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The Opioid Epidemic: State Trends in Opioid-Related Overdose Deaths from 2000 to 2016

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SUMMARY

This brief examines the United States opioid epidemic at the state-level, analyzing trends in overdose deaths from heroin and other opioids, such as prescription painkillers. Using vital statistics data, it looks at which states have the highest rates of opioid-related deaths and which have experienced the largest increases in death rates.

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INTRODUCTION

For nearly two decades, the United States has experienced a growing crisis of drug abuse and addiction that is illustrated most starkly by deaths from drug overdose. Since 2000, the annual number of drug overdose deaths has more than tripled from 17,500 to 63,500 in 2016.[1,2] Most of these deaths involved opioids, including heroin and prescription painkillers.[3] In the years since the U.S. Centers for Disease Control and Prevention (CDC) declared overdoses from prescription painkillers an "epidemic" in 2011, the opioid overdose crisis has evolved rapidly from a problem tied mostly to prescription opioid painkillers to becoming increasingly driven by illicitly trafficked heroin and synthetic opioids.

This brief provides high-level information about opioids and opioid addiction, presents the historical context for the epidemic of opioid-related addiction and mortality in the United States, and examines trends in opioid-related mortality across the country and among population subgroups.

COMPANION BRIEF

To read SHADAC's analysis of opioid-related overdose deaths by age, sex, race/ethnicity and urban/rural communities, visit: www.shadac.org/2016OpioidBriefs.

Background

Addictive properties of opioids

To better understand the development of the opioid crisis, it is important to recognize the addictive properties of opioids and the relationship between different opioid types. Generally, there are three kinds of opioids: 1) natural opiates, like morphine, which are made from the opium poppy plant; 2) semi-synthetic opioids, like hydrocodone and oxycodone, which are chemically derived from natural opiates; and 3) fully synthetic opioids, like fentanyl, which are chemically created to mimic natural opiates but are typically much more potent. In addition, opioids can be segmented into illicit opioids, such as heroin, and legal opioids, such as painkillers including oxycodone and hydrocodone.[4] Illicit and legal opioids are chemically similar and stimulate the same opioid receptors in the reward centers in the brain, creating similar feelings of euphoria.[5] Repeated use of opioids can affect the chemistry and wiring of the brain, causing addiction that prompts people to crave and use opioids habitually, and can cause symptoms of withdrawal if people stop using opioids.[6]

Because all opioids act similarly in the same parts of the brain, someone who is chemically dependent on a prescription opioid painkiller and unable to obtain it may switch to an illicit opioid, such as a heroin, to relieve their cravings or withdrawal symptoms. In fact, studies have shown that many people who use heroin or misuse prescription opioids began with "legitimate" prescriptions for their own pain treatment or obtained these painkillers from friends or family members with prescriptions.[7,8] For example, a national study found that 80 percent of people who reported using heroin also reported earlier misuse of prescription opioids.[9] Research also shows that people often advance from misuse of prescription opioids to heroin because heroin provides stronger effects and is often less expensive than prescription opioids.[10]

Rise of the epidemic

The rise of the opioid crisis is commonly attributed to an increase in the prescribing of opioid painkillers, which was driven by a confluence of several factors:

First, in the 1980s some peer-reviewed journals published letters and articles suggesting that opioids were an effective way to treat pain with little risk of addiction. Specifically, a commonly cited 1980 letter published in the *New England Journal of Medicine* and another commonly cited research article published in the journal *Pain* in 1986 are believed to have contributed to a belief that opioids did not pose a high risk for addiction.[11,12,13,14]

Second, in the 1990s and 2000s, there was an increased emphasis among health care professionals on the importance of recognizing and treating pain. In 1996, the president of the American Pain Society raised the idea of "pain as a vital sign," stating that "quality care means that pain is measured and treated"— a concept that was adopted by many health professionals and throughout many health care organizations.[15] As examples, the Veterans Health Administration undertook efforts beginning in 1999 to regularly measure and record patients' self-reported pain on a scale of 0 to 10, and the health care accreditation organization The Joint Commission introduced pain-management standards that encouraged the assessment and treatment of pain.[16,17]

