HHS Public Access

Author manuscript

J Hum Behav Soc Environ. Author manuscript; available in PMC 2020 January 09.

Published in final edited form as:

J Hum Behav Soc Environ. 2019 ; 29(3): 301–307. doi:10.1080/10911359.2018.1516591.

The Impact of Rural Classification Systems on a Comparison of Risky Drug-Related Behaviors in Kentucky and Ohio Counties

Amanda N. Stover, MPH[1], **Erin L. Winstanley, PhD**[2], **Yifan Zhang, MPH**[1], **Judith Feinberg, MD**[2]

[1]School of Pharmacy, West Virginia University, Morgantown, WV

[2]Behavioral Medicine & Psychiatry, West Virginia University, Morgantown, WV

Keywords

Drug Use; Rural; Urban; Opioids

Introduction

The current opioid epidemic has disproportionately affected rural areas in the U.S., with overdose rates increasing by 394% in rural counties compared to 279% in large central metropolitan counties (Rossen et al., 2013). This is exemplified by Kentucky and Ohio counties that span urban and rural areas and have some of the highest overdose rates (Rudd et al., 2016), with significantly higher fatality rates in Appalachian counties as defined by the Appalachian Regional Commission (ARC) (The Appalachian Regional Commission, 2017). Several classification schemes define rurality at the county level based on population, land use, and distance to principal cities (Ratcliffe et al., 2016).

The U.S. Census Bureau (USCB) uses four key characteristics to define an urban area: population threshold, residential population density, land use, and distance (US Census Bureau, 2010). However, this classification scheme can result in 'rural' counties that span both urban and rural areas. Similarly, the National Center for Health Statistics (NCHS) has a six-level classification scheme (large central metro, large fringe metro, medium metro, and small metro) that can also be dichotomized into metropolitan and non-metropolitan (Ingram & Franco, 2013). The USCB classifies counties as completely rural, mostly rural, and mostly urban (US Census Bureau, 2010).

Different classification schemes that identify the same county in different ways can alter its status as 'rural'. Thus, the definition of rurality applied at the county level confound our ability to detect differences geospatially. We analyzed county-level differences in injection drug use (IDU) behaviors and opioid overdoses in northern Kentucky and southwest Ohio using four definitions of rurality- the USCB 2010, ARC, and two multilevel NCHS schemas- to determine how classification choice can affect outcomes.

Methods

Sampling and Data Source

Existing clinical data were pooled across three regional programs serving greater Cincinnati: 1) an opioid overdose prevention program (OOPP) within a residential addiction treatment program (n=163), 2) a regional evaluation of four OOPPs (n=655), and 3) a mobile syringe services program (n=1,379) representing 17 counties in Kentucky (n=516) and Ohio (n=1,618). These programs utilized a self-reported baseline survey with 23 identical items that were combined into a single database including data from May 2013 to February 2017. This analysis was restricted to clients who endorsed IDU. All data were de-identified prior to analysis; the West Virginia University Institutional Review Board determined the study did not meet the requirements for human subjects research.

Demographics included age, sex, employment (no/yes), serious thoughts of suicide in the past 30 days (no/yes), serious lifetime thoughts of suicide (no/yes), attempted suicide in the past 30 days (no/yes), lifetime attempted suicide (no/yes), source of first prescription opioid (physician for pain, friend or family member, purchased, other), ever injected drugs (no/yes), age at first IDU, ever overdosed (no/yes), number of overdoses, age at first overdose, ever witnessed someone overdose (no/yes), and number of witnessed overdoses. Serious thoughts of suicide and attempted suicide were recoded as two dichotomous variables (never/ever). Questions covered substance use in the past three months (never, once or twice, monthly, weekly, and daily or almost daily) for alcohol, heroin, prescription opioids, sedatives, marijuana, cocaine, methamphetamine, prescription stimulants and other. The substance use variables were recoded as never, monthly/ever, or weekly/daily. The ‘other’ drug category is not reported because it was only endorsed by three clients.

Geographic Classification

Clients’ self-reported county of residence was categorized according to the different classification schemes described above (Ratcliffe et al., 2016). Both two- and three-category NCHS-based criteria were used. The three-level NCHS classification used rural (micropolitan, noncore), suburban (small metro, medium metro), and urban (large fringe metro, central metro); the two-level model used metropolitan versus nonmetropolitan.

Analysis

Stata/SE Version 14.2 was used for statistical analysis (Stata Corp, 2015). Pearson chi-square tests were used for dichotomous variables and an analysis of variance (ANOVA) was used to compare continuous variables. A tukey hsd posttest was used to identify statistically significant comparisons.

