

Kentucky Journal of Undergraduate Scholarship

Volume 6 | Issue 1

Article 3

2023

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Recommended Citation

Bellamy, Erica C. and Maples, James N. (2023) "Comparing Substance Use Social Issues in Appalachian and non-Appalachian Regions in Kentucky," *Kentucky Journal of Undergraduate Scholarship*: Vol. 6: Iss. 1, Article 3.

Available at: <https://encompass.eku.edu/kjus/vol6/iss1/3>

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Comparing Substance Use Social Issues in Appalachian and Non-Appalachian Regions in Kentucky

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Abstract: *Substance use and abuse is not a uniquely Appalachian problem, but it remains a prevalent social problem for the geographical region. Kentucky has been one of the central states experiencing generations of substance abuse, ranging from methamphetamines to OxyContin to heroin. Eastern Kentucky, which includes a portion of Central Appalachia, has been a focal point for the proposed war against substance use. What remains undemonstrated in studies is exactly how substance abuse differs between the Central Appalachian counties of Eastern Kentucky and the remainder of the state. In this study, the researchers examine how drug mortality, nonfatal overdoses, emergency room substance abuse diagnoses, and inpatient hospital substance abuse rates vary between Appalachian and non-Appalachian counties in Kentucky. Results indicated that there is a marginal difference in drug fatalities and a statistical difference in both emergency room and inpatient diagnoses of substance abuse. However, the non-fatal overdose rate is nearly identical for Appalachian and non-Appalachian counties across the state. The authors argue this can be explained through Relative Deprivation Theory, persistent underdevelopment of Kentucky's Appalachian counties, and medical use practices in the region. The researchers close with recommendations on reconsidering how substance use is treated.*

Keywords: *Substance use, Appalachia, social issues, relative deprivation theory*

Substance abuse and subsequent addictions remain an ongoing issue in the United States but are especially pronounced in Appalachia. The drug epidemic in America showed a dramatic increase in recent years, with deaths exceeding 107,000 in 2021 (American Medical Association, 2022). In Appalachia, overdose rates increased between 2015 and 2017 before briefly declining in 2018. However, by 2020, rates (particularly in West Virginia and Eastern Kentucky) were among the worst in the nation. This social problem continues to increase in recent years and has especially become pronounced in certain parts of the United States, in particular Central Appalachia, where prescription drugs and the prevalence of Fentanyl in injectable drugs have led to increased overdose rates.

Eastern Kentucky has a longstanding association with generational poverty, educational issues, and health disparities compared to the rest of the state, but what remains unclear is how substance use-related issues may vary across the state (Bunn & Slavova 2012; Estep, 2016). Although state funding supports efforts across its entire borders, it would be beneficial to establish statistically if certain parts of the state are facing social problems in different ways or in different levels. Moreover, as Eastern Kentucky has earned a reputation for generational poverty, it would be valuable to understand how these issues may be exacerbating existing issues across the state with substance abuse. As such, this study aims to address this gap by exploring

the extent that factors like drug overdoses (fatal and non-fatal) and substance use diagnoses may vary between Eastern Kentucky's Appalachian counties and the remainder of the state.

In this study the researchers use University of Kentucky Injury Prevention and Research Center's (2021) county-level resident drug overdose rates to understand how four measures of substance use (fatal overdoses, non-fatal overdoses, substance use diagnoses in emergency room settings, and substance abuse diagnoses in primary care settings) may vary between Appalachian and non-Appalachian counties in Kentucky. The researchers examined three exploratory hypotheses using difference of means testing: Appalachian counties will have higher instances of overdose fatalities, non-fatal overdoses treated in emergency rooms, substance abuse diagnosed in emergency room visit, and substance abuse diagnosed in inpatient care. Results indicate that there is a marginal statistical difference in fatal overdoses between Appalachian and non-Appalachian Kentucky counties. The lack of statistical significance may be partly explained by missing data). However, non-fatal overdoses are consistent across the state. Interestingly, both emergency room and primary care diagnoses of substance abuse are notably higher in Appalachian Kentucky counties compared to the rest of the state.

