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Characteristics of Prescription Opioid-impaired and Other Substance-Impaired Drivers in Rural Appalachian Kentucky

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Abstract

Previous studies have highlighted the prescription opioid epidemic in rural Appalachia and its associated risk behaviors; however, no studies have examined prescription opioid-impaired driving as a consequence of this epidemic. The purpose of the present study was to describe prescription opioid-impaired drivers in rural Appalachian Kentucky and examine how they are similar to and different from other substance-impaired drivers from the region. A sample of convicted DUI offenders from rural Appalachian Kentucky completed a confidential research interview focused on their substance use, mental health, and criminal activity. Prescription opioid-impaired drivers (n=33) were compared to other drug-impaired drivers (n=29) and to alcohol only-impaired drivers (n=44). Overall, prescription opioid-impaired drivers had a similar prevalence of illicit substance use and criminal activity, including impaired driving frequency, to other drug-impaired drivers but had a higher prevalence of illicit substance use and more frequent impaired driving when compared to alcohol only-impaired drivers. Study implications include the importance of comprehensive substance abuse assessment and treatment for DUI offenders and the need for tailored interventions for prescription opioid-impaired and other drug-impaired drivers.

Keywords

prescription opioids; impaired driving; rural Appalachia

Introduction

The misuse of prescription opioids has become a national epidemic (Dart et al. 2015). Recent estimates from the National Survey on Drug Use and Health (NSDUH) indicate that 12.5 million Americans ages 12 and older misused prescription opioids in the past year with

nearly 6000 new initiates each day (Substance Abuse and Mental Health Services Administration [SAMHSA] 2016). The prescription opioid epidemic has been linked to severe health consequences. For example, prescription opioid-related overdose deaths have quadrupled since 1999 (Centers for Disease Control and Prevention 2017). The need for services has also increased with the percentage of substance abuse treatment admissions for prescription opioid misuse and narcotic pain reliever-related emergency department visits approximately doubling in the past decade (SAMHSA 2017; Crane 2015).

Rural Appalachia has been found to be at particular high risk for prescription opioid-related problems (Zhang et al. 2008; Havens, Walker, and Leukefeld 2007). Rural Appalachian states such as Kentucky and West Virginia rank at or near the top in the U.S. in prescription opioid use disorders and treatment admissions (SAMHSA 2017; 2016) and overdose deaths (Kaiser Family Foundation 2017). Furthermore, injection drug use rates in rural Appalachia have risen sharply above national averages in conjunction with increased prescription opioid abuse and have led to increases in drug abuse-related infections (Staton et al. 2018; Havens et al. 2013). These consequences are compounded by the fact that many rural Appalachian areas are impoverished and lack, or offer limited, substance abuse treatment (Staton-Tindall et al. 2012). The shortage of substance abuse treatment (and health care provision, in general) coupled with a culture of self-reliance and distrust of outsiders in many Appalachian communities has resulted in particularly high rates of misuse and overdose of prescription medications, including prescription opioids, and high rates of unmet treatment need (Moody, Satterwhite, and Bickel 2017).

Despite the well-documented rural Appalachian prescription opioid problem and related health consequences, one unexamined effect of this epidemic is prescription opioid-impaired driving. Although there is evidence that individuals managed on therapeutic levels of prescription opioids may have limited impairment to their driving-related skills (Schumacher et al. 2017; Fishbain et al. 2003), other studies have shown prescription opioids can impede safe driving, especially under acute administration or in the context of opioid misuse (Zacny and Guitierrez 2009). Possible side effects include sedation, impaired concentration, and slowed information processing and reaction time, all of which decrease an individual's ability to safely operate a motor vehicle (Vearrier et al. 2016). Furthermore, previous studies have indicated that these effects may be exacerbated by co-ingesting other substances (Edvardsen et al. 2017). For example, using opioids and alcohol in combination leads to greater difficulty concentrating and other adverse side effects when compared to opioid use alone (Gudin et al. 2013).

The lack of data on prescription opioid-impaired drivers is an important omission given recent national data on drugged driving prevalence and traffic accident mortality. Estimates from the NSDUH indicate 10.1 million Americans drove under the influence of a drug other than alcohol in the past year (Lipari et al. 2016). The most recent National Roadside Survey indicated that opioids were one of the most prevalent drugs detected among drivers with 5.5% of daytime drivers and 4.7% of nighttime drivers testing positive. Opioids were second only to marijuana and other cannabinoids (Kelley-Baker et al. 2017). The increase in drug-impaired driving is associated with increased fatalities. In fact, the percentage of fatally injured drivers who test positive for drugs now surpasses the percentage testing positive for

alcohol (Hedlund 2017). Although impossible to attribute prescription opioids as the cause of the crash, an analysis of fatally injured drivers showed that the prevalence of detected prescription opioids increased seven-fold from 1995 to 2015 (Chihuri and Li 2017).