In 1995, around the same time that health professionals were focusing on under-treatment of pain, the Food and Drug Administration (FDA) approved the opioid painkiller OxyContin, which has become among the most commonly dispensed controlled substances in the U.S., and which the FDA has since described as "a focal point of opioid abuse issues."[18] In 2007, the maker of OxyContin, Purdue Pharma, settled criminal and civil claims by the U.S. Department of Justice that the company knowingly made false marketing claims that OxyContin was less addictive than other medications.[19,20] Despite its renown, the case of OxyContin is not unique; use of other opioid painkillers also has increased substantially, and other pharmaceutical companies have settled charges of misrepresenting the abuse-resistance and addictive properties of their medications.[21,22]

Trends of Increasing Deaths From Opioids

Over more than a decade, the U.S. has experienced statistically significant increases in overdose deaths related to opioids. The analysis below focuses on trends in opioid overdose deaths from 2000 to 2016, and it focuses on opioids that account for the bulk of opioid overdose deaths and are grouped according to how opioid overdose data are collected:

Natural and semi-synthetic opioids: Natural and semi-synthetic opioids include most prescription opioid painkiller pills, such as oxycodone and hydrocodone. Although these may be taken legitimately with a prescription, they are also sometimes used illicitly. For example, a person with a prescription may give them away or sell them, or a health care provider may improperly prescribe them (e.g., "pill mills"). Additionally, drug cartels manufacture and traffic counterfeit "prescription" opioid pills, which are sometimes mixed with other drugs.

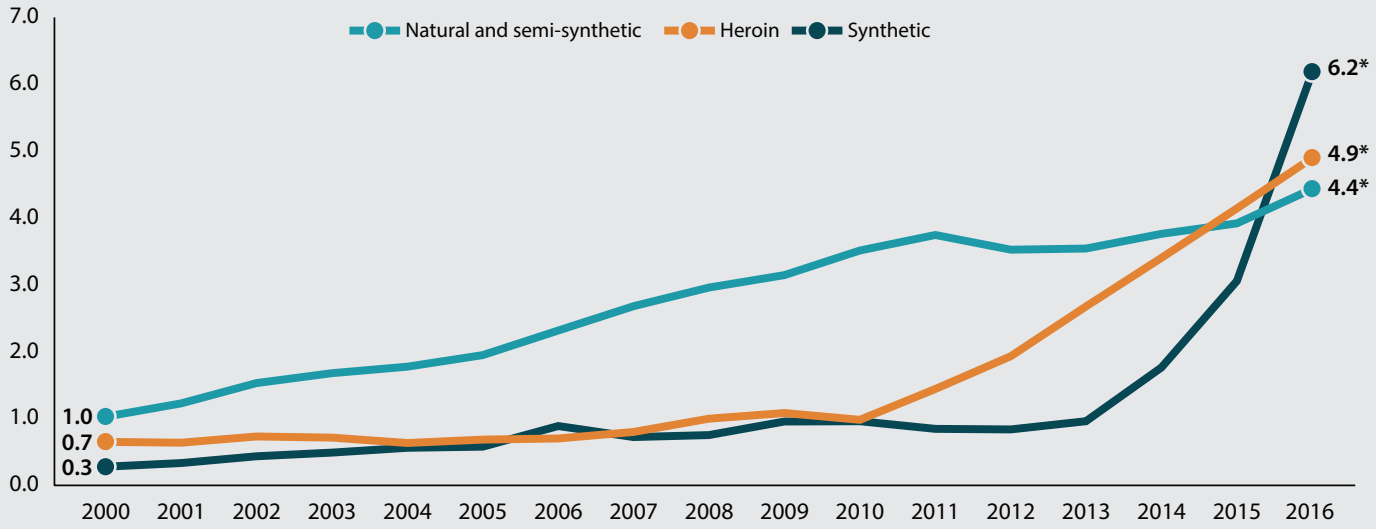
Synthetic opioids (except methadone): Some synthetic opioids, such as fentanyl, also are used legitimately as a medication. However, because they are commonly much more potent than natural and semi-synthetic opioids, synthetic opioids are typically administered in more-controlled settings, such as in a hospital. Recently, drug cartels have begun manufacturing and trafficking synthetic opioids, which are sometimes mixed with other drugs such as counterfeit painkillers and heroin as a way to cheaply increase their potency.

Methadone is one of three medications approved by the U.S. Food and Drug Administration for treatment of opioid use disorders and also is used sometimes as a prescription pain reliever medication. Although methadone is a synthetic opioid, our analysis has excluded methadone deaths from the category of deaths from synthetic opioids, mainly because it has not followed the same trend of increasing overdose deaths, and methadone deaths have remained at a relatively low rate compared to other opioids described in this brief.

