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Sara Warfield
West Virginia University

Robin Pollini
West Virginia University

Cara M. Stokes
West Virginia University

Rob Bossarte
West Virginia University

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Opioid-Related Outcomes in West Virginia, 2008–2016

Sara Warfield, MPH, Robin Pollini, PhD, Cara M. Stokes, PhD, and Rob Bossarte, PhD

Objectives. To examine opioid-related outcomes by using hospitalization and mortality data as an indicator of the current opioid crisis in West Virginia.

Methods. We used data from the West Virginia University Medicine health care system to examine the trend in opioid overdoses and percentage of patients with a repeat overdose from 2008 to 2016. We obtained the opioid overdose death rate for the state from Centers for Disease Control and Prevention WONDER (Wide-ranging ONline Data for Epidemiologic Research) mortality data for 2008 to 2016.

Results. The hospitalization rate for opioid overdoses increased (13%) on average each year in a similar fashion to the opioid overdose death rate for the state (12%) between 2008 and 2016. During the same time, the percentage of patients with a repeat opioid overdose increased annually by 13% on average.

Conclusions. There continues to be a surge of opioid overdoses in West Virginia. These findings suggest a need to amplify comprehensive prevention and treatment efforts throughout the state. Public health initiatives to reduce the morbidity and mortality associated with overdoses should consider how the changes in potency may be influencing these outcomes. (*Am J Public Health.* 2019;109:303–305. doi:10.2105/AJPH.2018.304845)

Drug overdose deaths more than doubled in the United States between 2000 and 2016.^{1–3} With the highest opioid overdose death rate in the United States since 2010, West Virginia is the center of the current opioid crisis.^{1,3,4} In 2016, West Virginia had a drug overdose death rate of 52.0 per 100 000, which is more than 250% higher than the national rate of 19.8 per 100 000. Currently, 66% of all drug overdose deaths in the nation are attributed to opioids, whereas more than 80% of the overdose deaths in West Virginia are attributed to opioids.^{2,4,5} Although rates of overdose mortality serve as an indicator of the opioid crisis, deaths alone do not capture the overall effect of this public health problem. Opioid-related fatalities are the tip of the iceberg in understanding the opioid crisis. Additional indicators such as nonfatal overdose and repeat overdose are needed to better illustrate the opioid crisis.

The main objective of this study was to identify the rate of opioid overdoses resulting in hospitalization, while specifically examining the percentage of repeat hospital

admission from an opioid overdose within 12 months following admission. A secondary objective was to compare the overdose hospitalization rate with the opioid overdose death rate for the state of West Virginia.

METHODS

We obtained data from the West Virginia University Medicine health care system (WVU Medicine) from 2008 to the end of 2016. WVU Medicine includes 6 inpatient facilities located throughout the state. In 2016, WVU Medicine provided care for

more than 27 200 unique patients. We used the following definitions:

- Opioid overdose hospitalization rate: the number of unique patients hospitalized for an opioid overdose divided by the number of unique patients hospitalized in a WVU Medicine facility per year, expressed as a rate per 10 000 per year.
- Percent repeat opioid overdose: the number of patients with at least 1 other opioid overdose admission within 12 months of a previous overdose admission divided by the total number of overdose admissions (by year) in any WVU Medicine facility.
- Opioid overdose mortality rate: the number of deaths from opioid overdose deaths divided by the total population in West Virginia, expressed as a rate per 100 000 per year.

We identified patients in WVU Medicine from 2008 to the end of 2016 with an admission diagnosis for an opioid overdose with *International Classification of Diseases, Ninth Revision* (Geneva, Switzerland: World Health Organization; 1980), codes: 965.00–965.02, 965.09; E850.0–E850.2. To compare opioid overdose admission in WVU Medicine with the opioid overdose death rate for the state, we obtained additional data from the National Vital Statistics System's multiple cause-of-death files, Centers for Disease Control and Prevention WONDER (Wide-ranging ONline Data for Epidemiologic Research), to calculate the opioid-specific overdose

