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Analysis of Opioid Hospitalizations in Michigan Counties

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Abstract

The escalating opioid epidemic has affected the United States on both national and local levels. In the state of Michigan, the opioid overdose death rate increased by 13.3% between 2014 and 2015 (Centers for Disease Control and Prevention, 2017). Due to a gap in the literature regarding opioid hospitalization rates, this study focused on the demographic correlates of unemployment, health insurance, and poverty level in relation to the Michigan counties that indicated the highest opioid hospitalization rates in the 2013-2015 time period. The five Michigan counties with the highest opioid hospitalization rates were Oscoda, Arenac, Roscommon, Clare, and Benzie County. All three examined correlates were associated with opioid hospitalization rates in these counties. This study suggests further research into the demographics of the opioid epidemic in Michigan counties.

Introduction

Opioids have been used worldwide for thousands of years as a medication for pain relief (Trescot, Datta, Lee, & Hansen, 2008). Opioids have progressed beyond the opium poppy to semi-synthetic and synthetic forms that are being increasingly used to treat chronic pain. The Centers for Disease Control and Prevention (CDC) has referred to the dramatic rise in opioid prescription drug overdoses as an "epidemic" (Paulozzi et al., 2012, p. 774). The growing public attention to the opioid prescription crisis is further evidenced by the Obama Administration's release of the strategic plan *Epidemic: Responding to America's Prescription Drug Abuse Crisis* in 2011 (United States Office of National Drug Control Policy, 2011). This publication and the creation of an opioid commission by the Trump Administration in 2017 suggest opioid usage in the United States is still considered a critical situation (White House, 2017). The extent of the opioid epidemic is well represented in the data. In 2014, out of the 47,055 drug poisoning deaths, 40.1% of the deaths came from opioid analgesics. Another concerning statistic is that 22.5% of those drug poisoning deaths came from illegal heroin usage (Chopra & Marasa, 2017).

The escalating opioid related death epidemic in the United States serves as the impetus for this investigation. Most existing research focuses on opioid overdose deaths, and the author has noted a gap in the literature regarding opioid hospitalizations. As Unick and Ciccarone (2017) state "hospitalizations encompass a wider range of overdose severity, and [thus] capture events that may be missed in death data" (p.113). Analyzing opioid related hospitalizations provides a deeper perspective into the quality of life for individuals, as opposed to the limited perspective that death statistics provide. Specific drugs are often unlisted on death certificates leading to an underestimation of the epidemic's extent (Ruhm, 2017). The focus of this study is to examine demographic characteristics of the Michigan counties that had the five highest rates

of opioid hospitalizations during the period of 2013-2015. These characteristics include: unemployment, poverty level, and health insurance. Previous studies have shown that a lack of economic opportunity and social isolation are linked to increases in drug overdoses (Zoorob & Salemi, 2017). For sufficient comparison, these correlates were also explored in the five Michigan counties that had the lowest opioid hospitalizations in the same time period.

Literature Review

Opium poppy cultivation is estimated to have begun as early as 3400 BC in Mesopotamia (Trescot et al., 2008). The terms "opioid" and "opiate" are often used interchangeably but have different technical definitions. Opiates refer to alkaloids found naturally, such as codeine, while opioids refer to any compounds that interact with opioid receptors (Trescot et al., 2008). The term "opioid" will be used primarily throughout this article due to the focus on all opioids, including those that are synthetic. Historically, what is currently being deemed America's opioid crisis can be considered a second wave. During the nineteenth century, opioid addiction reached a peak. In fact, in the 1890s, it was estimated that 4.59 people out of every thousand were addicted to opioids (Courtwright, 2001).

The primary demographic of opioid addiction in the nineteenth century was middle-aged white women of the middle to upper class (Courtwright, 2001). During this time period, Courtwright (2001) declares that there were four significant sources of opium and morphine addiction: "administration by physicians, the Civil War, self-dosage, and nontherapeutic usage" (p. 36). During the Civil War, increased amounts of opium were dispensed for treatment on the frontlines. The potential for iatrogenic addiction greatly increased with the lack of regulation regarding opioids during the war. Another factor of opioid addiction in this period was the widespread use of the hypodermic syringe. The hypodermic syringe, first introduced to America

in 1856, has been implicated in the enhancement of iatrogenic addiction in the mid-nineteenth century (Courtwright, 2001). Hypodermic morphine administration avoided the potential gastric side effects of oral administration and in addition, provided relief sooner to patients (Courtwright, 2001).