Heroin: Heroin is a form of opioid that is derived from opium poppies and trafficked by international drug cartels. Most heroin sold in the U.S. comes from Latin America, with a smaller amount coming from Afghanistan and Southeast Asia. It is illegal in the U.S. and is typically cheaper to obtain than opioid painkillers, so it is sometimes used as a substitute by people who began their addictions with painkillers.

Between 2000 and 2016, rates of U.S. drug poisoning deaths related to all three types of opioids increased significantly. Drug overdose deaths from natural and semi-synthetic opioids grew more than four times, from 1.0 to 4.4 per 100,000 people (Figure 1). Deaths from heroin increased more than seven times, from 0.7 to 4.9 per 100,000 people, and deaths from synthetic opioids climbed more than 22 times, from 0.3 to 6.2 per 100,000 people. These trends were largely consistent across different sub-groups of the U.S. population, such as age and race/ethnicity.[23]

Figure 1: U.S. Opioid Death Rates Per 100,000 People, 2000-2016



* Statistically significant at 95% level.
Source: SHADAC analysis of vital statistics data from the CDC WONDER system.

Although deaths from all three forms of opioids have increased since 2000, their trends have differed. Deaths from natural and semi-synthetic opioids increased gradually but continuously from 2000 to 2010 in a pattern that mirrors legal sales of prescription painkillers. They then dropped slightly for a few years beginning in 2011, likely due to efforts to curb abuse of prescription painkillers through a variety of interventions, such as pharmaceutical companies' introduction of new tamper-resistant formulations, law enforcement efforts to shut down "pill mills", and more-stringent prescribing practices by health care providers. Around the same time that deaths from natural and semi-synthetic opioids slowed, deaths from heroin began increasing dramatically, having grown from 1.0 per 100,000 people in 2010 to 4.9 deaths per 100,000 people just six years later. That increase may be due to people seeking heroin as a substitute for prescription painkillers as they have become harder to obtain. Then even more recently, deaths from synthetic opioids have increased precipitously, from 1.0 per 100,000 people in 2013 to 6.2 per 100,000 people just three years later. That rise is likely due to fentanyl and similar drugs that are illegally manufactured and trafficked, then commonly mixed with heroin and counterfeit painkillers.

Some research is available to support the hypothesis that the increase in heroin death rates since 2010 may be due, at least in part, to people switching from prescription painkillers to heroin.[24,25] For example, studies have found that most people who use heroin began by abusing prescription painkillers and that rates of heroin use have increased in recent years among people who use prescription opioids for non-medical purposes.[26,27] Other studies also have found evidence that a reformulation of the popular prescription opioid OxyContin, designed to make the medication abuse-resistant, may have caused some people to adopt heroin as a substitute.[28,29,30]

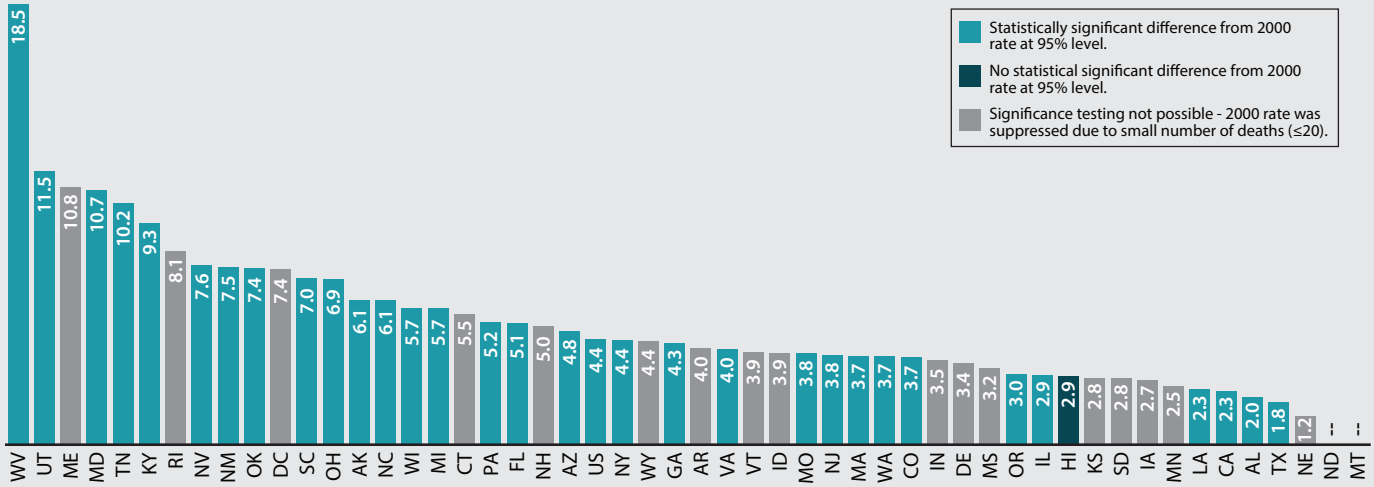
Opioid Overdose Deaths at the State-level