Given the high rates of prescription opioid misuse found in rural Appalachia and the effects that prescription opioids can have on driving-related skills, particularly when misused or used in combination with other substances, the lack of information on prescription opioid-impaired drivers in this region is conspicuous. In fact, we were unable to identify any studies that have focused specifically on prescription opioid-impaired drivers in rural Appalachia. As a result, it remains unclear how this group may be different from other impaired drivers and whether new approaches for prevention and intervention are needed. The current study examines a sample of DUI offenders from rural Appalachian Kentucky to addresses two research questions: 1) What are the characteristics of prescription opioid-impaired drivers in rural Appalachian Kentucky? and 2) How are prescription opioid-impaired drivers similar to and different from other substance-impaired drivers in rural Appalachian Kentucky?

Methods

Participants

A purposive sample of 118 individuals convicted of driving under the influence (DUI) was recruited from one of three rural Appalachian counties in Kentucky. Study eligibility included (a) being at least 18 years old; (b) convicted of a DUI within the past 12 months in one of the three targeted counties; and (c) residing in the same county in which they were convicted of DUI.

Procedure

Two participant recruitment methods were used. The majority (90%) of participants were recruited from district court houses. Potential study participants were identified from court dockets, and trained interviewers attended their scheduled court proceeding. If an individual was convicted of DUI, the interviewer immediately approached them outside the courtroom, extending an invitation to participate in the study. If the DUI offender was interested in participating and met eligibility criteria, the interviewer either facilitated the interview the same day or scheduled a later appointment. Approximately 27% of approached, eligible offenders refused to participate. Primary reasons for refusal included not having time or being accompanied by family/friends. The remaining participants (10%) were recruited through flyers placed in various locations around the community. Interested individuals contacted interviewers and were assessed for eligibility. Participants' DUI conviction information was also verified through court records. For those eligible, interviews were scheduled with the participant at their earliest convenience.

After participants provided their informed consent, they completed a one-time confidential research interview. Participants received \$25 for their participation, and their responses were protected by a federal Certificate of Confidentiality. All study procedures were approved by the University of Kentucky Institutional Review Board.

Measures

Demographic information included age, sex, race/ethnicity, marital status, education level, and whether they had a valid driver's license at the time of arrest.

Past year substance use was collected using sections of the Addiction Severity Index (McLellan et al. 1992). Participants were asked to report on their past year use of alcohol, marijuana, powder and crack cocaine, methamphetamine, heroin, amphetamines, sedatives/tranquilizers/barbiturates, and prescription opioids. Only illicit, nonmedical use was recorded for prescription medications.

Past year mental health information was also collected using the Addiction Severity Index. Participants self-reported whether they had experienced more than two weeks of depression, anxiety, or trouble remember or concentrating in the past year.

Participants were asked to report their past criminal activity, including DUI and non-DUI offenses. They reported their age at the time they first drove impaired, were first arrested for DUI, and were first convicted of DUI. Participants also reported the total number of times they had been arrested and convicted of DUI and estimated the number of times they have driven impaired in the past year and in their lifetime. Finally, participants reported separately whether their most recent DUI involved alcohol and whether it involved drugs. If drugs were involved, participants indicated the specific drug(s).

For other criminal activity, participants reported whether they had ever committed (regardless of arrest) drug crimes (drug possession or trafficking), property crimes (shoplifting, burglary, motor vehicle theft, forgery or fraud, other theft/larceny, trafficking stolen goods, arson, or vandalism), and violent crimes (assault, rape/sexual assault, or robbery). Participants also reported the age they first committed a non-DUI crime and the total number of lifetime arrests for non-DUI offenses.

Analytic Plan

Upon examination of participants' estimates of past year and lifetime frequency of impaired driving episodes, a few of the estimates provided by participants seemed implausibly high. As a result, any value of 1000 or above for past year estimates ($n=2$) and 10,000 or more for lifetime estimates ($n=4$) was removed. After the removal of these cases for the analysis of these specific variables, the distribution of estimates remained positively skewed. To better approximate a normal distribution, the natural logarithm of each estimate was calculated. These logarithmically transformed estimates were then used in the subsequent ANCOVA analyses for past year and lifetime impaired driving episodes.

Participants were then separated into three groups based on the substances they reported were involved in their most recent DUI conviction: those who reported being under the influence of prescription opioids (including those who were impaired by other substances), those who reported being under the influence of drugs (but not prescription opioids), and those who reported being under the influence of alcohol but not any drugs. Five participants could not be categorized either because they denied having alcohol or drugs in their system at the time of DUI arrest ($n=4$) or had missing data ($n=1$). Additionally, seven participants

were removed from the sample because they reported that their current DUI involved prescription opioids but denied illicit use (n=7). This left data from 106 participants available for analysis.

Prescription opioid-impaired drivers (n=33) were compared to other drug-impaired drivers (n=29) and alcohol only-impaired drivers (n=44) using a series of ANCOVA and logistic regression analyses controlling for sex differences across groups. Analyses examined differences in demographic information, past year substance use and mental health characteristics, and criminal history, including DUI. Analyses were conducted using SPSS 24 (IBM Corp. 2016).

Results

Demographics

The sample was predominately male (69.8%), White (96.2%), with an average age of 35.0 years (SD = 10.1) and 11.8 years of education (SD = 1.8). Almost one-third of participants were married (31.4%), and they reported an average annual income of \$18,756 (SD = \$21,697). Participants had a high prevalence of past year substance use; more than three-quarters reported using alcohol (82.1%) and drugs (76.4%) in the past year while nearly half (47.6%) reported past year prescription opioid misuse. The majority had been arrested for a drug-involved DUI offense (58.5%). Participants reported driving under the influence for the first time at 19.4 years old (SD = 6.5) with their first DUI arrest occurring at 27.1 years old (SD = 10.4). Participants reported an average of 3.1 DUI arrests (SD = 3.0) with an average of 2.6 DUI convictions (SD = 2.2).