In the late nineteenth century, opium smoking was associated with the demographic of Chinese laborers on the West Coast (Courtwright, 2001). The combination of racially motivated views of this particular demographic and the fact that opium smoking was not typically connected with medical usage led to stigmatization of the practice (Courtwright, 2001, p.61). In the early 1900s, a shift in public opinion of certain opioids occurred with the Harrison Tax Act of 1914. The act required those who "imported, produced, sold, or dispensed 'narcotics' to register, pay a nominal tax, and keep detailed records" and demonstrated the increasingly punitive treatment of opioid usage by public sentiment (Courtwright, 2015, p. 2095).

Another transformative wave of the demographic of opioid addiction occurred in post-war America in the late 1950s and 1960s. While the mid-nineteenth century saw opium usage primarily by upper class white women, the late twentieth century saw heroin usage in large cities among urban minorities such as African Americans and Hispanics (Wendel & Curtis, 2000). According to Courtwright (2001), heroin trafficking and addiction would "remain concentrated in the [poorer sections of cities] and barrios for the rest of the century" (p. 151).

The saga of the current opioid wave arguably began with the establishment of pain as the fifth vital sign by the American Pain Society in 1995 (Morone & Weiner, 2013). Prior to this time, physicians had been cautious with prescribing opioids for chronic pain (Tompkins, Hobelmann, & Compton, 2017). Previous concerns on opioid usage for chronic pain had ranged from tolerance to addiction. Yet two small studies that suggested low addiction risk when

prescribing opioids for pain became the primary sources for physicians during the American Pain Society's pain awareness campaign (Tompkins et al., 2017). New drugs were also rolled out in the changing atmosphere of pain management. The most notable of these opioid medications was Purdue Pharma's Oxycontin® release in 1996 (Tompkins et al., 2017). Oxycontin® is the prescription opioid that arguably began the new opioid crisis iteration. The opioid landscape has changed drastically from the heroin crisis in urban centers of the late twentieth century. The opioid epidemic's latest wave can be seen even in the small rural corners of twenty-first century Midwestern America (Drug Enforcement Administration, 2015).

Research has shown rural areas have certain demographic differences from urban areas regarding nonmedical opioid use. Rural residents exhibiting nonmedical opioid use tend to be white and have less income than their urban counterparts (Wang, Becker, & Fiellin, 2013). Other research has affirmed recent users of heroin to be predominantly white and living in nonurban areas (Cicero, Ellis, Surratt, & Kurtz, 2014). This contrasts with the primary demographic of inner city minorities that epitomized heroin use in the late twentieth century (Cicero, Ellis, Surratt, & Kurtz, 2014). These rural users have also shown a tendency to transition to heroin from prescription opioids due to heroin's availability and lower cost (Cicero, Ellis, Surratt, & Kurtz, 2014; Dasgupta et al., 2014).

Individuals with a history of drug overdose have often referenced aspects of their rural communities as reasons for their behavior. One study in the mill town of McKeesport, Pennsylvania found participants with histories of drug overdoses repeatedly referring to unemployment and regional poverty in their community as underlying causes for the staggering levels of illicit drug use (McLean, 2016). Insurance coverage may also play a role in drug use in certain communities. Cross-sectional studies have found uninsured workers have a higher

likelihood of using illicit drugs (Waehrer, Zaloshnja, Miller, & Galvin, 2008). These aforementioned factors in the literature have informed this study's hypotheses of Michigan counties with high rates of opioid hospitalizations.

Hypotheses

Hypothesis I: The five Michigan counties that show the highest rates of opioid hospitalizations will have a higher average *unemployment rate* than the five Michigan counties with the lowest rates of opioid hospitalizations.

Hypothesis II: The five Michigan counties that show the highest rates of opioid hospitalizations will have a higher average *uninsured rate* than the five Michigan counties with the lowest rates of opioid hospitalizations.

Hypothesis III: The five Michigan counties that show the highest rates of opioid hospitalizations will have a higher average *percentage of people under the poverty level* than the five Michigan counties with the lowest rates of opioid hospitalizations.