Similar to the U.S., most states have experienced increases in opioid-related deaths. The following section of our brief examines differences in opioid-related death rates across states from 2000 to 2016. (Additional national-level analysis, including analysis by age, gender, race/ethnicity and rurality, can be found in the companion brief: *The Opioid Epidemic: National Trends in Opioid-Related Overdose Deaths from 2000 to 2016*).

Natural and semi-synthetic opioids

Between 2000 and 2016, 31 states saw statistically significant increases in deaths from natural and semi-synthetic opioids (Figure 2). Overdose death rates from natural and semi-synthetic opioids remained statistically stable in only one state (Hawaii), and no states experienced significant declines. Statistical testing for increases from 2000 to 2016 was not possible for 18 states and the District of Columbia because overdose death rates from 2000 were suppressed due to small numbers.[31]

Figure 2: Natural and Semi-synthetic Opioid Death Rates Per 100,000 People, 2016

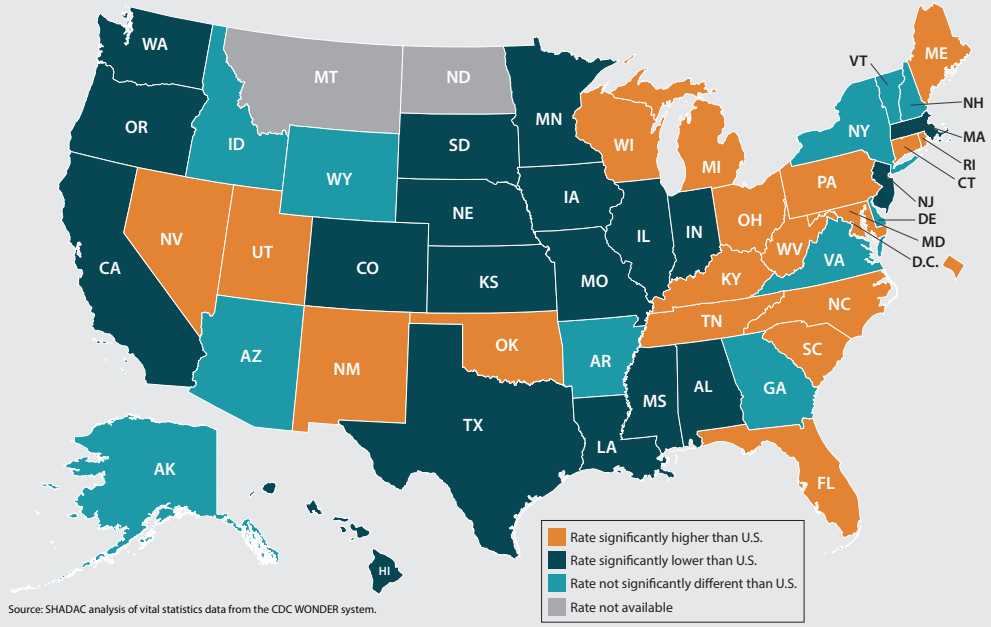


Source: SHADAC analysis of vital statistics data from the CDC WONDER system.

Despite widespread increases in overdose death rates from natural and semi-synthetic opioids, individual states' death rates varied widely. In 2016, Nebraska's rate of 1.2 deaths per 100,000 people was the lowest in the U.S., while West Virginia's rate (the highest) was more than 15 times larger, at 18.5 deaths.

Although most states have experienced significant increases in death rates from natural and semi-synthetic opioids, the eastern portion of the U.S. has been more severely affected. Of the 27 states (including the District of Columbia) east of the Mississippi River, 21 have death rates statistically equivalent to or higher than the U.S. rate.[32] Of the 24 states west of the Mississippi, only nine have rates at or above the U.S. rate (Figure 3).