The sociodemographic characteristics were similar between prescription opioid-impaired drivers and other substance-impaired drivers, with the only significant difference between groups being sex. Specifically, alcohol only-impaired drivers were significantly more likely to be male than prescription opioid-impaired drivers (OR = 3.44, 95% CI 1.18 – 9.99, $p = .023$), while female impaired drivers were overrepresented in the prescription opioid-impaired and other drug-impaired groups.

Substance Use and Mental Health

Participants' past year substance use and mental health histories varied across groups (see Table 2). Compared to prescription opioid-impaired drivers, alcohol only-impaired drivers were significantly less likely to have used sedatives (AOR = 0.26, CI 0.10 – 0.70, $p = .007$) or any illicit drugs (AOR = 0.08, CI 0.02 – 0.38, $p = .002$) in the past year. However, alcohol only-impaired drivers were more likely to have used alcohol in the past year (AOR = 5.92, CI 1.14 – 30.77, $p = .035$). Participants who were alcohol only-impaired (AOR = 0.04, CI 0.01 – 0.14, $p < .001$) and those impaired by other drugs (AOR = 0.07, CI 0.02 – 0.27, $p < .001$) were both less likely to report having misused prescription opioids in the past year.

Alcohol only-impaired drivers (AOR = 0.04, CI 0.01 – 0.14, $p < .001$) and those who were impaired by other drugs (AOR = 0.07, CI 0.02 – 0.27, $p < .001$) were significantly less likely to report experiencing mental health problems in the past year compared to prescription opioid-impaired drivers.

DUI and Other Criminal Activity

An analysis of DUI and other criminal activity revealed additional differences between prescription opioid-impaired drivers and other substance-impaired drivers. Alcohol only-impaired drivers reported significantly fewer past year ($F(2,98)=6.28, p = .003, \eta^2 = .11$) and lifetime ($F(2,98)=4.59, p = .012, \eta^2 = .09$) impaired driving episodes compared to prescription opioid-impaired drivers (Table 3). Other criminal history was then compared across the three impaired driver groups. The majority of participants self-reported that they had committed a non-DUI crime in their lifetime, although little variability was observed across groups. The exception was for alcohol only-impaired drivers who were significantly less likely to have committed a property crime in the past (AOR = 0.27, CI 0.10– 0.73, $p = .01$).

Discussion

The present study examined characteristics of prescription opioid-impaired drivers in rural Appalachian Kentucky and explored similarities to and differences from other substance-impaired drivers from this region. While prescription opioid-impaired drivers were similar to other rural Appalachian substance-impaired drivers on many characteristics, particularly when compared to other drug-impaired drivers, several notable differences between groups did emerge.

Substance Use

Prescription opioid-impaired and other rural Appalachian substance-impaired drivers use a wide variety of substances, a finding consistent with prior research (Staton-Tindall et al. 2014; Webster et al. 2009). Alcohol and illicit marijuana, sedative, and prescription opioid use were most prevalent with significantly higher prescription opioid use among those with a prescription opioid-involved DUI. Although alcohol only-impaired drivers had significantly lower rates of illicit drug use, more than half of this group reported past year illicit drug use, which is consistent with earlier research highlighting the co-occurrence of alcohol and drug use disorders among DUI offenders (Palmer et al. 2007).

Mental Health

High rates of past year mental health problems were also found, most notably for depression and anxiety. This has been shown in other samples of DUI offenders, particularly in repeat DUI offenders (Nelson et al. 2015; Freeman, Maxwell, and Davey 2011), as well as in samples of rural Appalachian offenders (Staton et al. 2015). Other studies have shown that individuals with mental health problems are more likely to report prescription opioid use and abuse (Edlund et al. 2007; Sullivan et al. 2006), with some citing the well-known association between mental health problems and physical pain as the cause for such variation (Scott et al. 2009).

DUI and Other Criminal Activity

The analysis of criminal history yielded few group differences but did suggest that past year criminal activity of substance-impaired drivers from rural Appalachian Kentucky was not limited to their DUI conviction. Rather, the majority of participants reported a non-DUI

crime in the past year, and approximately half of the prescription opioid- and other drug-impaired drivers reported a history of incarceration. This finding is consistent with other research showing a range of criminal activity among DUI offenders, especially those with multiple DUI convictions (Webster et al. 2009; LaBrie et al. 2007).

Frequency of impaired driving episodes was another criminal activity difference between impaired driver groups. Prescription opioid-impaired drivers reported more frequent past year and lifetime impaired driving episodes when compared to alcohol only-impaired drivers. One possible explanation for this finding is the lower overall substance use reported by alcohol only-impaired drivers in the sample. Although alcohol only-impaired drivers reported less frequent impaired driving, it is noteworthy that more than half of the sample reported more than 100 lifetime impaired driving episodes and more than half of those participants reported more than 1000 episodes. This finding that most impaired driving episodes do not result in arrest is consistent with the discrepancy found between national estimates of alcohol-impaired driving episode (121 million, Jewett et al. 2015) compared to the annual number of DUI arrests (1.3 million, Federal Bureau of Investigation 2012).