Results

United States Census Bureau 2010

Using the USCB, 1.4% (n=31) of clients lived in completely rural counties, 2.6% (n=58) in mostly rural counties, and 96.0% (n=2,108) lived in mostly urban counties. The mean age at first IDU was significantly younger among completely rural residents (19.6 years, SD=4.1)

compared to both mostly rural (26.2 years, SD= 9.6), and mostly urban (25.5 years, SD=8.1) residents (p=0.013). Completely rural county residents had significantly higher methamphetamine use (41.4%, p=0.002) and sedative use at 42.9% (p=0.036), compared to both mostly rural and mostly urban residents (Table 1A).

National Center for Health Statistics 2013 (2- and 3-Level)

Using this classification, 1.9% (n=41) of clients lived in nonmetropolitan counties, and 98.1% (n=2,156) lived in metropolitan counties. Mean age of nonmetropolitan clients was 30.0 years (SD=7.3) with 33.7 years (SD=9.0) for clients in metropolitan counties (p=0.011). Mean age at first IDU was significantly younger for nonmetropolitan clients at 21.6 years (SD=6.3), compared to 25.5 years for metropolitan clients (p=0.019). Methamphetamine use was reported significantly more often by nonmetropolitan residents (48.7%) compared to 17.7% for metropolitan residents (p<0.000; see Table 1B).Using the 3-level classification, 1.6% (n=35) of clients lived in rural counties, 0.5% (n=11) lived in suburban counties, and 97.9% (n=2,151) lived in urban counties. There was no statistically significant difference in mean age or in age at first IDU. Methamphetamine use was significantly higher among rural clients (51.5% reporting use in the last 30 days) compared to suburban (27.3%) and urban (17.7%) clients (p<0.000; Table 1C).

Appalachian Classification

Most clients lived in non-Appalachian counties (83.6%; n=1,836). The mean age of Appalachian clients was 31.6 (SD=8.19) years old compared to 34.0 (SD=9.08) years old for non-Appalachian residents (p<0.001). Substance use was significantly higher for non-Appalachian clients in all categories except for prescription stimulant use (Table 1D).

Discussion

The different county classification schemes generated varying results. Age at first injection drug use was consistently younger in the most rural counties (i.e. Appalachian, rural, or completely rural), but this was only statistically significant when applying the USCB 2010 and NCHS 2-level county classifications. Likewise, methamphetamine use was higher in counties classified as rural and it is notable that non-Appalachian clients endorsed higher methamphetamine use.

The higher rates of methamphetamine use among rural substance users is consistent with a previous study done by Havens and colleagues among community-based stimulant users in Arkansas, Kentucky, and Ohio (Havens et al., 2009). Results of the Havens et al. study found that over half of rural stimulant users also misused prescription opioids in the six months prior to study enrollment; likewise, methamphetamine use, younger age, and increased likelihood of opioid misuse also characterized rural stimulant users (2009). These results mimic patterns seen among rural injection opioid users in our study who reported a younger age at IDU initiation and higher proportions of methamphetamine use.

The results of this study have several implications for health services and future research. Geospatial classifications are often used to assess the need for and availability of behavioral health services. Public health and clinical programs in rural areas should consider which

classification scheme was applied when evaluating needs assessments and whether their catchment area counties can be differently classified. Application of different definitions of rurality can thus impact how the allocation of future funds, assessment of service needs, and policy decisions are made. One finding from this study, a younger age of onset of IDU in completely rural counties compared to suburban or urban counties, highlights the importance of age-appropriate prevention interventions in rural areas. Existing research has documented increasing rates of IDU among adolescents and young adults (ages 15–29) (Chatterjee et al., 2011; Tempalski et al., 2013). However, most of this research has been conducted in metropolitan areas. Furthemore, younger age of initation of IDU is associated with an increased risk of poor outcomes including overdose and death (Tempalski et al., 2013). Future research may want to consider how county classification schemes can impact the measurement of residents' health status and access to resources.

Limitations

Data regarding drug use were collected as part of routine programming and not specifically for research purposes; hence, the amount of missing data varies across the different programs and survey items. Our analysis is limited to county-level classifications that may encompass a geospatial area too large to generalize the results to specific rural and urban samples. Furthermore, the sites from which clients received services were clustered in urban areas. Clients from rural areas in this sample may have been more motivated to engage in health services and/or had the means to travel to the program sites.

Conclusions

Our results suggest that choice of classification scheme used to identify rural counties may be an important consideration in research studies, as different classification schemes can identify the same county in different ways that alters its rural status. Developing one classification mechanism that addresses the complex health needs of a population may not be feasible given geographic, land use, exposures, and city population variation within county boundaries. Future studies should consider how regional classification schemes can affect the outcomes of epidemiological studies.