Literature Review

Overdose rates have gradually increased across the United States in recent years with rates notably high in Appalachia. In 2020, over 91,000 people in the United States died from overdoses (up from 70,000 the year before; National Institute on Drug Abuse, 2022). Overdoses further increased to over 107,000 deaths in 2021 (American Medical Association, 2022) Notably, death from synthetic opioids, including fentanyl, accounted for over half the deaths. In comparison, Appalachia saw its own increases in what Appalachian scholars have referred to as “diseases of despair” in the region (Heffernan et al., 2021). In Appalachia, overdose rates had increased from 2015 to 2018, but appeared to decline in 2019 (Heffernan et al., 2021). Throughout rates frequently remained higher than in non-Appalachian counties.

So-called street drugs (such as heroin) are no longer the central focus regarding overdose deaths as prescription medication overdoses are on the rise. A study found 91% of persons deceased from overdoses had records of opioid painkillers 5 years prior to death (Slavova et al., 2017). Additionally, 77% had opioid prescriptions filled within 2 years before death and 41% had a record of high-measure opioid use. Among the fentanyl overdose mortalities, 46% had a history of substance use. (Slavova et al., 2017). Fentanyl involved a higher concentration than heroin which created a significant problem that resulted in increased mortality. Fentanyl was used to enhance drugs at the street level. Sadly, most people who thought they did just heroin were taking fentanyl that created higher death rates. Fentanyl linked a higher correlation between those ending up in the ER and overall overdoses. There was no correlation of those using just heroin deaths with hospital visits. Louisville, Kentucky’s (Jefferson County) population of 730,000, had (10%) heroin overdoses; the remaining 22% heroin overdoses were in 10 other counties (Slaovova et al., 2017).

State poverty and state unemployment rates further complicated prescription opioid misuses (Spiller et al., 2009). A program by Fayette County Court System provided help for drug addicts facing criminal charges a chance for sobriety. Participants were required to find approved housing and maintain full-time employment. In the court system, 491 people participated. Specifically, 146 people graduated with a 48% retention rate. Participants involved 71% male and 64% African American with an average age of 31 (Mateyoke-Scrivner, et al., 2004). In Kentucky 53% of all drug overdose deaths involved prescription drugs (Slavova et al., 2017).

Characteristics of Appalachia, such as a lack of health professionals and services due to cost and distance to care, make treating addiction in the region unique from other areas (Moody, Satterwhite et al., 2017). A huge concern with opioid overdoses was lack of resources for mental health issues related to drug addiction (Bunn & Slavova, 2012). Likewise geographical differences may contribute to outcomes. Jefferson County has the highest overdose rates in Kentucky. Kentucky’s overdose death record for Jefferson County in 2020 recorded 512 overdose deaths compared to 319 deaths in 2019 (Noble & Ingram, 2020). Overdose deaths in Kentucky and across the U.S., were attributed primarily with natural or semi-synthetic opioid use including,

oxycodone, oxymorphone, hydrocodone, and morphine. However, in 2015 the attributable drug to overdoses was fentanyl. Fentanyl deaths in Jefferson County led to 417 residents, this increased fentanyl usage compared to heroin (Slalova et al., 2017).