Prescription Opioid-impaired Driving

Finally, it is important to highlight the overall proportion of prescription opioid-impaired drivers in the present study. Nearly one-third of the sample reported being prescription opioid-impaired at the time of DUI arrest. This finding documents prescription opioid-impaired driving as a consequence of the prescription opioid epidemic in rural Appalachia. These rates are significantly higher than other studies that have assessed same day use of prescription opioids in DUI offenders (8.4%; Pilkinton, Robertson, and McCluskey 2013) and in fatally injured drivers (7.2%; Chihuri and Li 2017). The elevated rates of prescription opioid misuse in rural Appalachia (Zhang et al. 2008; SAMHSA 2017), in general, may explain the higher prevalence of prescription opioid-impaired drivers in this sample compared to other substance-impaired driving populations. Opioid prescription rates are significantly higher in Appalachian Kentucky than in other areas of the state (Luu et al. 2018). This greater availability of prescription opioids has led to their diversion and misuse (Keyes et al. 2014).

Implications

The prevalence of illicit drug use in this sample highlights the need for thorough clinical assessment for drug use disorders in addition to the alcohol use disorders typically associated with DUI offenders (Maxwell 2012; Webster et al. 2010), especially given recent evidence from a national sample of nighttime drivers which found that positive, alcohol breath tests were associated with certain drug use disorders and that a significant proportion of drivers had polysubstance use disorders (Scherer et al. 2017). Failing to identify the scope and magnitude of an individual's substance use problems can limit the effectiveness of treatment. Comprehensive substance abuse assessment and treatment of DUI offenders is crucial in areas like rural Appalachia where substance abuse services are limited. Criminal justice involvement may provide the only opportunity to receive substance abuse services (Staton-Tindall et al. 2015; Leukefeld et al. 2005).

Study findings also point to the importance of identifying and treating mental health problems among rural Appalachian DUI offenders.. The increased prevalence of co-occurring mental health and substance use disorders among criminal justice populations are well documented (Peters et al. 2015); however, these mental health problems are often inadequately addressed, particularly for those under community supervision (Lurigio and Swartz 2000). Just as in the case with substance abuse disorders, failure to detect a co-occurring mental health disorder can lead to an increased risk of re-offending and other poor treatment outcomes (Peters et al. 2008).

Study findings also have implications for impaired driving prevention. The majority of substance-impaired drivers from rural Appalachian Kentucky reported that their DUI arrest was drug-involved. This finding is indicative of the changing landscape with respect to impaired driving in the US (Hedlund 2017; Lipari et al. 2017). As a result, existing prevention programs and education programs for DUI offenders that stress the “Don’t Drink and Drive” message may need to also emphasize the dangers associated with drug-impaired driving, including driving under the influence of medications like prescription opioids (Pilkinton et al. 2013). This is particularly important in light of findings that youth perceive drug-impaired driving, particularly marijuana-impaired driving, as less dangerous than alcohol-impaired driving (McCarthy, Lynch, and Pederson 2007).

Finally, these findings present challenges for the criminal justice system in rural Appalachia. Drug-impaired driving detection by law enforcement is hampered by the absence of uniform roadside drug testing, necessitating that suspected drug-impaired drivers be taken to a facility (e.g., hospital) to obtain a biological specimen for drug testing. Other cues officers use to detect drunk drivers (e.g., the smell of alcohol) may not be effective to detect drug-impaired drivers, such as prescription opioid-impaired drivers. Conviction of drugged driving is further complicated by drivers who hold a valid prescription for a drug and are arrested after taking a therapeutic dose (DuPont 2010). The policies surrounding drugged driving and legal prescription drug use are a clear avenue for continued research (Voas et al. 2013). In addition, future studies should examine undetected drug use among alcohol-impaired drivers, including the effects of opioids and other drugs used in combination with alcohol.

Limitations

Consideration of study limitations is important when interpreting the present findings. First, the purposive sample described in this study was recruited from three rural Appalachian counties in Kentucky, which may limit generalizability to other areas of rural Appalachia. Although certain demographic characteristics of the sample were consistent with the Central Appalachian region, generalizability may also be affected by the fact that the sample was largely comprised of White males. Second, the study sample is relatively small and may be unable to detect smaller, but potentially important, differences between groups. Third, combinations of opioids or other drugs and alcohol were not accounted for in creating the three groups of impaired drivers, despite recent research indicating opioids and other narcotics as the most prevalent drug class found in multiple drug-using drivers (Lacey et al. 2016). Future research should consider examining impaired drivers who use only one

substance prior to driving compared to those under the influence of multiple substances, using toxicology reports as biological verification. Fourth, no information on drug dose or level of drug-impairment was obtained, making assessments of actual traffic safety risk difficult. Participants, however, were specifically asked to report driving episodes when they were under the influence of drugs. Finally, data are self-reported. Response validity could have been impacted given participants' recent legal trouble relating to their substance use and courthouse recruitment; however, previous research has shown that self-report data from drug users and criminal offenders can be reliable and valid (Solbergdottir et al. 2004; Thornberry and Krohn 2000).