Methodology

Opioid hospitalization data was collected through the Michigan Inpatient Hospitalization Files from the Division for Vital Records and Health Statistics. The data was collected based on a coding system from The International Classification of Disease (ICD). It should be noted that this system changed from the ICD-9-CM to ICD-10-CM in October 2015, which was during the time period for this data analysis (Centers for Disease Control and Prevention, 2017). In this study, opioid hospitalizations include both illicit and prescription opioid poisoning under ICD-9-CM codes (i.e., ICD-9-CM codes 965.02, 965.09, E850.1, and E850.2) and ICD-10-CM codes (i.e., ICD-10-CM codes T40.2X1-T40.2X4, T40.3X1-T40.3X4, and T40.4X1-T40.4X4). Opioid hospitalization data was collected by Dr. Su Min Oh, an epidemiologist working for the state of

Michigan, who provided the data for this study. In a phone interview with the author, Dr. Oh reported that the hospitalization data does not include emergency room visit data, which was identified as a potential limitation (S. Oh, personal communication, February 14, 2018). The author used the United States Census Bureau's online American Fact Finder software to collect data regarding unemployment rate, percentage without health insurance, and percentage under poverty level for each county (United States Census Bureau, 2010).

Results

The five Michigan counties with the highest opioid hospitalization rates were Oscoda, Arenac, Roscommon, Clare, and Benzie. They were ranked according to Average Annual rate, as seen below in Table 1. For example, Oscoda County had 21 opioid hospitalizations from 2013-2015 in its 8,353-person population, or an average annual rate of 83.8 opioid hospitalizations per 100,000 people. The five Michigan counties with the lowest opioid hospitalization rates were Clinton, Ottawa, Hillsdale, Oceana, and Eaton.

Table 1

Michigan Counties with the Highest Five and Lowest Five Average Annual Opioid Hospitalization Rates, 2013-2015

County of Residence (High Group)	Total Number of Opioid Hospitalizations, 2013-2015	Average Annual Number of Opioid Hospitalizations, 2013-2015	2014 Population	Average Annual Rate (per 100,000 people)
Oscoda	21	7.0	8,353	83.8
Arenac	26	8.7	15,324	56.6
Roscommon	36	12.0	23,932	50.1
Clare	40	13.3	30,703	43.4
Benzie	21	7.0	17,511	40.0

County of Residence (Low Group)	Total Number of Opioid Hospitalizations, 2013-2015	Average Annual Number of Opioid Hospitalizations, 2013-2015	2014 Population	Average Annual Rate (per 100,000 people)
Eaton	41	13.7	108,679	12.6
Oceana	9	3.0	26,175	11.5
Hillsdale	15	5.0	45,955	10.9
Ottawa	75	25.0	276,963	9.0
Clinton	15	5.0	77,370	6.5

Source: Michigan Inpatient Hospitalization Files,
Division for Vital Records and Health Statistics
Michigan Department of Health and Human Services

As seen in Figure 1 below, the Michigan counties with the highest opioid hospitalization rates were all located in the northeast region of the state. All of the counties with the highest opioid hospitalization rates, seen in Figure 1, were categorized as rural according to the 2010 United Census. Two of the five counties, Clare and Roscommon, were considered mostly rural. Benzie, Arenac, and Oscoda were considered to be completely rural (United States Census Bureau, 2012). All of the counties in Figure 1, showing the high group, were predominantly white. Each of the Figure 1 counties showed whites composing 95% or more of the total population (United States Census Bureau, 2010). In Figure 2, Michigan counties with the lowest opioid hospitalization rates appeared to all be primarily located in the southwest region of the state. While the low group counties were also predominantly white, whites composed a slightly lower percentage of the total population in these counties with an average of 91.6% (United States Census Bureau, 2010).