Narcan helped substance users recover from drug overdoses in the immediate sense but does not address longstanding addiction patterns. Narcan reversed opioid overdoses onsite and reduced mortality rates. Health care providers who used Narcan blocked opioid receptors in the brain during an overdose. The wide access to Narcan solved some solutions to overdose rates. Certain programs helped distributed the need for naloxone (Narcan). In 2019, Arizona received a \$2 million grant from Substance Abuse and Mental Health Administration to start the Tempe first-responders Opioid Recover Project. This project allowed officers to be trained and equipped to administer Narcan (White et al., 2021). Programs that provided training to first responders and police helped decrease overdose deaths. Medicaid OUD treatment prescriptions for buprenorphine, naltrexone and naloxone increased 136% and jumped from \$394 million to \$929.9 million. The average annual spending increased 19% nationally with faster growth in upcoming years. 30% increased between 2015 and 2016. As a result of Medicaid’s creation of fast access for overdose rates via Narcan, there was an increase in the demand for Narcan across the country, including Kentucky (Clemens-Cope et al., 2017). That said, Narcan does not address longstanding addiction patterns, creating scenarios where users may overdose, be treated with Narcan, and then immediately return to past addictive behaviors. This supports a need for continuing Narcan, but also addressing, ideally at the state/federal levels, long-term substance abuse plans beyond treating overdoses. A senate bill entitled “H.R. 1628” set aside \$2 billion dollars for opioid related treatment. Poverty prevented Medicaid from helping those in need of treatment. Low-income families lack access to affordable healthcare that covers treatment for OUD. Uninsured individuals with OUD were less likely to receive treatment (Clemens-Cope et al., 2017). One future solution, then, is that the application of Narcan could qualify individuals for counseling and in-person therapy sessions.

Strong opioid use started with pharmaceutical companies over prescribing medication. During the Civil War veterans who suffered injuries were given morphine for pain. In 1912 the United States signed a deal called the International Opium Convention Act, which controlled the distribution of synthetic opioids. In 1924 the Heroin Act prohibited the production, importation, and possession of heroin. Veteran opioid addiction continued to skyrocket, even though these laws and acts tried to prevent addiction (Rummans, et al., 2018). Oxycontin prescriptions decreased in the start of the 90’s. Nationwide, the drug epidemic regarding opioid use flourished specifically in rural, suburban, and small suburban areas. Late 90’s Research Abuse, Diversion and Addiction related surveillance system provided methods to fix the problem of OxyContin (Miller & Griffing, 2011). The Radars program analyzed prescription opioids were more popular than heroin or cocaine (Cicero, et al.,

2007). Pharmaceutical facilities created over prescription of opioids during 1995-2012 at startling rates. 72.4% opioid prescriptions were written per 100 people in 2006. In 2016 those numbers decreased by 66.5% per 100 people prescribed opioids. Even though prescription rates lowered, people were still dying of opioid overdoses, indicating a greater social problem at hand, particularly in Appalachian areas (Rummans et al., 2018).

Sociological theory helps explain Appalachia's addiction rates when compared to non-Appalachian regions. Robert Merton's Strain Theory explores what happens when society pushes certain goals that individuals should achieve but the functional resources to actually meet those achievements may not exist or have equal access (Merton, 1938). In society, this could represent the premise of the American Dream. In America, there are social expectations to live a life that fits into a very specific series of frameworks, such as work, family, and marriage. As members of society, one's job to achieve the American Dream by going to college or trade school to move up in the world to be successful. Lack of education, resources, and funding creates barriers for drug addiction to rise. The inability to reach these often very unattainable expectations results in a sense of rejection from society. With regards to crime and deviancy, drugs are used as coping mechanism or means to achieve success by selling drugs or escaping the pressure by regularly using them. Crime may also be used to avoid strains from society. Individuals with drug addiction may try to alleviate negative emotions through drug use (Agnew, 2018). Lack of resources in Appalachia show a connection between related factors and opioid overdoses where high poverty and unemployment rates occur. Lack of medical care in these counties are also a contributing factor for overdoses. Age ranges 25-44 had 70% higher overdose deaths in Appalachian counties, which also overlaps with a young demographic who would be attempting to reach things like wealth and financial stability in the region while also being at higher odds of substance use (Thompson et al., 2020).