Conclusion

The present study provides important new information about an unexamined and dangerous consequence of the prescription opioid epidemic in rural Appalachia. Almost one-third of the sample indicated that illicit prescription opioid use was involved in their DUI offense. Prescription opioid-impaired drivers were found to use a variety of drugs and have high rates of mental health problems and other non-DUI criminal activity. Furthermore, prescription opioid-impaired drivers reported frequent impaired driving, representing a potential threat to public safety in their communities. Although not conclusive, findings suggest that prescription-opioid drivers in rural Appalachian Kentucky could possess a more complicated set of problems and behaviors than the typical alcohol-impaired driver. As a result, future research should continue to examine prescription opioid-impaired drivers, not just in rural Appalachian Kentucky but in other settings as well, to gain a better understanding of their possible unique characteristics. These studies are essential to inform the development of effective tailored interventions, especially in areas like rural Appalachia, which have limited resources to address drug-impaired driving.

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References

- Associated Press. 2012 N.C. governor hears White House drug czar's warning. The Virginian-Pilot Accessed January 2, 2018. http://kdl.kyvl.org/catalog/xt7bnz80kw7k_3/text.
- Centers for Disease Control and Prevention. 2017 Prescription opioid overdose data Accessed December 7, 2017. <https://www.cdc.gov/drugoverdose/data/overdose.html>.
- Chihuri S, and Li G. 2017 Trends in prescription opioids detected in fatally injured drivers in 6 US states: 1995–2015. American Journal of Public Health 107 (9):487–92. doi:10.2105/AJPH.2017.303902. [PubMed: 28272960]
- Cohen J 1988 Statistical power analysis for the behavioral sciences 2nd ed. Hillsdale, NJ: Erlbaum.
- Crane EH 2015 The CBHSQ report: Emergency department visits involving narcotic pain relievers Rockville, MD: Substance Abuse and Mental Health Services Administration, Center for Behavioral Health Statistics and Quality.
- Dart RC, Surratt HL, Cicero TJ, Parrino MW, Severtson SG, Bucher-Bartelson B, and Green JL. 2015 Trends in opioid analgesic abuse and mortality in the United States. New England Journal of Medicine 372 (3):241–48. doi:10.1056/NEJMsa1406143. [PubMed: 25587948]

- DuPont RL. 2010 Prescription drug abuse: An epidemic dilemma. *Journal of Psychoactive Drugs* 42, (2):127–32. doi:10.1080/02791072.2010.10400685. [PubMed: 20648908]
- Edlund MJ, Steffick D, Hudson T, Harris KM, and Sullivan M. 2007 Risk factors for clinically recognized opioid abuse and dependence among veterans using opioids for chronic non-cancer pain. *Pain* 129 (3):355–62. doi:10.1016/j.pain.2007.02.014. [PubMed: 17449178]
- Edwardsen HE, Tverborgvik T, Frost J, Rogde S, Morild I, Waal H, Clausen T, Slørdal L, and Vindenes V. 2017 Differences in combinations and concentrations of drugs of abuse in fatal intoxication and driving under the influence cases. *Forensic Science International* 281:127–33. doi:10.1016/j.forsciint.2017.10.045. [PubMed: 29128652]
- Federal Bureau of Investigation. 2012 Crime in the United States 2012 Accessed January 27, 2018. https://ucr.fbi.gov/crime-in-the-u.s/2012/crime-in-the-u.s.-2012/tables/29tabledatadecpdf/table_29_estimated_number_of_arrests_united_states_2012.xls.
- Fishbain DA, Cutler RB, Rosomoff HL, and Rosomoff RS. 2003 Are opioid-dependent/tolerant patients impaired in driving-related skills? A structured evidence-based review. *Journal of Pain and Symptom Management* 25 (6):559–77. doi:10.1016/S0885-3924(03)00176-3. [PubMed: 12782437]
- Freeman J, Maxwell JC, and Davey J. 2011 Unraveling the complexity of driving while intoxicated: A study into the prevalence of psychiatric and substance abuse comorbidity. *Accident Analysis and Prevention* 43 (1):34–39. doi:10.1016/j.aap.2010.06.004. [PubMed: 21094294]
- Gudin JA, Mogali S, Jones JD, Comer SD. 2013 Risks, management, and monitoring of combination opioid, benzodiazepines, and/or alcohol use. *Postgraduate Medical Journal* 125 (4):115–130. doi:10.3810/pgm.2013.07.2684
- Havens JR, Lofwall MR, Frost SD, Oser CB, Leukefeld CG, and Crosby RA. 2013 Individual and network factors associated with prevalent hepatitis C infection among rural Appalachian injection drug users. *American Journal of Public Health* 103 (1):e44–52. doi:10.2105/AJPH.2012.300874.
- Havens JR, Walker R, and Leukefeld CG. 2007 Prevalence of opioid analgesic injection among rural nonmedical opioid analgesic users. *Drug and Alcohol Dependence* 87 (1):98–102. doi:10.1016/j.drugalcdep.2006.07.008. [PubMed: 16959437]
- Hedlund J. 2017 Drug-impaired driving: A guide for states Washington, DC: Governors Highway Safety Association Accessed September 12, 2017 http://www.ghsa.org/sites/default/files/2017-04/GHSA_DruggedDriving2017_FINAL.pdf.
- IBM Corp. 2016 IBM SPSS Statistics for Macintosh, Version 24.0. [Computer software] Armonk, NY: IBM Corp.
- Jewett A, Shults RA, Banerjee T, and Bergen G. 2015 Alcohol-impaired driving among adults—United States, 2012. *MMWR Morb Mortal Wkly* 64 (30):814–17.
- Kaiser Family Foundation (2017). State health facts Accessed October 19, 2017. <https://www.kff.org/other/state-indicator/prescription-opioid-overdose-deaths-and-death-rate-per-100000-population-age-adjusted/?dataView=1andcurrentTimeframe=0andsortModel=%7B%22colId%22:%22Location%22,%22sort%22:%22asc%22%7D>
- Kelley-Baker T, Berning A, Ramirez A, Lacey JH, Carr K, Wachrer G, and Compton R. 2013–2014 National Roadside Study of alcohol and drug use by drivers: Drug results (Report No. DOT HS 812 411) Washington, DC: National Highway Traffic Safety Administration.
- Keyes KM, Cerdá M, Brady JE, Havens JR, and Galea S. 2014 Understanding the rural–urban differences in nonmedical prescription opioid use and abuse in the United States. *American Journal of Public Health* 104 (2):e52–e59. doi:10.2105/AJPH.2013.301709 [PubMed: 24328642]
- LaBrie RA, Kidman RC, Albanese M, Peller AJ, and Shaffer HJ. 2007 Criminality and continued DUI offense: Criminal typologies and recidivism among repeat offenders. *Behavioral Sciences and the Law* 25 (4):603–14. doi:10.1002/bsl.769. [PubMed: 17620272]
- Lacey JH, Kelley-Baker T, Berning A, Romano E, Ramirez A, Yao J, Moore C, Brainard K, Carr K, Pell K, et al. 2016 Drug and alcohol crash risk: A case-control study (Report No. DOT HS 812 355) Washington, DC: National Highway Traffic Safety Administration.
- Leukefeld C, Staton M, Webster JM, and Smiley McDonald H. 2005 Treatment of patients under legal restrictions. In *The Treatment of Opioid Dependence*, ed. Strain EC and Stitzer ML, 485–496. Baltimore: Johns Hopkins University Press.