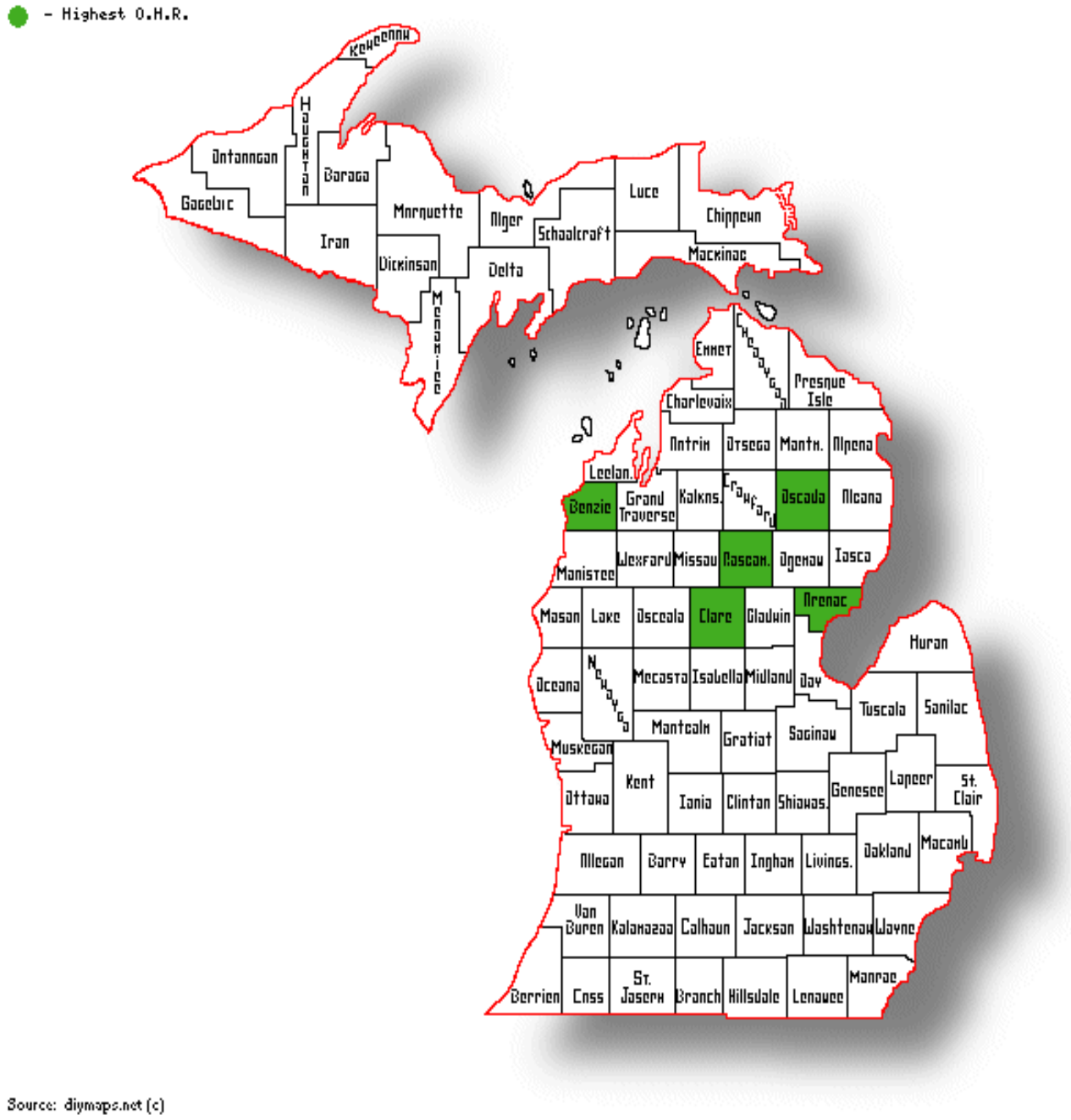

Figure 1: Top 5 Michigan Counties with Highest Opioid Hospitalization Rates

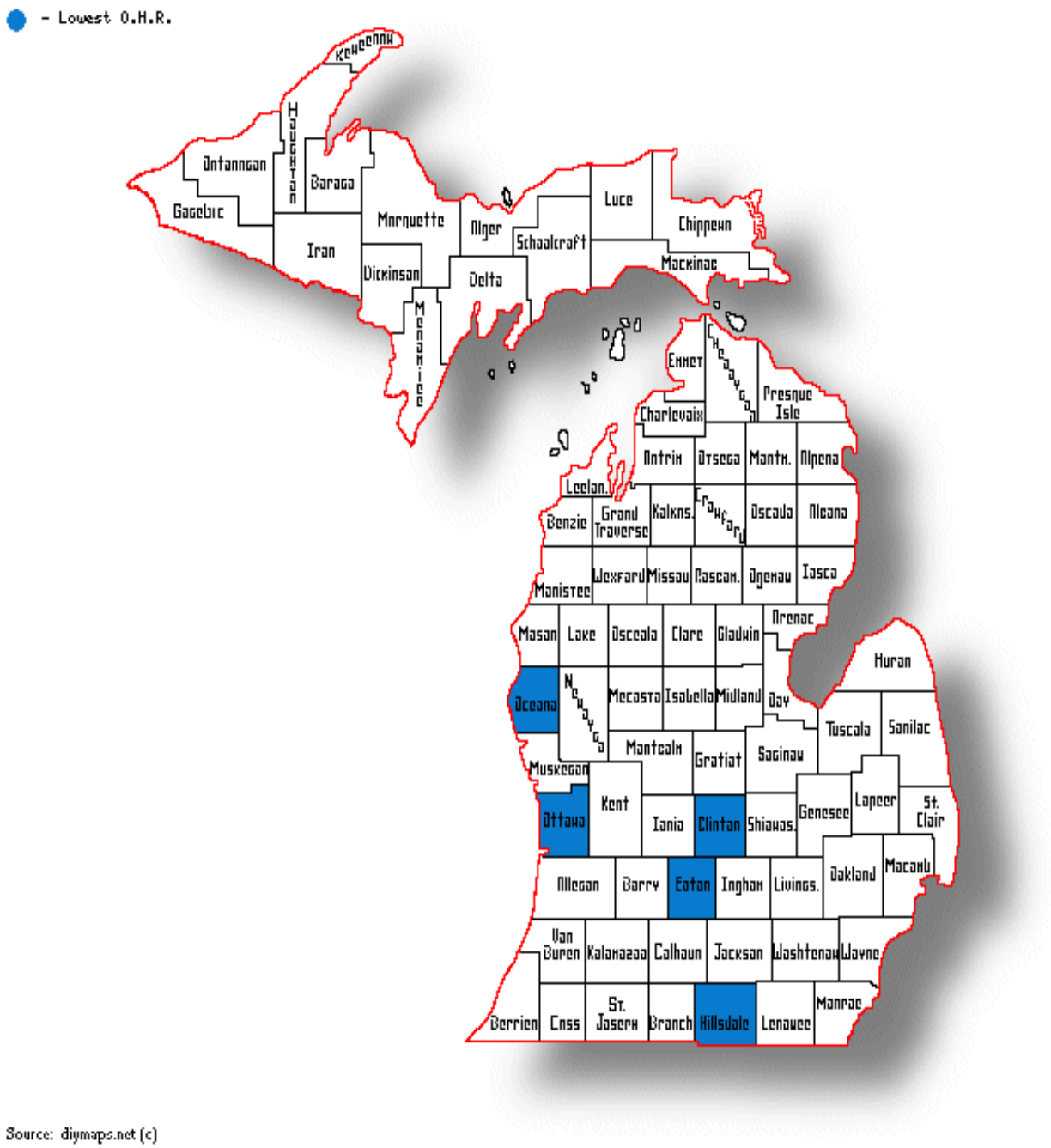

Figure 2: Bottom 5 Michigan Counties with Lowest Opioid Hospitalization Rates

The counties with the highest opioid hospitalization rates had a noticeably lower average unemployment rate in comparison to the counties with the lowest opioid hospitalization rates as seen in Table 2 below. The average unemployment rate for the "low group" (LG) was 7.6% in contrast to the 12.2% unemployment rate for the "high group" (HG). There was also a disparity in health insurance coverage between the two groups. Table 2 shows the HG had an average 13.1 % of the population without health insurance coverage while the LG had only 9.4% of the population lacking health insurance. It should be noted that the Michigan county with the highest opioid hospitalization rate, Oscoda County, also had the highest percentage of uninsured citizens among the top five examined counties. In regard to income below poverty level, on average, the HG had a higher average percentage of the population with an income below the poverty level in contrast to the LG. In this case, on average, 19.6% of the HG's population had an income under the poverty level as opposed to the average 14.7% for the LG. Finally, the data also reveals the Michigan counties with the highest rates of opioid hospitalization had, on average, much smaller populations than the counties with the lowest rates of opioid hospitalizations.