One longstanding premise of the opioid (and even past substance use patterns like methamphetamines) crisis in the United States has been that the problem is notably worse in Appalachia when compared to the rest of the nation. There is at least some evidence this is true. For example, for Eastern Kentucky counties have been listed in the past as among the top ten worst counties for opioid hospitalization rates (Kentucky Office of Drug Control Policy, 2017). Notably, Central Appalachian counties, Perry and Leslie county, were placed first and second for highest rates of opioid hospitalization. Clay County, an Appalachian county in Kentucky, recently gained notoriety in having a population of 21,000 residents but filling 2.2 million doses of hydrocodone and 617,000 doses of oxycodone in a single year (Estep, 2017). Having statistical analysis of these issues as they differ between Kentucky's Appalachian and non-Appalachian counties could provide some new approaches to discussing treatment.

Method

Data utilized in this study are from the 2020 wave of the University of Kentucky Injury Prevention and Research Center's publicly available county-level resident drug overdose rates (Kentucky Injury Prevention and Research Center, 2021). This dataset represents a partnership between the research center (located in the University of Kentucky College of Public Health) and Kentucky Department for Public Health. The dataset authors collected data from hospital chart codes indicating types of treatment related to substance abuse and to death certificates indicating substance overdoses as the cause of death. The dataset only examines Kentucky residents, which means someone visiting in Kentucky and experiencing any of the above scenarios would be excluded. The data represent all known cases of Kentucky residents, and the full methodology is available on the research center's website. For the interest of this study, the researchers focused on three ideas: residents dying from an overdose, residents seeking medical care for an overdose and surviving, and residents being diagnosed with a substance abuse disorder while under medical care at an emergency room or inpatient care scenario.

Overdose fatalities are established through death certificates containing death codes indicating poisoning by opioids (including heroin, methadone, and similar narcotics) and stimulants (such as cocaine) commonly associated with drug overdose deaths. Nonfatal overdoses emergency room visits include any of the overdose fatality categories where the patient visited the emergency room and survived the overdose. This also includes overdoses coded with multiple drugs. It can also include accidental, self-harm, assault, and undetermined intent scenarios. For example, a suicide attempt using opioids would still be counted. Substance use diagnoses received in the emergency room or in inpatient care, indicate that a person under medical care received a diagnosis of substance use on their chart. For clarity, the data excluded alcohol, nicotine, and inhalant uses. The substance abuse can also be one of multiple diagnoses from the medical provider. All four measures are examined as rates per 100,000 population. This step helps control for large metro areas such as Lexington or Louisville having more cases due to their size in comparison to rural counties like Lee or Fulton. Finally, counties were coded in the dataset as either being Appalachian counties or non-Appalachian counties using the Appalachian Regional Commission's list of Kentucky Appalachian counties.

The researchers examined each of the identified hypotheses using a difference of means test to determine how overdose rates, survived overdoses, and diagnosis of substance abuse vary for Appalachian versus non-Appalachian counties. The researchers expected, based on literature summarized above, Appalachian counties will have higher instances of overdose fatalities, non-fatal overdoses treated in emergency rooms, substance abuse diagnosed in emergency room visit, and substance abuse diagnosed in inpatient care. Difference of means testing is the most appropriate analysis as the four dependent variables of interest are continuous rates and Appalachian/non-Appalachian counties is a dichotomous measure.

Results

Table A1 (*see Appendix A*) describes the variables utilized in this study. Roughly 45% of counties in Kentucky qualify as Appalachian counties per the Appalachian Regional Commission. Overdose fatalities averaged around 48 per 100,000 residents across all counties. However, note that 73 counties were suppressed for being under ten but greater than one. This somewhat skews the results. Note also that zero is a legitimate value indicating no reported cases. This may cause issues in the hypothesis testing stage. When examining the remaining variables, there were roughly 239 non-fatal overdoses treated in emergency room scenarios per 100,000 residents across all counties. An average of 945 substance abuse cases per 100,000 residents were diagnosed in emergency room settings across all counties, while 882 per 100,000 residents were reported in inpatient settings.