- Lipari RN, Hughes A, and Bose J. 2016 Driving under the influence of alcohol and illicit drugs. The CBHSQ Report Rockville, MD: Center for Behavioral Health Statistics and Quality, Substance Abuse and Mental Health Services Administration.
- Lurigio AJ, and Swartz JA. 2000 Changing the contours of the criminal justice system to meet the needs of persons with serious mental illness. *Criminal Justice* 3:45–108.
- Luu H, Slavova S, Freeman PR, Lofwall M, Browning S, and Bush H. 2018 Trends and patterns of opioid analgesic prescribing: Regional and rural-urban variations in Kentucky from 2012 to 2015. *Journal of Rural Health* doi: 10.1111/jrh.12300
- Maxwell JC 2012 Drunk versus drugged: how different are the drivers? *Drug and Alcohol Dependence* 121 (1–2):68–72. doi:10.1016/j.drugalcdep.2011.08.009. [PubMed: 21925803]
- McCarthy DM, Lynch AM, and Pederson SL. 2007 Driving after use of alcohol and marijuana in college students. *Psychology of Addictive Behaviors* 21 (3):425–30. doi:10.1037/0893-164X.21.3.425. [PubMed: 17874895]
- McLellan AT, Kushner H, Metzger D, Peters R, Smith I, Grissom G, Pettinati H, and Argeriou M. 1992 The fifth edition of the Addiction Severity Index. *Journal of Substance Abuse Treatment* 9 (3):199–213. doi:10.1016/0740-5472(92)90062-S. [PubMed: 1334156]
- Moody LN, Satterwhite E, and Bickel WK. 2017 Substance use in rural Central Appalachia: Current status and treatment considerations. *Journal of Rural Mental Health* 41 (2):123–35. doi:10.1037/rmh0000064. [PubMed: 29057030]
- Muntaner C, and Barnett E. 2000 Depressive symptoms in rural West Virginia: Labor market and health services correlates. *Journal of Health Care for the Poor and Underserved* 11 (3):284–300. doi:10.1353/hpu.2010.0788. [PubMed: 10929469]
- National Center for Statistics and Analysis. 2017 Rural/ urban comparison of traffic fatalities: 2015 data (Traffic Safety Facts. Report No. DOT HS 812 393) Washington, DC: National Highway Traffic Safety Administration.
- Nelson SE, Belkin K, LaPlante DA, Bosworth L, and Shaffer HJ. 2015 A prospective study of psychiatric comorbidity and recidivism among repeat DUI offenders. *Archives of Scientific Psychology* 3 (1):8–17. doi:10.1037/arc0000009. [PubMed: 26539339]
- Palmer RS, Ball SA, Rounsaville BJ, and O'Malley SS, S. S. 2007 Concurrent and predictive validity of drug use and psychiatric diagnosis among first-time DWI offenders. *Alcoholism: Clinical and Experimental Research* 31 (4):619–24. doi:10.1111/j.1530-0277.2007.00346.x.
- Peters RH, Bartoi MG, and Sherman PB, P.B. 2008 Screening and assessment of co-occurring disorders in the justice system Delmar, NY: CMHS National GAINS Center.
- Peters RH, Wexler HK, and Lurigio AJ. 2015 Co-occurring substance use and mental disorders in the criminal justice system: A new frontier of clinical practice and research. *Psychiatric Rehabilitation Journal* 38 (1):1–6. doi:10.1037/prj0000135. [PubMed: 25799301]
- Pilkinton MW, Robertson A, and McCluskey DL. 2013 Drugged driving: Increased traffic risks involving licit and illicit substances. *Journal of Drug Education* 43 (2):183–201. doi:10.2190/DE.43.2.f. [PubMed: 25068170]
- Robertson RD, Wicklund C, Holmes E, and Biderman P. 2016 Impaired driving in rural jurisdictions: Problems and solutions Traffic Injury Research Foundation Accessed December 1, 2017. http://tirf.ca/wp-content/uploads/2017/01/WG-2012-_Rural-DWI-FINAL.pdf.
- Scherer M, Canham S, Voas RB, and Furr-Holden CD. 2017 Intercorrelation of alcohol and other drug use disorders among a national sample of drivers. *Journal of Psychoactive Drugs*: 1–8. doi: 10.1080/02791072.2017.1366605. [PubMed: 27918874]
- Schumacher MB, Jongen S, Knoche A, Petzke F, Vuurman EF, Vollrath M, and Ramaekers JG. 2017 Effect of chronic opioid therapy on actual driving performance in non-cancer pain patients. *Psychopharmacology* 234 (6):989–99. doi:10.1007/s00213-017-4539-3. [PubMed: 28190085]
- Scott KM, Von Korff M, Alonso J, Angermeyer MC, Bromet E, Fayyad J, de Girolamo G, Demyttenaere K, Gasquer I, Gureje O et al. 2009 Mental-physical co-morbidity and its relationship with disability: Results from the World Mental Health Surveys. *Psychological Medicine* 39 (1):33–43. doi:10.1017/S0033291708003188. [PubMed: 18366819]
- Solbergstodt E, Bjornsson G, Gudmundsson L, Tyrfinsson T, and Kristinsson J. 2004 Validity of self-reports and drug use among young people seeking treatment for substance abuse or