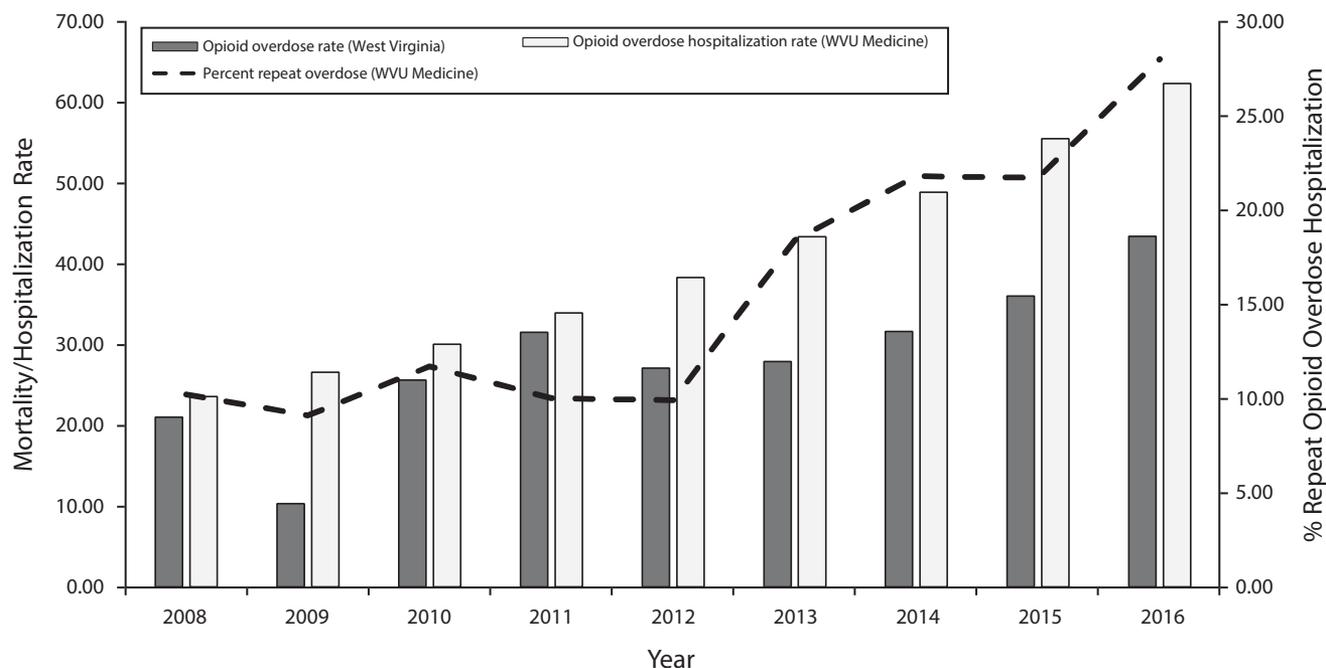
ABOUT THE AUTHORS

The authors are with West Virginia University Injury Control Research Center, Morgantown. Sara Warfield, Robin Pollini, and Rob Bossarte are also with West Virginia University School of Public Health, Department of Epidemiology. Robin Pollini, Cara M. Stokes, and Rob Bossarte are also with West Virginia University School of Medicine, Department of Behavioral Medicine and Psychiatry. Rob Bossarte is also with West Virginia University, Department of Sociology and Anthropology.

Correspondence should be sent to Sara Warfield, MPH, West Virginia University, Injury Control Research Center, PO Box 9151, Morgantown, WV 26506 (e-mail: swarfield@hsc.wvu.edu). Reprints can be ordered at <http://www.ajph.org> by clicking the "Reprints" link.

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Note. Opioid overdose mortality per 100 000 is age adjusted and is for all of West Virginia according to data obtained from the Centers for Disease Control and Prevention WONDER online database. Data from West Virginia University (WVU) Medicine were used to determine opioid overdose hospitalization rate per 10 000 and percent repeat opioid overdose.

FIGURE 1—West Virginia's Overdose Death Rate, Opioid Overdose Hospitalization Rate, and Percent Repeat Overdose: 2008–2016

death rate (age-adjusted). The following *International Classification of Diseases, 10th Revision (ICD-10)*; Geneva, Switzerland: World Health Organization; 1992), codes were used to identify overdose mortality: X40–44 (unintentional), X60–64 (suicide), X85 (homicide), or Y10–14 (undetermined). Of these, we identified opioid overdose deaths with the following *ICD-10* codes: T40.0–40.4 and T40.6. The ICD system is not able to discern between illicitly made fentanyl and pharmaceutical-made fentanyl; therefore, all fentanyl cases were grouped with prescription opioids.