Looking ahead, one issue in analyzing the first hypothesis will be the high instances of missingness in overdose fatalities. Only 47 of 120 counties had data for this variable. In most cases the data were redacted because less than ten instances occurred in the county. Note this is ten actual events, not ten cases per 100,000 residents. Further examination of the data indicated that about half (39) of the missing cases are non-Appalachian counties while 34 were Appalachian counties. In an attempt to understand how these missing cases may influence the findings, the authors identified Appalachian versus non-Appalachian missing counties which had higher than mean data for non-fatal overdoses diagnosed in an emergency room visit. Appalachian counties Bath (344), Bell (302), Casey (261), Clay (259), Fleming (246), Lee (371), Nicholas (248), Rockcastle (268), Rowan (251), and Wolfe (337) all had higher than the mean cases for non-fatal overdoses. In comparison, non-Appalachian counties Bracken (301), Carroll (410), Gallatin (330), Grayson (268), Harrison (348), Mercer (324), Muhlenberg (288), Owen (245), Pendleton (342) and Washington (279) had higher scores than the mean for non-fatal overdoses. Although not tested for statistical differences, the mean non-fatal overdose rate for Appalachian counties with missing fatal overdose rates is 214 cases, while non-Appalachian counties averaged 197 cases. Although not summarized here for word count considerations, this relationship continues when looking at substance use diagnoses in emergency rooms (Appalachian counties $M = 1,077$ vs non-Appalachian counties $M = 631$) and substance use diagnoses in primary care (Appalachian counties $M = 1,211$ vs non-Appalachian counties $M = 471$). As such, there is at least some evidence here to argue that the results in H1 may be overlooking potentially higher fatal overdoses in Appalachian counties.

Table A2 (*see Appendix A*) lists the results of the difference of means tests of the hypotheses. Hypothesis one examines differences in overdose fatalities among Appalachian and non-Appalachian counties. Here, the results are marginally significant ($p = .06$) with Appalachian counties having roughly 17 more cases per 100,000 residents. Hypothesis two examines nonfatal overdoses treated in emergency rooms. Here, the means did not statistically differ with both groups having roughly the same number of cases per 100,000 residents. Hypothesis three

examines substance use diagnoses in emergency room scenarios. This variable significantly ($p = .001$) varies by Appalachian and non-Appalachian counties. Appalachian counties reported (on average) over 400 more cases per 100,000 residents than non-Appalachian counties. Similarly, in hypothesis four, Appalachian counties had significantly ($p = .001$) higher cases than non-Appalachian counties. Here, Appalachian counties had over 700 more cases per 100,000 residents of substance abuse diagnoses in inpatient settings than non-Appalachian counties.

Discussion

The findings in this paper, summarized here, indicate that Kentucky's Appalachian counties had higher instances of substance abuse diagnoses in both emergency room and primary care settings compared to non-Appalachian counties in Kentucky. Likewise, Kentucky's Appalachian counties had a marginally significant difference in fatal overdoses, with arguably higher rates of fatal overdoses compared to non-Appalachian Kentucky counties. This result was likely impacted by the high rate of missing data for fatal overdoses which was almost evenly divided between Appalachian and non-Appalachian counties. However, using non-fatal overdoses requiring an emergency room visit as a proxy, the researchers found the missing Appalachian counties had overall more non-fatal overdoses on average compared to the missing non-Appalachian counties. As such, this provides reasonable evidence for supporting this marginal finding and exploring it further in future analyses.

Sociological theories provide a starting point for understanding these findings, particularly Merton's work on Relative Deprivation Theory. Relative Deprivation Theory indicates that having access to fewer resources (such as human, social, and spatial capital as well as financial resources) may cause persons to feel maligned and deprived (Merton & Kitt, 1950). In Appalachian counties, this could be represented by the frequent lack of resources (defined in many ways) absent in these counties. For this theory to hold, the authors would need to identify a way in which that feeling of deprivation could manifest. Substance use certainly seems feasible. Arguably, people seeking an escape to this scenario could look to the momentary rush and even long-term distraction of substance use as a tangible solution given few to no other options. Further supporting this perspective here could include underdevelopment in Appalachian Kentucky counties. Eller (2008) argues that Central Appalachia (which includes much of Eastern Kentucky and all of Kentucky's Appalachian counties) has experienced generations of underdevelopment due to its reliance on extractive industries and a lack of extensive and diverse development over time.