- dependence. *Journal of Addictive Diseases* 23 (1): 29–38. doi:10.1300/J069v23n01_03. [PubMed: 15077838]
- Staton M, Ciciurkaite G, Havens JR, Tillson M, Leukefeld C, Webster M, Oser C, and Peteet B. 2018 Correlates of injection drug use among rural Appalachian women. *Journal of Rural Health* 34 (1): 31–41. doi:10.1111/jrh.12256. [PubMed: 28685884]
- Staton-Tindall M, Harp K, Minieri A, Oser C, Webster JM, Havens J, and Leukefeld C. 2015 An exploratory study of mental health and HIV risk behavior among drug-using rural women in jail. *Psychiatric Rehabilitation Journal* 38 (1):45–54. doi:10.1037/prj0000107. [PubMed: 25799305]
- Staton-Tindall M, Havens JR, Webster JM, and Leukefeld C. 2014 METelemedicine: A pilot study with rural alcohol users on community supervision. *Journal of Rural Health* 30 (4):422–32. doi: 10.1111/jrh.12076. [PubMed: 24800699]
- Staton-Tindall M, Wahler E, Webster JM, Godlaski T, Freeman R, and Leukefeld C. 2012 Telemedicine-based alcohol services for rural offenders. *Psychological Services* 9 (3):298–309. doi:10.1037/a0026772. [PubMed: 22867122]
- Staton-Tindall M, Webster JM, Oser CB, Havens JR, and Leukefeld CG. 2015 Drug use, hepatitis C, and service availability: Perspectives of incarcerated rural women. *Social Work in Public Health* 30 (4):385–96. doi:10.1080/19371918.2015.1021024. [PubMed: 25950907]
- Substance Abuse and Mental Health Services Administration, Center for Behavioral Health Statistics and Quality. 2016 2015 National Survey on Drug Use and Health: Detailed Tables Substance Abuse and Mental Health Services Administration, Rockville, MD.
- Substance Abuse and Mental Health Services Administration, Center for Behavioral Health Statistics and Quality 2017 Treatment Episode Data Set (TEDS): 2005–2015. National Admissions to Substance Abuse Treatment Services. BHSIS Series S-91, HHS Publication No. (SMA) 17–5037 Rockville, MD: Substance Abuse and Mental Health Services Administration.
- Sullivan MD, Edlund MJ, Zhang L, Unützer J, and Wells KB. 2006 Association between mental health disorders, problem drug use, and regular prescription opioid use. *Archives of Internal Medicine* 166 (19):2087–93. doi:10.1001/archinte.166.19.2087. [PubMed: 17060538]
- Thornberry TP, and Krohn MD. 2000 The self-report method for measuring delinquency and crime. *Criminal Justice* 4 (1):33–83.
- Vearrier D, Vearrier L, McKeever R, Okaneku J, LaSala G, Goldberger D and McCloskey K. 2016 Issues in driving impairment. *Disease-a-Month* 62 (4):72–116. doi:10.1016/j.disamonth.2016.02.002. [PubMed: 26997643]
- Voas RB, DuPont RL, Shea CL, and Talpins SK. 2013 Prescription drugs, drugged driving and per se laws. *Injury Prevention*, 19 (3):218–22. doi:10.1136/injuryprev-2012-040498. [PubMed: 23024170]
- Webster JM, Dickson MF, Duvall JL, and Clark DB. 2010 Rural and urban differences in Kentucky DUI offenders. *Journal of Addiction Medicine* 4 (3):186–90. doi:10.1097/ADM.0b013e3181c6cb24. [PubMed: 21769034]
- Webster JM, Oser CB, Mateyoke-Scriver A, Cline VD, Havens JR, and Leukefeld C. 2009 Drug use and criminal activity among rural probationers with DUI histories. *International Journal of Offender Therapy and Comparative Criminology* 53 (6):717–30. doi:10.1177/0306624X08323615. [PubMed: 18940930]
- Zacny JP, and Gutierrez S. 2009 Within-subject comparison of the psychopharmacological profiles of oral hydrocodone and oxycodone combination products in non-drug-abusing volunteers. *Drug and Alcohol Dependence* 101 (1):107–14. doi: 10.1016/j.drugalcdep.2008.11.013. [PubMed: 19118954]
- Zhu M, Zhao S, Gurka KK, Kandati S, and Coben JH. (2013). Appalachian versus non-Appalachian US traffic fatalities, 2008–2010. *Annals of Epidemiology* 23 (6):377–80. doi:10.1016/j.annepidem.2013.04.001. [PubMed: 23619016]

