



Commentary

Opioid-related mortality in rural America: Geographic heterogeneity and intervention strategies

Khary K. Rigg^{a,*}, Shannon M. Monnat^b, Melody N. Chavez^c^a Department of Mental Health Law & Policy, Louis de la Parte Florida Mental Health Institute, College of Behavioral & Community Sciences, University of South Florida, 13301 Bruce B. Downs Blvd., Tampa, FL, 33612, United States^b Department of Sociology, Lerner Center for Public Health Promotion, Maxwell School of Citizenship and Public Affairs, 426 Eggers Hall, Syracuse, NY, 13244, United States^c Department of Community & Family Health, College of Public Health, University of South Florida, 13201 Bruce B. Downs Blvd., Tampa, FL, 33612, United States

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ABSTRACT

Over the last two decades, opioid-related mortality rates have increased dramatically to become a serious public health concern in the United States. Opioid-related mortality has reached epidemic levels in certain rural areas of the U.S., such as Appalachia, New England, and the Mountain West, while remaining relatively low in others, such as the Delta South and Great Plains. Explanations for geographic variation in opioid mortality are unclear, contributing to ineffective policies and interventions. The goal of this article is to summarize the existing literature on the opioid epidemic in the rural U.S. to help guide intervention efforts. This paper 1) describes geographic heterogeneity in opioid-related mortality, with a focus on rural areas, 2) summarizes factors that likely contribute to this heterogeneity, and 3) discusses potential strategies for addressing the opioid epidemic in the hardest-hit rural communities. The information presented in this paper dispels the myth that the opioid epidemic is disproportionately rural, and demonstrates that the magnitude of the epidemic has varied considerably across different rural areas. This paper provides important insights for public health professionals, treatment practitioners, researchers, and policymakers as they work toward solutions that take into account the diversity of rural communities and the dynamic nature of the opioid epidemic.

Introduction

Over the last two decades, opioid¹-related mortality rates have increased dramatically to become a major public health crisis in the United States (U.S.). In 2016 alone, opioids were involved in 45, 838 deaths, an increase of over 400% since 1999 (Centers for Disease Control and Prevention (CDC), 2017). Additionally, since 2005, the national rate of opioid-related inpatient hospital stays has increased by 64%, and the rate of opioid-related emergency department (ED) visits has increased by 99% (Weiss et al., 2017). A recent report by the White House Council of Economic Advisers estimated that the cost of the opioid crisis, including health care, criminal justice, lost productivity, and value of lives lost was \$504 billion in 2015 (2.8% of GDP; White House Council of Economic Advisers, 2017).

Although it is technically true that “addiction does not discriminate,” there is significant geographic variation in drug mortality rates across the U.S. (Monnat, 2018). Rates of opioid-related inpatient

hospital stays, ED visits, and mortality are high in some predominantly rural² states like Maine, Kentucky, and West Virginia (Estep, 2016; Keyes, Cerda, Brady, Havens, & Galea, 2014), but rates are among the lowest in other largely rural states, including Iowa and Nebraska (Weiss et al., 2017). Compared to large urban centers, rural places have historically been overlooked by national politicians, media, and researchers, but the current opioid epidemic has prompted significant attention toward rural areas. Unfortunately, most national studies obscure the geographic diversity of the opioid epidemic. Recent media and political attention on rural areas provides a time-sensitive opportunity for researchers to inform place-based strategies for addressing the crisis.

Our objectives are to: 1) describe geographic heterogeneity in opioid-related mortality, with a focus on rural areas, 2) summarize factors that likely contribute to this heterogeneity, and 3) discuss potential strategies for mitigating the opioid epidemic in the hardest-hit rural areas. Throughout the paper, we give attention to both rural

* Corresponding author.

E-mail addresses: rigg@usf.edu (K.K. Rigg), smonnat@maxwell.syr.edu (S.M. Monnat), mchavez4@health.usf.edu (M.N. Chavez).¹ Throughout the paper we use the term opioids to include prescription opioid pain relievers, heroin, and synthetic opioids (e.g., fentanyl).² Throughout the paper, we use the term “rural” to mean people and places that are outside metropolitan statistical areas.

versus urban and *within*-rural variation in opioid mortality, particularly as it relates to regional and racial/ethnic differences.

Geographic heterogeneity in opioid-related mortality

Studies are mixed on whether opioid use disorder (OUD) rates are higher in rural or urban areas, with some national studies finding higher rates in rural areas (Cicero, Surratt, Inciardi, & Munoz, 2007; Paulozzi & Xi, 2008), especially among certain vulnerable rural populations, including youth, American Indians, individuals with disabilities, and workers in manual labor occupations (Havens, Young, & Havens, 2011; Keyes et al., 2014; Monnat & Rigg, 2016; Rigg & Monnat, 2015b). Other studies find higher rates in urban areas or no significant difference (Lenardson, Gale, & Ziller, 2016; Rigg & Monnat, 2015a; Weiss et al., 2017). Inconsistencies in the literature on rural/urban differences in OUDs and mortality may be because national trends obscure important regional and between-state differences (Buchanich et al., 2016). Accordingly, in this section, we use data from the CDC and existing studies to describe geographic heterogeneity in opioid-related mortality (CDC, 2017). Full methodological details are described in Appendix A.