Outcome measures included the overdose mortality rate in West Virginia (for comparison), the opioid overdose admission rate among all patients admitted to WVU Medicine, and the prevalence of repeat opioid overdose among patients admitted for an opioid overdose within the past year. We used Joinpoint Regression, version 4.5.0.1 (National Cancer Institute, Bethesda, MD), to examine changes in trends between 2008 and 2016. We tested the linearity in trends and examined the change over time by calculating

the average annual percent change in opioid overdose.

RESULTS

Between 2008 and 2016, there were 833 total admissions for an opioid overdose and 152 patients with at least 1 repeat overdose in a 12-month period to any WVU Medicine facility. The rate of admission for opioid-related overdoses increased by 181% between 2008 and 2016, from a hospitalization rate of 22.5 per 10 000 in 2008 to 63.3 per 10 000 in 2016. During that time, the percentage of patients with a 12-month repeat overdose increased by 175%, from 10.2% in 2008 to 28.0% in 2016, an average annual percentage increase of 13%.

For all of West Virginia, data from National Vital Statistics showed that 4430 deaths were attributed to an opioid overdose between 2008 and 2016.⁶ During this time, the opioid overdose death rate for the state of West Virginia increased more than 107%, from 21.0 per 100 000 in 2008 to 43.4 per 100 000 in 2016, an average annual

percentage increase of 12% (Figure 1). Although the percentage of patients with a repeat opioid overdose remained relatively stable between 2008 and 2012, it more than doubled from 2012 to 2016. Although these findings indicate an increase in morbidity and mortality associated with opioid use in general, state-specific data suggest a rise in overdose deaths attributed to more potent opioids, such as heroin.⁷

DISCUSSION

Although hospital and mortality data both depict a worsening opioid crisis in West Virginia, recent data from the National Survey on Drug Use and Health showed that the percentage of individuals who were dependent on or abusing prescription opioids remained relatively steady in recent years.⁸ These reports also showed that the percentage of residents in West Virginia with pain reliever use disorder did not differ drastically from the national average.⁸ However, heroin use in the past year was substantially higher in West Virginia. In fact, 0.57% of those older

than 12 years were estimated to use heroin within the past year compared with the national estimate of 0.33%.⁸ Because heroin use is more frequent and the potency is higher, these data suggest that the risk of opioid overdose is elevated in West Virginia. Together, the admission rates for an opioid overdose, the percentage of patients with a 12-month repeat overdose, and findings from the National Survey on Drug Use and Health suggest a complex process of increasing morbidity and mortality.^{6–8} These findings suggest that West Virginia's increase in overdose mortality is a function of an increasing potency of opioid compounds rather than a significant increase in the number of persons with opioid dependency or abuse. Although data for this study did not examine the type of opioid involved in the overdose, other recent reports found that certain opioids such as heroin have been associated with the surge in overdoses in West Virginia and across the nation.^{7,9–11}

This study had several limitations. Analyses were limited to patients admitted to WVU Medicine. Even though WVU Medicine provides care to patients in all regions of West Virginia, analyses from a larger population of West Virginia residents could have produced different results. Data were limited to opioid overdoses identified through admission diagnoses, which could have underestimated the number of opioid overdoses. Furthermore, this study did not consider mortality following a nonfatal overdose or subsequent overdose that was not treated in a WVU Medicine facility.

PUBLIC HEALTH IMPLICATIONS

Future studies should use data from other large health networks to examine how the opioid crisis is evolving to better inform the delivery of health care services. Public health initiatives aimed to reduce adverse outcomes associated with opioid overdoses should consider how the changes in potency are influencing these outcomes. **AJPH**

CONTRIBUTORS

S. Warfield conceptualized the idea for the article, performed the data analysis, and contributed to writing the article. R. Pollini provided feedback and edits to the article. C. M. Stokes helped formulate and draft the article. R. Bossarte and S. Warfield obtained the data,

interpreted the data analysis, and provided critical revision of the article.

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Note. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

CONFLICTS OF INTEREST

No authors have disclosures to report.

HUMAN PARTICIPANT PROTECTION

This study used aggregate-level analysis and no protected health information and therefore was exempt from approval by the West Virginia University institutional review board.

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