Table 2

Demographic Correlates of Michigan Counties with the Highest and Lowest Opioid Hospitalization Rates from 2013-2015

County (High Group)	Average Annual Rate (opioid hospitalizations per 100,000)	Population	Unemployment Rate (%)	No Health Insurance Coverage (%)	Income Below Poverty Level (last 12 mo) (%)
Oscoda	83.8	8,353	13.2	17.3	19.8
Arenac	56.6	15,324	12	10.5	19.9
Roscommon	50.1	23,932	14.2	11.5	20.6
Clare	43.4	30,703	13.2	14.3	26.1
Benzie	40	17,511	8.4	12	11.6
Average for HIGH	54.78	19,164.60	12.2	13.12	19.6
County (Low Group)	**Average Annual Rate (opioid hospitalizations per 100,000)**	**Population**	**Unemployment Rate (%)**	**No Health Insurance Coverage (%)**	**Income Below Poverty Level (last 12 mo) (%)**
Eaton	12.6	108,679	7.8	8	10.8
Oceana	11.5	26,175	8.7	12.7	20.4
Hillsdale	10.9	45,955	9	12.8	20.1
Ottawa	9	276,963	6.1	6.6	10.4
Clinton	6.5	77,370	6.5	7	11.8
Average for LOW	10.1	107,028.40	7.62	9.42	14.7

Discussion

This study documents the five Michigan counties with the highest opioid hospitalization rates in the time period of 2013-2015 and contrasts them with the five Michigan counties with the lowest opioid hospitalization rates. Oscoda, Arenac, Roscommon, Clare, and Benzie are all relatively rural counties with the average population size for all five counties at 19,165 persons (United States Census Bureau, 2012). These sparsely populated counties composed the group with the highest opioid hospitalization rates in the state of Michigan from 2013-2015.