Figure 3: State Rates of Natural and Semi-synthetic Opioid-related Deaths, 2016

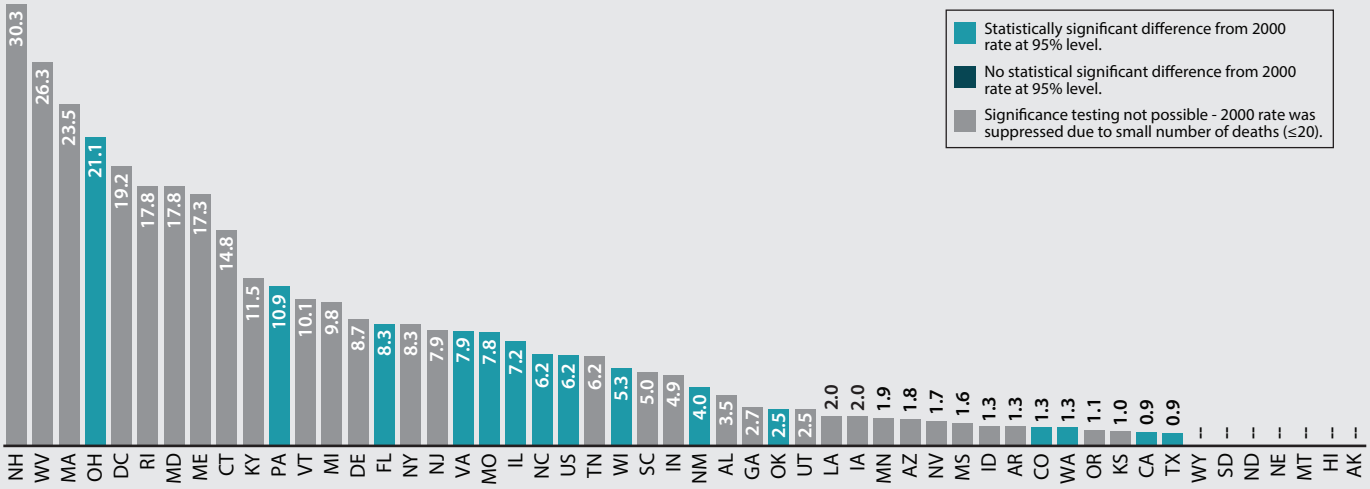


Source: SHADAC analysis of vital statistics data from the CDC WONDER system.

Synthetic opioids

Because deaths from synthetic opioid overdoses were relatively rare in 2000, statistical testing for significant changes between 2000 and 2016 was only possible for 14 states. However, all of those 14 states have experienced statistically significant increases in death rates from synthetic opioids (Figure 4). As the numbers of deaths from synthetic opioids have grown, data on death rates have become increasingly available: 2016 death rates from synthetic opioid overdoses are available for 44 states, including the District of Columbia, and 32 of these 44 states have overdose death rate data as far back as 2006 as well, so it is possible to test for statistically significant changes over the decade from 2006 to 2016 in these cases. Among these 32 states, 28 experienced statistically significant increases in death rates from synthetic opioids, while overdose death rates remained statistically stable in four (see Appendix Table 2).[33] No state experienced statistically significant declines in synthetic opioid overdose death rates from 2006 to 2016.

