | 36 |
| West | 50 |
| By County | |
| Davidson | 20 |
| Shelby | 19 |
| Knox | 16 |
| Madison | 14 |
| All Others | 104 |
| By Time Period | |
| 2005-2007 | 66 |
| 2008-2009 | 2 |
| 2010-2013 | 17 |
| 2014-2017 | 88 |
| By provider | |
| Caregiver | 72 |
| Business owner | 15 |
| Nurse | 14 |
| Nurse Practitioner | 7 |
| Physician | 28 |
| Other | 37 |

Notes: This table was created from press releases of cases undertaken by the TBI’s Medicaid Fraud Unit. They were gathered from the Tennessee Bureau of Investigation’s website “TBINewsRoom” and from a collection of press releases I obtained at the TBI headquarters. I manually categorized each case type and each provider based on what was written in the press release.

Table 3 Multiple Linear Regression Results

$$\text{Opioids Incident Rate 2016} = \beta_0 + \beta_1(\text{poverty rate}) + \beta_2(\text{Primary care Physicians per 10,000}) + \beta_3(\text{Population}) + \beta_4(\text{prescription rates}) + \beta_5(\text{Healthcare cost}) + \varepsilon$$

| Variables | Coefficients | Standard Error | P-value |
|----------------------------------|--------------|----------------|---------|
| Intercept | 12.80833 | 16.62477 | 0.4430 |
| Prescription Rate per 100 Person | 0.036449 | 0.037384 | 0.3321 |
| Physician per 10000 | -0.16457 | 0.477986 | 0.7314 |
| Healthcare Cost | -0.0017 | 0.001586 | 0.2872 |
| Poverty Rate | 0.939157 | 0.308673 | 0.0030 |

| | |
|--------------------------|----------|
| <i>R Square</i> | 0.106353 |
| <i># of Observations</i> | 95 |

Notes: With the multiple linear regression function in excel it was determined that the only significant factor was poverty rate. Healthcare cost was taken from the Robert Wood Johnson Foundation website and is measured by the mean medicare cost per person in the county. Each variable is measured at the county level therefore every variable has 95 observations.