In a time when both opioid usage and overdoses have risen dramatically, a focus on local communities has never been more important in understanding the nature of the epidemic (Centers for Disease Control and Prevention, 2017; Kolodny et al., 2015). The CDC shows statistically significant opioid overdose death rate increases in multiple Midwestern states during the examined time period. Michigan, in particular, showed a 13.3% increase in its opioid overdose death rate between 2014-2015 (Centers for Disease Control and Prevention, 2017).

A recent publication in the *International Journal of Drug Policy* describes a deindustrialized risk environment where poverty and a lack of jobs created the ideal vacuum for drug overdose (McLean, 2016). Demographic correlates such as unemployment, health insurance coverage, and poverty level percentages relate to a low socioeconomic status. Additionally, a lower socioeconomic level speaks of a community dwindling in opportunity. Interviewees from the deindustrialized mill town of McKeesport, Pennsylvania provided further insight into this phenomenon. The interviewees in the study described how they believed that the lack of economic opportunity in their town led to the proliferation of illegal drug markets that offered them employment and recreation (McLean, 2016). The unemployment rate provides a window into the availability of economic opportunity in these counties. The average

unemployment rate was higher in the inspected Michigan counties with the highest opioid hospitalization rates in comparison to the counties with the lowest opioid hospitalization rates. The HG had an average unemployment rate of 12.2% while the LG had an average unemployment rate of only 7.62%. This difference in average unemployment rate between the two groups supports Hypothesis I.

Additionally, the rate of uninsured persons in these ten counties was examined. Oscoda County has the highest opioid hospitalization rate out of Michigan's 83 counties. Table 2 shows Oscoda County also had an uninsured rate of 17.3 %, more than 1.5 times greater than the national rate. A large cross-sectional study based on data from the National Survey of Drug Use and Health (NSDUH) has found uninsured workers to have "50%-70% greater odds of being illicit drug users" (Waehrer, Zaloshnja, Miller, & Galvin, 2008, p. 991). The low counties showed an average uninsured rate of 9.42 %, a rate that was even lower than the national uninsured rate of 10.4% in 2014 (Barnett & Vornovitsky, 2016). The evidence regarding the difference between the average uninsured rate in the HG counties and LG counties supports Hypothesis II. This further suggests a possible correlation between the rate of uninsured and illicit drug use in a community.

During the time period represented, the national poverty rate was 14.8% (DeNavas-Walt & Proctor, 2015). In Clare County particularly, the poverty rate was a striking 26.1% in 2014. The average poverty rate among the five high counties was 19.6%, a statistic still higher than the national rate. Hypothesis III was supported by the evidence and affirms the association between poverty and drug use.

The opioid epidemic that arguably began with the transition in treatment of chronic pain from a multidisciplinary approach to one dominated by prescription opioids is important to

explore (Tompkins et al., 2017). While both rural and urban counties have been affected by the nonmedical use of prescription opioids, the current opioid crisis appears to uniquely affect the rural communities of the United States. It has been hypothesized that lower income levels and unemployment play a role in the differences in nonmedical use of prescription opioids between rural and urban ethnic minorities (Wang et al., 2013). Multiple studies have found nonmedical pain reliever use to be far more ubiquitous among rural adolescents in comparison to their urban peers (Young, Glover, & Havens, 2012). A study using the RADARS® System Poison Center program, which covered 90.8% of the United States population at the time of data collection, found rural areas to have a proportionally larger amount of the population filling prescription opioids in contrast to urban and suburban locations (Le Lait et al., 2014).

While nonmedical prescription opioid use is concerning by itself, the increased risk of illicit heroin stemming from nonmedical prescription opioid use is just as alarming (Dasgupta et al., 2014). A study of North Carolina residents provided preliminary evidence of a shift from prescription opioid deaths to those involving heroin (Dasgupta et al., 2014). The evolving opioid epidemic in rural areas is an area that can be further explored. This study, however, sought to fill a gap in the literature regarding opioid hospitalizations by providing demographic correlates of the inspected Michigan counties with the highest and lowest opioid hospitalization rates.

