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The effects of rurality on substance use disorder diagnosis: A multiple-groups latent class analysis

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HIGHLIGHTS

- A qualitative difference was found in SUD class models between rural and urban samples.
- The Rural sample fit a 3-class latent structure of SUD while the urban fit a 6-class model.
- Covariates less predictive of rural class membership compared to urban sample of past-year users
- Class membership less dependent on individual characteristics in rural sample of substance users
- Psychological distress most predictive of membership in all disorder classes in both rural and urban

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ABSTRACT

Background: Rates of accidental overdose mortality from substance use disorder (SUD) have risen dramatically in the United States since 1990. Between 1999 and 2004 alone rates increased 62% nationwide, with rural overdose mortality increasing at a rate 3 times that seen in urban populations. Cultural differences between rural and urban populations (e.g., educational attainment, unemployment rates, social characteristics, etc.) affect the nature of SUD, leading to disparate risk of overdose across these communities.
Methods: Multiple-groups latent class analysis with covariates was applied to data from the 2011 and 2012 National Survey on Drug Use and Health ($n = 12.140$) to examine potential differences in latent classifications of SUD between rural and urban adult (aged 18 years and older) populations. Nine drug categories were used to identify latent classes of SUD defined by probability of diagnosis within these categories. Once the class structures were established for rural and urban samples, posterior membership probabilities were entered into a multinomial regression analysis of socio-demographic predictors' association with the likelihood of SUD latent class membership.
Results: Latent class structures differed across the sub-groups, with the rural sample fitting a 3-class structure (Bootstrap Likelihood Ratio Test P value $= 0.03$) and the urban fitting a 6-class model (Bootstrap Likelihood Ratio Test P value < 0.0001). Overall the rural class structure exhibited less diversity in class structure and lower prevalence of SUD in multiple drug categories (e.g. cocaine, hallucinogens, and stimulants).
Conclusions: This result supports the hypothesis that different underlying elements exist in the two populations that affect SUD patterns, and thus can inform the development of surveillance instruments, clinical services, and prevention programming tailored to specific communities.

1. Introduction

In rural areas, deaths from unintentional overdose have increased by >250% since 1999 while urban deaths have increased at a fraction of this rate (Keyes, Cerda, Brady, Havens, & Galea, 2014). Previous studies have explored the association between "rurality," as defined by low population density in areas distal from metro regions, and risk of substance abuse with mixed results (Havens, Young, & Havens, 2011; Havens et al., 2007; Wang, Becker, & Fiellin, 2013). Study of prescription opioid use rates in adult probationers indicates higher use among rural populations of adult probationers compared to those in urban areas (Havens et al., 2007). In a sample of non-institutionalized adults however, rates of non-medical prescription drug abuse (NMPDU) were found

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not to be significantly different between rural and urban areas (Havens et al., 2011).

During the last half of the 20th century, rural areas in the U.S. underwent a significant decline in economic viability, causing disparate rates of unemployment, low education, and poverty (Thomas, Ellis, Konrad, Holzer, & Morrissey, 2009). Mass out-migration of young adults aged 18–24 from rural to urban areas has contributed to further economic decline by draining the community of individuals that may possess qualities protective against adverse behavior such as substance abuse (Leukefeld, Walker, Havens, Leedham, & Tolbert, 2007; Rosciguo & Crowle, 2001). The resultant clustering of individuals at higher risk for SUD in rural areas is one possible explanation for the high prevalence of non-medical opioid use (NMOU) in those communities.

Historical rates of serious mental illness (SMI) in rural areas have been comparable with those found in urban areas; however, accessibility, acceptability and utilization of prevention and treatment services in rural areas is quite different (US Department of Health and Human Services, Health Resources and Services Administration, Office of Rural Health Policy, 2005) The impact of SMI such as major depressive episodes (MDE) and anxiety disorders on the risk of substance abuse has been shown to be significant in nationally representative samples. A longitudinal study conducted using data from the National Comorbidity Survey (NCS) indicated that individuals reporting no SUD at baseline were 3 to 5 times as likely to report SUD at a ten year follow-up if they experienced MDE or various anxiety disorders in the interim (Swendsen et al., 2010) This is consistent with findings from a study of adolescent NMOU in rural areas (Havens et al., 2011).

Aspects of the social environment in rural areas, such as greater neighborhood cohesion and larger family and social networks, are potentially having a negative impact on risk of SUD in that population (Dew, Elifson, & Dozier, 2007). National Survey on Drug Use and Health (NSDUH) data show that >60% of individuals reporting NMOU indicate that they most recently obtained drugs from a family member or friend (Substance Abuse and Mental Health Services Administration, 2014). The impact of this diversion route is likely more pronounced in areas where greater social cohesion exists. Therefore, rural NMOU could potentially be mediated by increased availability of prescription pills through family and social networks. Individuals with risk factors such as unemployment, low educational attainment, and SMI in rural communities have a larger pool of individuals from which to solicit drugs possibly leading to an interactive effect on SUD diagnosis (Keyes et al., 2014).