Table 1.

Demographic Information by DUI Type (N=106)

	Prescription Opioid-Impaired (n=33)	Other Drug-Impaired (n=29)	Alcohol Only-Impaired (n=44)
Age	33.2	32.3	38.1
% Male	60.6%	58.6%	84.1% [*]
% White	97.0%	96.6%	95.5%
% Never Married/Single	15.2%	31.0%	29.5%
Education (years)	12.2	11.9	11.6
% Valid License	78.8%	62.1%	72.7%

Note. Significance levels are in comparison to the prescription opioid-impaired group

^{*}
p .05

^{**}
p .01

^{***}
p .001.

Table 2.

Past Year Substance Use & Mental Health by DUI Type (N=106)

	Prescription Opioid-Impaired (n=33)	Other Drug-Impaired (n=29)	Alcohol Only-Impaired (n=44)
Substance Use			
Alcohol	75.8%	69.0%	95.5% [*]
Marijuana	48.5%	51.7%	40.9%
Cocaine	9.1%	13.8%	9.1%
Crack	12.1%	10.3%	0.0%
Sedatives	66.7%	72.4%	31.8% ^{**}
Amphetamine	15.2%	10.3%	2.3%
Methamphetamine	9.1%	0.0%	2.3%
Heroin	3.0%	0.0%	0.0%
Prescription Opioids	87.9%	35.7% ^{***}	25.0% ^{***}
Any Illicit Drug Use	93.9%	89.7%	54.5% ^{***}
Mental Health			
Depression	59.4%	42.9%	45.5%
Anxiety	74.2%	50.0%	56.8%
Trouble Remembering	34.4%	39.3%	29.5%
Any Mental Health Problem	84.4%	57.1% [*]	59.1% [*]

Note. Significance levels are in comparison to the prescription opioid-impaired group

* p .05

** p .01

*** p .001.

Table 3.

DUI and Other Criminal Activity by DUI Type (N=106)

	Prescription Opioid-Impaired (n=33)	Other Drug-Impaired (n=29)	Alcohol Only-Impaired (n=44)
<u>DUI History</u>			
Age first drove impaired	19.8	19.4	19.1
Age first DUI arrest	24.3	28.8	28.1
Age first DUI conviction	25.0	28.9	29.2
Number of DUI arrests	3.1	2.3	3.5
Number of DUI convictions	2.6	1.8	3.0
Past Year Impaired Driving Episodes [^]			
Mean (SD)	169.4 (236.4)	74.3 (148.5) ¹	59.6 [*] (120.1)
Median	61	12	1.5
Lifetime Impaired Driving Episodes [^]			
Mean (SD)	1772.3 (2385.8)	941.6(1381.5) ²	1049.4 ^{**} (1953.5) ³
Median	592	268.5	81
<u>Other Criminal History</u>			
Drug Crimes (%)	100.0%	92.9%	84.1%
Property Crimes (%)	65.6%	67.9%	34.1% ^{**}
Violent Crimes (%)	40.6%	39.3%	27.3%
Any non-DUI crime (%)	100.0%	96.4%	88.6%
Age first committed a crime	14.0	15.2	15.6
Number of lifetime arrests (non-DUI)	5.0	3.5	2.0
Ever incarcerated after conviction (%)	54.5%	58.6%	40.9%

Note. Significance levels are in comparison to the prescription opioid-impaired group

^{*}
p .05

^{**}
p .01

^{***}
p .001

[^] Raw means are presented in the table, but ANCOVA analyses were conducted using logarithmic transformed means.

¹
n=27

²
n=26

³
n=43