Recommendations

There are still many areas for further research in this realm. Deeper analysis of other factors that correlate with opioid hospitalization rates in Michigan counties is suggested. Continued research is recommended to understand racial composition, levels of deindustrialization, and possible shifts from prescription opioids to heroin in these rural Michigan counties. In addition, the author has noted differences between opioid hospitalizations,

opioid overdose deaths, and opioid prescribing rates in Michigan counties. The CDC noted high retail opioid prescription rates in the Michigan HG counties in 2014 but overdose deaths in the next year for the HG counties were close to zero (Centers for Disease Control and Prevention, 2017; Tanner, 2017). In 2015, the three counties of Benzie, Calhoun, and Gogebic, had the highest opioid overdose death rates in the state at 3 overdose deaths per ten thousand people (Tanner, 2017). Only one of those counties was in this study's HG in the 2013-2015 time period. This implies a complicated relationship between opioid prescribing rates, opioid hospitalizations, and opioid overdose deaths that requires further investigation in these counties. Stigmatization of chronic pain and prescription opioid usage in conjunction with the limited availability of dependence treatment programs in rural counties may support why opioid hospitalization rates are higher in these Michigan counties. Examination of disparities in opioid dependence treatment programs, naloxone distribution, and social capital between urban and rural counties on the state and national level would also benefit the field.

There are several limitations in this study. One limitation is that causation cannot be implied between the factors examined and the rates of opioid hospitalization since the study was not conducted experimentally. Additionally, the correlations were not tested for statistical significance between the five counties with the highest opioid hospitalization rates and the five counties with the lowest opioid hospitalization rates. Testing for statistical significance in unemployment rates, the rate of uninsured people, and poverty level rates between the two groups would be a beneficial future endeavor. Finally, while opioid hospitalizations are valuable in understanding the opioid epidemic, emergency room (ER) visits are not included in these hospitalizations (S. Oh, personal communication, February 14, 2018). Many opioid overdoses go through the ER and often cycle through the system multiple times without patient

hospitalization. It is possible that ER departments in some of the Michigan rural counties examined in this study were more sensitive in recording opioid hospitalizations within a hospital setting. In contrast, it is probable that many urban cases that would warrant an opioid hospitalization in rural areas were treated onsite by emergency services and never hospitalized formally. This possibility could explain why the Michigan counties with high opioid overdose death rates in the examined time period did not generally overlap with the top five Michigan counties that had the highest opioid hospitalization rates from 2013-2015. Due to these multiple phenomena, this study likely underrepresents the extent of the opioid epidemic in Michigan counties and adds additional weight to the need for further study.

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References

Barnett, J. C., & Vornovitsky, M. (2016, September 13). Health insurance coverage in the United states: 2015. Retrieved April 12, 2018, from https://www.census.gov/library/publications/2016/demo/p60-257.html

Centers for Disease Control and Prevention. (2017, August 18). International classification of diseases, tenth revision, clinical modification (ICD-10-CM). Retrieved April 14, 2018, from https://www.cdc.gov/nchs/icd/icd10cm.htm

Centers for Disease Control and Prevention. (2017, December 19). Opioid overdose. Retrieved April 12, 2018, from https://www.cdc.gov/drugoverdose/data/statedeaths.html

Centers for Disease Control and Prevention. (2017, July 31). U.S. County prescribing rates, 2014. Retrieved April 17, 2018, from https://www.cdc.gov/drugoverdose/maps/rxcounty2014.html

Chopra, N., & Marasa, L. H. (2017). The opioid epidemic. *International Journal of Psychiatry in Medicine, 52*(2), 196–201. doi:10.1177/0091217417720900

Cicero TJ, Ellis MS, Surratt HL, Kurtz SP. The Changing Face of Heroin Use in the United States: A Retrospective Analysis of the Past 50 Years. *JAMA Psychiatry.* 2014;71(7):821–826. doi:10.1001/jamapsychiatry.2014.366

Courtwright, D. T. (2001). *Dark paradise a history of opiate addiction in America / David T. Courtwright.* (Enl. ed. .). Cambridge, MA : Cambridge, MA : Harvard University Press.