Acknowledgments

Miss Stover receives travel support and is a current scholar at West Virginia University in the Biomedical and Behavioral Sciences and is supported by NIGMS grant T32 GM081741. Research for this study was facilitated by the Center for Chemical Addictions Treatment and Interact for Health and the Cincinnati Exchange Project in Cincinnati, Ohio.

References

1. The Appalachian Region - Appalachian Regional Commission. (2017). Retrieved October 8, 2017, from https://www.arc.gov/appalachian_region/TheAppalachianRegion.asp
2. Chatterjee S, Tempalski B, Pouget ER, Cooper HL, Cleland CM, & Friedman SR (2011). Changes in the prevalence of injection drug use among adolescents and young adults in large US metropolitan areas. AIDS and Behavior, 15(7), 1570–1578. [PubMed: 21739288]

3. Havens JR, Stoops WW, Leukefeld CG, Garrity TF, Carlson RG, Falck R, ... & Booth BM (2009). Prescription opiate misuse among rural stimulant users in a multistate community-based study. The American journal of drug and alcohol abuse, 35(1), 18–23. [PubMed: 19152201]

4. Ingram DD, & Franco SJ (2014). 2013 NCHS urban–rural classification scheme for counties. Vital and Health Statistics. Series 2, Data Evaluation and Methods Research, (166), 1–81. [PubMed: 24775908]

5. Ratcliffe M, Burd C, Holder K, & Fields A (2016). Defining Rural at the U.S. Census Bureau. US Census, (12), 1–8.

6. Rossen LM, Khan D, & Warner M (2013). Trends and geographic patterns in drug-poisoning death rates in the US, 1999–2009. American journal of preventive medicine, 45(6), e19–e25. [PubMed: 24237925]

7. Rudd RA, Seth P, David F, & Scholl L (2016). Increases in Drug and Opioid-Involved Overdose Deaths — United States, 2010–2015. MMWR. Morbidity and Mortality Weekly Report, 65(5051), 1445–1452. [PubMed: 28033313]

8. StataCorp. 2015 Stata Statistical Software: Release 14. College Station, TX: StataCorp LP.

9. Tempalski B, Pouget ER, Cleland CM, Brady JE, Cooper HL, Hall HI, ... & Friedman SR (2013). Trends in the population prevalence of people who inject drugs in US metropolitan areas 1992–2007. PloS one, 8(6), e64789. [PubMed: 23755143]

10. United States Census Bureau. (2010). 2010 Census Urban and Rural Classification and Urban Area Criteria. United States Census Bureau. Retrieved April 3, 2017, from https://www.census.gov/geo/reference/ua/urban-rural-2010.html

Table 1:

County Classifications Schema Data

	A)USCB 2010				B) NCHS 2-Level			C) NCHS 3-Level				D) ARC		
	Completely Rural[1]	Mostly Rural[2]	Mostly Urban[3]	p	Metropolitan	Non-Metropolitan	p	Rural[1]	Suburban[2]	Urban[3]	p	Appalachia	Non-Appalachia	p
Mean Age (std. dev.)	32.25 (8.79)	31.22 (8.13)	33.69 (8.99)	0.0909	33.67 (8.99)	30.03 (7.33)	0.0111	30.80 (7.64)	31.13(8.97)	33.66 (8.99)	0.1211	31.63 (8.19)	33.98 (9.08)	0.000
Mean Age First Injection (std. dev.)	19.56 (4.10)	26.23 (9.64)	25.52 (8.13)	0.0129 (1 vs 2,3)	25.53 (8.16)	21.63 (6.30)	0.0199	21.81 (6.58)	28.29 (10.73)	25.50 (8.15)	0.0781	24.98 (7.81)	25.51 (8.18)	0.4818
Source of First Prescription Opioid (%)							0.429				0.878			0.081
Physician	51.61% (16)	42.31% (22)	55.62% (1,069)		55.47% (1,091)	42.11% (16)		43.75% (14)	57.14% (4)	55.39% (1,089)		54.97% (188)	55.26% (919)	
Friend/Family	22.58% (7)	30.77% (16)	27.89% (536)		27.71% (545)	36.84% (14)		31.25% (10)	28.57% (2)	27.82% (547)		24.27% (83)	28.62% (476)	
Purchased	25.81% (8)	19.23% (10)	14.05% (270)		14.29% (281)	18.42% (7)		21.88% (7)	14.29% (1)	14.24% (280)		18.42% (63)	13.53% (225)	
Other	0	7.69% (4)	2.45% (47)		2.54% (50)	2.63% (1)		3.13% (1)	0	2.54% (50)		2.43% (8)	2.59% (43)	
Substance Use (EVER) (%)														
Alcohol Use	50.00% (14)	35.71% (20)	45.84% (925)	0.291	45.61% (941)	46.15% (18)	0.946	48.48% (16)	36.36% (4)	45.63% (939)	0.783	34.96% (122)	47.75% (837)	0.000
Cannabis Use	55.17% (16)	41.82 %(23)	52.43%(1,048)	0.284	53.13% (1,066)	55.26% (21)	0.701	56.25% (18)	36.36% (4)	52.21% (1, 065)	0.518	38.44% (133)	54.92% (954)	0.000
Cocaine Use	39.29% (11)	25.93% (14)	40.31% (807)	0.103	39.83% (815)	44.74% (17)	0.541	40.63% (13)	45.45% (5)	39.88% (814)	0.929	26.82% (92)	42.50% (740)	0.000
Prescription Stimulant Use	11.11% (3)	12.96% (7)	16.84% (333)	0.555	16.58% (335)	21.62% (8)	0.414	22.58% (7)	9.09% (1)	16.62% (335)	0.538	13.86% (47)	17.22% (296)	0.130
Methamphetamine Use	41.38% (12)	25.93% (14)	17.71% (351)	0.002	17.67% (358)	48.72% (19)	0.000	51.52% (17)	27.27% (3)	17.66% (357)	0.000	11.88% (41)	19.53% (336)	0.001
Sedative or Sleeping Pill Use	42.86% (12)	19.23% (10)	35.61% (704)	0.036	35.22% (711)	39.47% (15)	0.586	40.63% (13)	45.45% (5)	35.15% (708)	0.634	22.65% (77)	37.80% (649)	0.000
Prescription Opioids	51.72% (15)	33.96% (18)	47.94% (929)	0.120	47.55% (943)	51.35% (19)	0.647	48.39% (15)	36.36% (4)	47.67 (943)	0.753	41.92% (140)	48.75% (822)	0.022
Street Opioids	72.41% (21)	81.03% (47)	86.08% (1,763)	0.065	85.77% (1,796)	85.37% (35)	0.942	85.71% (30)	54.55% (6)	85.93% (1,795)	0.012	69.23% (243)	89.01% (1,588)	0.000
Ever witnessed an overdose (%)	75.86% (22)	80.36% (45)	78.64% (1,627)	0.891	78.67% (1,663)	77.50% (31)	0.859	76.47% (26)	81.82% (9)	78.66% (1,659)	0.922	80.85% (287)	78.21% (1,407)	0.268
Mean number of overdoses witnessed (std. dev.)	5 (3.06)	2.64 (2.73)	5.44 (7.611)	0.3837	5.42 (7.59)	3.73 (2.55)	0.7365	3.67 (2.84)	4.83 (7.47)	5.42 (7.59)	0.7133	4.93 (4.48)	5.44 (7.75)	0.9867
Ever overdose during lifetime (%)	46.43% (13)	55.17% (32)	48.41% (1,004)	0.581	48.40% (1,026)	57.50 (23)	0.254	52.94% (18)	54.55% (6)	48.46% (1,025)	0.808	49.44% (175)	48.39% (874)	0.720
Mean number of times overdosed (std. dev.)	3.2 (1.64)	2.64 (1.98)	3.14 (3.16)	0.8681	3.13 (3.15)	3.33 (2.64)	0.5775	3.33 (2.92)	2.25 (1.26)	3.14 (3.16)	0.8383	3.18 (3.64)	3.13 (3.09)	0.7637
Mean age first overdose (std. dev.)	24.4 (2.07)	23.67 (6.52)	27.80 (8.39)	0.2263	27.79 (8.37)	23.64 (5.92)	0.1020	25.0 (5.86)	34.25 (13.72)	27.71 (8.33)	0.1925	27.38 (7.63)	27.75 (8.42)	0.7482
Serious thoughts of suicide in lifetime (% Ever)	42.86% (6)	38.89% (14)	38.79 (289)	0.953	39.10% (303)	30.0% (6)	0.410	29.41% (5)	28.57% (2)	39.17% (302)	0.612	32.46% (74)	41.45% (235)	0.019
Suicide attempt in lifetime (% Ever)	28.57% (4)	31.43% (11)	21.43% (159)	0.316	22.15% (171)	15.79% (3)	0.508	17.65% (3)	0	22.32% (171)	0.288	18.67% (42)	23.32% (132)	0.154

J Hum Behav Soc Environ. Author manuscript; available in PMC 2020 January 09.