This relative deprivation/underdevelopment argument could also be partly rooted and reinforced by the lack of medical options in Appalachia. Krasnopolksy and Maples (2021) explored health differences in Appalachia and outlined how Appalachians in Kentucky had statistically-worse health outcomes, physician access, and insurance access compared to the rest of the state's counties. Much of this is rooted in the lack

of medical options available to the community. As such, patients are apt to delay care on minor issues, sometimes leading to major medical visits such as primary care in hospitals or emergency services. This could partly explain the higher rates of substance use diagnoses at both options in Kentucky's Appalachian counties. Patients there are more apt to use those services than non-emergency visits or even use of walk-in clinics. There, substance use problems are diagnosed (possibly for the first time) in emergency settings where long-term care for this issue may come second to addressing other health issues at hand.

Recall the researchers noted in the literature a prevalence of prescription drug use in Appalachian counties, such as opioids like OxyContin. In some ways, this reliance and use pattern again falls back to Relative Deprivation Theory. The region was effectively targeted as a consumer base looking for pain mediation and treatment. This partly ties back to the working-class lifestyles of the region as well as its reliance on physical labor and wage compulsion as a means of survival (Gaventa, 1982). Prescription opioids provided a legally-available approach to addressing feelings of deprivation. This later transitioned into additional forms of substance use, such as heroin and fentanyl. A similar argument can be made about the transition of using legal and prescribed stimulants over time before transitioning into illegally produced methamphetamines in Appalachia even prior to (and certainly still overlapping with) its most recent opioid issues.

The question of what can be done about this problem remains. First, it is important to avoid hesitation in treating this social problem. It is not something that will go away. Moreover, it will require active involvement from numerous social welfare organizations and medical practitioners. At the ground level, Narcan provides a solution to drug overdose fatalities. Narcan was first released in 1971 by the Food and Drug administration. This harm reduction tactic was rarely used at first (Kavanaugh, 2020). It provides an individual that is overdosing to reverse the effects of the opioid in their system. Increasing the use of Narcan before paramedics arrive could save lives at a faster rate and making it both cheaper and more prevalent will save lives. Narcan, however, does not address transitioning from substance use to addiction.

Addiction starts from biological and psychological occurrences from that individual's life leading to a dependency on a substance (or substances) to live day to day. An important component of addressing the mental and physical ties to substance abuse begin with rehabilitation and counselling. Rehab and counseling help the individual recover by looking back at past trauma that brought them to addiction in the first place. Unfortunately, Appalachian Kentuckians have unequal access to treatment programs, much like they have limited access to medical care, and have statistically lower rates of having insurance which might reduce the costs of rehabilitation. It would behoove the Commonwealth of Kentucky to take a more hands-on approach in treating substance addiction by providing universal access to rehabilitation service for its residents. While this is a great task to achieve, attempts to combat this problem have failed to mitigate addiction in the state. However, this may

prove less expensive than the long-term costs of policing drug-related crimes, social work services, and state-sponsored medical care for overdoses.