Substance abuse research has begun to consider latent classification of users as a tool for illuminating the clustering tendencies of multiple drug use. A latent class is the product of a structural equation model that represents a subtype of a population based on responses to a set of indicators. Past research into the latent classification of illicit substance users has identified distinct groups of users based on the probability of engaging in the illicit use of different drugs. One study found that a five-class structure fit their data best (Lynskey et al., 2006). The authors also found significant differences in the rates of psychopathology among the different classes, suggesting an association between SMI and substance use latent classification (Lynskey et al., 2006).

Another study conducted in 2006 examined the latent class structure of SUD among a nationally representative sample of non-institutionalized adults (Agrawal, Lynskey, Madden, Bucholz, & Heath, 2007). Rather than modeling the class structure for use, Agrawal et al. (2007) tried to identify the classes of use disorder for multiple drugs. The result was a 5-class structure as was the case in the Lynskey et al. (2006) study; however, the characteristics of the classes were different.

Research into the co-occurrence of SUD across multiple drugs provides valuable information to prevention and treatment providers as they work to develop and implement effective programs in their target communities. Demographic differences, economic challenges and geographic isolation in rural areas impact the type of substances available for abuse as well as the culture around substance abuse in the population. Differences between rural and urban substance abuse prevalence and characteristics have been observed across rural and urban populations in multiple studies overt the last decade (Havens et al., 2007, 2011; Jonas, Young, Oser, Leukefeld, & Havens, 2012; Keyes et al., 2014; Leukefeld et al., 2007; Shannon, Havens, Oser, Crosby, & Leukefeld, 2011; Young, Havens, & Leukefeld, 2010, 2012).

The goal of this study was to investigate mediation of latent class SUD membership by "rurality," which has implications for both prevention and treatment of SUD in rural areas. Our hypothesis is that the qualitatively distinct effect of "rurality" can be seen between the two populations within the latent class membership probability distribution.

2. Methods

2.1. Study sample

NSDUH is a population-based survey developed to gather information about substance abuse prevalence and determinants by drawing a nationally representative sample of individuals 12 years and older. Details of the study are published elsewhere (Substance Abuse and Mental Health Data Archive, 2014). Data from the 2011 and 2012 NSDUH were merged on the response identification variable. Data were then limited to adults in large metro (urban) and non-metro (rural) regions reporting past-year use of nine drug types (prescription analgesics, cocaine, heroin, marijuana, hallucinogens, sedatives, stimulants, tranquilizers, and inhalants). All individuals in study also completed a diagnostic battery of SUD indicators leaving a final sample of 12,140 records, with 3409 individuals aged 18 years and older from rural areas and 8731 from urban settings. Listwise deletion of records was not conducted since SUD was defined within NSDUH as either a diagnosis of abuse or dependence.

2.2. Measurement items

The observed outcome for this analysis was past-year drug-specific SUD identified through the administration of the DSM-IV diagnostic criteria. The main predictor for the latent class analysis (LCA) portion of the study was the two-level variable identifying sample regions as large metro or non-metro. Large metro was defined as being within a metropolitan area and having a population >1.000,000 and non-metro was outside of any metropolitan area and having a population smaller than 1,000,000 (Substance Abuse and Mental Health Data Archive, 2014). Throughout this article large metro will be referred to as urban while non-metro will be identified as rural (Havens et al., 2011).

Covariates assessed in the study were age, race, gender, income, self-reported health, marital status, insurance coverage, educational attainment, and psychological distress. All variables were dichotomized for analysis to avoid quasi-separation of data within the model due to low cell frequency.

Self-reported health status was measured in the NSDUH on a categorical scale of poor, fair, good, very good, and excellent. The variable used in the analysis was dichotomized as poor/fair vs. good/very good/excellent. This was done for ease of interpretation and was grounded in results from previous research indicating higher substance abuse risk in populations of individuals reporting poor/fair health (Simoni-Wastila & Strickler, 2003).

Respondents to the survey were asked to indicate if they were married, widowed, divorced, or never married. For the analysis individuals were categorized as married or other, again justified by previous findings (Substance Abuse and Mental Health Services Administration, 2014). Insurance coverage was evaluated as having insurance of any kind (i.e. private or Medicaid/CHIP) or none. The educational attainment variable was dichotomized from an 11-level categorical variable ranging from fifth grade to graduate school. This step generated a binary response indicating less than 12th grade or high school and greater. As with the marital status variable, the insurance and education covariates