Dasgupta, N., Creppage, K., Austin, A., Ringwalt, C., Sanford, C., & Proescholdbell, S. K. (2014). Observed transition from opioid analgesic deaths toward heroin. *Drug and Alcohol Dependence, 145*, 238–241. doi:10.1016/j.drugalcdep.2014.10.005

DeNavas-Walt, C., & Proctor, B. D. (2015, September 01). Income and Poverty in the United States: 2014. Retrieved April 12, 2018, from https://www.census.gov/library/publications/2015/demo/p60-252.html

Kolodny, A., Courtwright, D. T., Hwang, C. S., Kreiner, P., Eadie, J. L., Clark, T. W., & Alexander, G. C. (2015). The prescription opioid and heroin crisis: A public health approach to an epidemic of addiction. *Annual Review of Public Health*, *36*(1), 559–574. doi:10.1146/annurev-publhealth-031914-122957

Le Lait, M., Martinez, E. M., Severtson, S. G., Lavery, S. A., Bucher-Bartelson, B., & Dart, R. C. (2014). Assessment of prescription opioid intentional exposures across the rural-urban continuum in the United States using both population and drug availability rates. *Pharmacoepidemiology and Drug Safety*, *23*(12), 1334–1337. doi:10.1002/pds.3653

Mclean, K. (2016). There's nothing here: Deindustrialization as risk environment for overdose. *International Journal of Drug Policy*, *29*, 19–26. doi:10.1016/j.drugpo.2016.01.009

Morone, N. E., & Weiner, D. K. (2013). Pain as the fifth vital sign: Exposing the vital need for pain education. *Clinical Therapeutics*, *35*(11), 1728–1732. doi:10.1016/j.clinthera.2013.10.001

Paulozzi Grant ; Franklin, Gary ; Kerlikowske, R ; Jones, Christopher ; Ghiya, Neelam ; Popovic, Tanja;, L. ; B. (2012). CDC grand rounds: Prescription drug overdoses—a U.S. epidemic. *JAMA*, *307*(8), 774–776.

Ruhm, C. J. (2017). Geographic variation in opioid and heroin involved drug poisoning mortality rates. *American Journal of Preventive Medicine*, *53*(6), 745–753. doi:10.1016/j.amepre.2017.06.009

Tanner, K. (2017, April 22). Tragic toll: Drug overdose deaths quadruple in Michigan. Retrieved April 17, 2018, from https://www.freep.com/story/opinion/contributors/raw-data/2017/04/21/drug-overdose-deaths-quadruple-michigan-since-1999/100686662/

Tompkins, D. A., Hobelmann, J. G., & Compton, P. (2017). Providing chronic pain management in the fifth vital sign era: Historical and treatment perspectives on a modern-day medical dilemma. *Drug and Alcohol Dependence, 173*(Suppl 1), S11–S21. doi:10.1016/j.drugalcdep.2016.12.002

Trescot, Andrea M., M., Datta, Sukdeb., M., Lee, Marion., M., & Hansen, Hans., M. (2008). Opioid pharmacology. *Pain Physician, 1975*(3), S133–S153. doi:https://www.ncbi.nlm.nih.gov/pubmed/18443637

United States Census Bureau. (2010, October 05). American fact finder. Retrieved April 12, 2018, from https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=CF

United States Census Bureau. (2012, September 01). Urban and rural (county classification lookup table). Retrieved April 16, 2018, from https://www.census.gov/geo/reference/urban-rural.html

United States Office of National Drug Control Policy. (2011, January 01). Epidemic: Responding to America's Prescription Drug Abuse Crisis. Retrieved March 18, 2018, from https://www.hsdl.org/?abstract&did=4609

Waehrer, G. M., Zaloshnja, E., Miller, T., & Galvin, D. (2008). Substance-use problems: are uninsured workers at greater risk? (Report). *Journal of Studies on Alcohol and Drugs, 69*(6), 915. doi:10.15288/jsad.2008.69.915

Wang, K., Becker, W., & Fiellin, D. (2013). Prevalence and correlates for nonmedical use of

prescription opioids among urban and rural residents. *Drug and Alcohol Dependence*, *127*(1–3), 156–162.

Wendel, T., & Curtis, R. (2000). The heraldry of heroin: Dope stamps; and the dynamics of drug markets in New York City.(Statistical Data Included). *Journal of Drug Issues*, *30*(2), 225.

White House. (2017, October 26). President Donald J. Trump is Taking Action on Drug Addiction and the Opioid Crisis. Retrieved April 10, 2018, from https://www.whitehouse.gov/briefings-statements/president-donald-j-trump-taking-action-drug-addiction-opioid-crisis/

Young, A. M., Glover, N., & Havens, J. R. (2012). Rural Adolescents' Nonmedical Prescription Drug Use: Implications for Intervention. *Prevention Researcher*, *19*(1), 7–9.

Zoorob, M., & Salemi, J. (2017). Bowling alone, dying together: The role of social capital in mitigating the drug overdose epidemic in the United States. *Drug and Alcohol Dependence*, *173*, 1.