Additionally, the fight against substance abuse may require rethinking the treatment process. The researchers examined a few instances where substance use is identified: overdose mortalities, overdoses requiring emergency room care, and diagnoses in either emergency room or in-patient care scenarios. One observed, and potentially overlapping, is police custody. Thus far, how substance use (and in at least some cases, substance addiction) is being treated has not had a satisfactory outcome from a societal perspective. Thus, medical practitioners, police forces, courts, social workers, and state government offices will need to find a way to react as a team to address addictions whenever they appear in any corner of their web of services. For example, when substance use cases appear in the hospitals, assigning a social worker for case monitoring and long-term support, providing contacts and context for seeking rehabilitation, and making treatment a long-term goal may prove more beneficial than simply treating overdoses with Narcan and releasing them. This may also include courts moving away from custodial sentencing toward a rehabilitation model. A successful program that represented success came from Chief Campanello who worked under narcotics unit for seven years. Campanello announced addiction was a disease. The police department from a small town in Massachusetts created the Gloucester's Angel Act. Since the start of the program 391 addicts have been placed in treatment rather than jail. As of 2016, 56 police departments in 17 states their own version of the act (Seelye, 2016), although the long-term results of these efforts are not established in the article. Further, future studies examining how arrest rates vary across Appalachian and non-Appalachian counties could prove useful in this conversation.

Limitations of this study can provide guidance for future research. First, these findings are bound to the Commonwealth of Kentucky which makes them difficult to apply to other states. Conditions in Eastern Kentucky may also be hard to replicate and compare to other areas. Arguably, Eastern Kentucky has one of the highest concentrations of poverty in the nation, and this arbitrarily overlaps with Central Appalachia's western border through the state. A more effective (but much larger) study would be to explore all Central Appalachia's counties and the substance use rates for counties in Kentucky, West Virginia, North Carolina, Virginia, and Tennessee using a similar analytical approach. Next, this study could benefit from utilizing a statistical approach which allows for control variables. The authors examine here only how substance use varies by counties in two groups but being able to control for issues like poverty or educational attainment may create valuable knowledge about the Commonwealth. One additional issue is that the authors chose to use data on all overdoses versus drug-specific overdoses. Separating out different kinds of overdoses may provide additional evidence of differences between Appalachian and non-Appalachian Kentucky. As previously noted, the missing data in the fatal overdose category is also problematic. Although the authors argue these missing data lean in favor of higher

overdoses overall in Appalachian counties, it would be valuable to back this finding up with other data sources. Further, the researchers do not have data on outcomes from substance use diagnoses or non-fatal overdoses. For example, it isn't clear what happens after the patient leaves the hospital. Having individual level data which can be tracked over time would likely provide valuable information about how substance use in Kentucky functions and moreover what can be done to support those using in seeking treatment.

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APPENDIX A

Table A1:
Descriptive Statistics

Variable	N	Min	Max	Mean	SD
Appalachian county status (0=not app county, 1= app county)	120	0	1	0.45	.49
Overdose fatalities	47	0	130.93	48.38	27.54
Non-fatal overdoses treated in emergency rooms	112	0	543.59	239.75	100.01
Substance abuse diagnosed in emergency room visit	119	277.07	5079.35	945.42	736.69
Substance abuse diagnosed in inpatient care	118	103.86	5857.17	882.30	814.81

H1: Appalachian Kentucky counties will have higher rates of overdose fatalities than non-Appalachian Kentucky counties.

Group Zero Non-Appalachian County Mean (N = 27)	Group One Appalachian County Mean (N = 20)	t	df	p
41.91	57.10	-1.92	45	.06

H2: Appalachian Kentucky counties will have higher rates of nonfatal overdoses than non-Appalachian Kentucky counties.

Group Zero Non-Appalachian County Mean (N = 60)	Group One Appalachian County Mean (N = 50)	t	df	p
239.62	239.52	.005	110	.99

H3: Appalachian Kentucky counties will have higher rates of substance use diagnoses in emergency room scenarios than non-Appalachian Kentucky counties.

Group Zero Non-Appalachian County Mean (N = 65)	Group One Appalachian County Mean (N = 54)	t	df	p
750.04	1180.61	-3.30	117	.001

H4: Appalachian Kentucky counties will have higher rates of substance use diagnoses in inpatient hospitalization scenarios than non-Appalachian Kentucky counties.

Group Zero Non-Appalachian County Mean (N = 65)	Group One Appalachian County Mean (N = 53)	t	df	p
544.23	1296.92	-5.60	116	.001