Fig. 1 shows opioid-related mortality rates by metropolitan status for the U.S. overall and disaggregated by U.S. Census region. As shown in Panel A, as of 2016, opioid-related mortality rates for the U.S. overall were highest in large fringe and medium metro counties and lowest in the most rural counties (i.e., noncore nonmetro). However, over the past two decades, mortality rates increased more in rural than in urban areas. Between 1999 and 2016 the age-adjusted opioid-related mortality rate increased by 158% in large central metro counties, 507% in large fringe metro counties, 388% in medium metro counties, 584% in small metro counties, 682% in micropolitan nonmetro counties, and 721% in noncore nonmetro counties. However, these aggregate trends obscure important regional differences. In the northeast (Panel B), since the late 2000s, rates have been higher outside of large central metro counties, with the largest increase since 1999 (over 1000%) occurring in micropolitan counties. Conversely, in the Midwest (Panel C), rates have consistently been the highest within large central metro counties, but as with the Northeast, rates have increased the most (185%) in micropolitan counties in the Midwest. In the South (Panel D), rates are highest in large fringe metro and medium metro counties, but increases were larger in small metro and micropolitan counties. Finally, in the West (Panel E), rates have consistently been higher in small and medium metro and nonmetro counties since the mid-2000s, and increases across all categories of metropolitan status in the West have been smaller than the increases observed in the other three regions.

However, these regional patterns do not reveal the full story. There is also tremendous variation *within* rural areas. Fig. 2 shows opioid-related mortality rates for 2012–2016 among only the rural counties within each state. Rural opioid-related mortality rates are highest throughout central Appalachia, New England, New Mexico, and Utah, and lowest in the south and upper Great Plains. At 32.3 deaths per 100,000 population (2012–2016), collectively the rural counties in West Virginia had the highest opioid-related mortality rates but rural mortality rates were very low in other states, including Nebraska, South Dakota, and North Dakota with rural mortality rates of 2.2, 3.9, and 4.0 per 100,000 respectively in 2012–2016. Increases in rural opioid-related mortality rates also varied considerably (Fig. 3), with the largest absolute increases since the early 2000s occurring in West Virginia, Ohio, Kentucky, and Connecticut, and the largest percentage increases occurring in New York, Ohio, Pennsylvania, and Wisconsin. Importantly, state- and/or county-level variation in cause-of-death reporting by medical examiners may contribute to state differences in opioid-related mortality rates, and deaths attributable to opioids are likely undercounted more in some states than in others (Ruhm, 2017a, 2017b).

Discussions of geographic differences in the opioid epidemic also

typically fail to distinguish between the types of opioids involved. The effectiveness of particular interventions at reducing overdoses may vary depending upon the type of opioid (i.e., prescription, heroin, fentanyl) responsible for most deaths in an area. For example, prescription drug monitoring programs and physician training may be effective at preventing prescription opioid overdoses (Haegerich, Paulozzi, Manns, & Jones, 2014; Patrick, Fry, Jones, & Buntin, 2016; Rigg, March, & Inciardi, 2010), whereas naloxone distribution may be more effective at preventing heroin overdoses than fentanyl-related overdoses (Fairbairn, Coffin, & Walley, 2017). As shown in Fig. 4a, prescription opioids make up a larger share of rural drug-related deaths than either heroin or synthetic opioids. It is also noteworthy that since 2013, synthetic opioids (primarily fentanyl) have contributed to a larger share of rural drug-related deaths than heroin. As shown in Fig. 4b, heroin contributes to a larger share of urban than to rural drug overdoses. As of 2015, synthetic opioids contributed the largest share of drug overdoses in urban areas. The percentage of drug overdoses attributed to unspecified opioids has declined over time, especially in urban areas. Better medical examiner education about different types of opioids may explain this decline. Importantly, the majority of drug deaths involve multiple classes of drugs (Ruhm, 2017b), and alcohol is often a contributing factor in both accidental and intentional drug overdoses (Kaplan et al., 2013; Tesfazion, 2014).

Finally, existing discussions of rural opioid mortality typically ignore racial/ethnic differences. Despite a common misconception, rural does not automatically equate to white. Racial/ethnic minorities comprise over 20% of the rural population, and rural racial/ethnic diversity is expected to increase due to rural Hispanic population growth (Lichter, 2012). This is important because rural racial/ethnic minorities are geographically concentrated, with most rural blacks living in the south, Hispanics in the southwest, and American Indians in the southwest and northwest (U.S. Census Bureau, 2015). If race/ethnicity is mentioned in rural opioid studies at all, it is usually to emphasize high rates of mortality among non-Hispanic whites. Among non-Hispanic whites, blacks, and American Indians, opioid mortality rates are higher in urban than in rural areas (Fig. 5). Among Hispanics, rates are comparable between rural and urban areas. With the exception of American Indians, rural racial/ethnic minorities have lower rates of opioid-related mortality than both rural and urban whites. Rural blacks have the lowest opioid-related mortality rate of any group. Research is needed to better understand the protective factors that contribute to especially low rates of opioid-related mortality among rural blacks. We encourage researchers to build on the descriptive analyses presented in this paper to more fully examine within-rural variation in the causes and consequences of the opioid epidemic.

Factors contributing to geographic heterogeneity in the opioid epidemic

Below we summarize three major groups of factors (infrastructural; demographic/socioeconomic; and social) that have likely contributed to higher prevalence of opioid-related mortality in the hardest-hit rural areas of the country. Moreover, despite the fact that opioid mortality rates are not disproportionately higher in rural versus urban areas, these factors may make addressing the epidemic in rural areas especially difficult.

Infrastructural factors

Drug treatment programs and providers

Addiction treatment services and providers are more limited in rural areas (National Rural Health Association Policy Brief, 2014, 2016; Oser et al., 2011; Rosenblatt, Andrilla, Catlin, & Larson, 2015). Moreover, rural hospitals, clinics, and treatment professionals are often dispersed across large geographic areas, making access difficult (Benavides-

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