Figure 4: Synthetic Opioid Death Rates Per 100,000 People, 2016

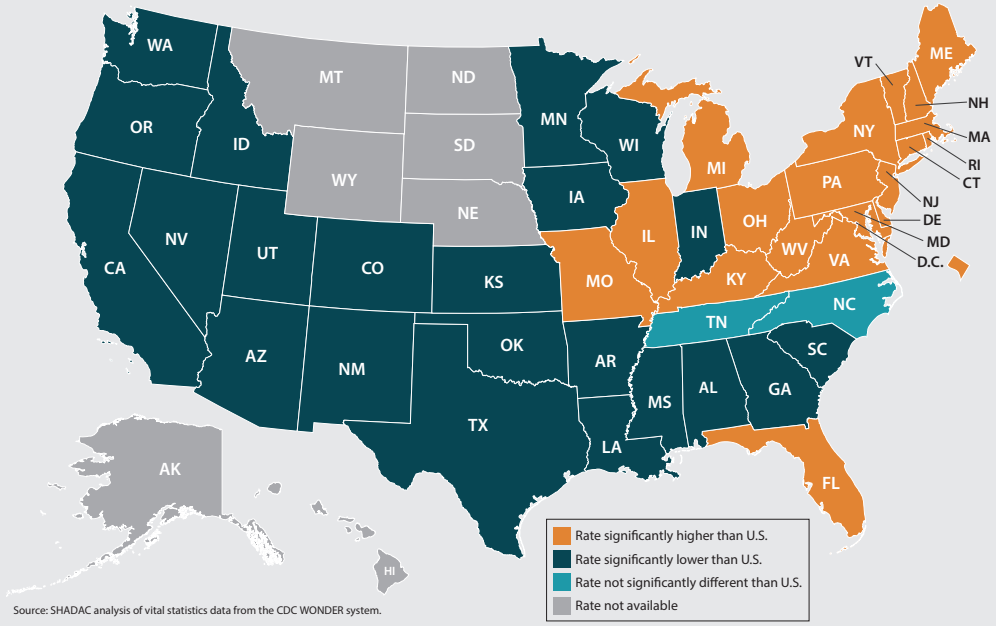


Source: SHADAC analysis of vital statistics data from the CDC WONDER system.

Compared to natural and semi-synthetic opioids, death rates from synthetic opioids vary more widely across states. In 2016, California and Texas had the lowest rates of deaths from synthetic opioids in the U.S., at 0.9 deaths per 100,000 people. The rate in New Hampshire, with the highest rate of deaths from synthetic opioids, was 30.3 per 100,000 people—more than 33 times the lowest rate.

In 2016, the states with the highest death rates from synthetic opioids were more regionally concentrated—mostly in the Northeast and part of the Midwest—than deaths from natural and semi-synthetic opioids. Of the 22 states with synthetic opioid death rates statistically equivalent to or higher than the U.S. rate, 21 are found in a contiguous block mostly east of the Mississippi.

Figure 5: State Rates of Synthetic Opioid-related Deaths, 2016



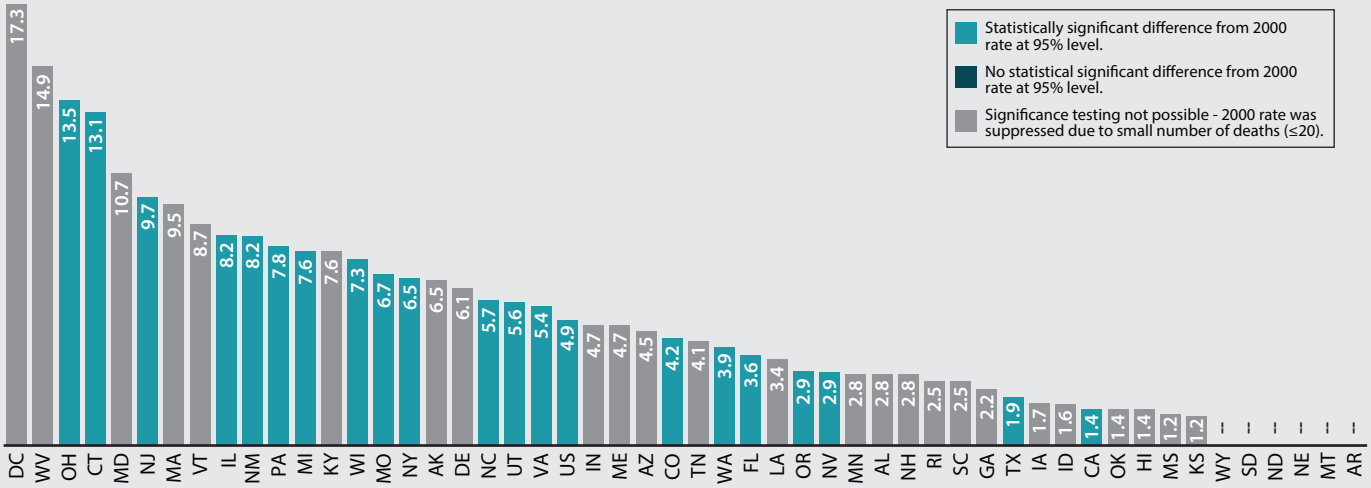
Source: SHADAC analysis of vital statistics data from the CDC WONDER system.

Heroin-related deaths

Similar to synthetic opioids, because deaths from heroin overdoses were relatively rare in 2000, statistical testing for significant changes between 2000 and 2016 was only possible for 20 states. However, all of those 20 states have experienced statistically significant increases in death rates from heroin (Figure 6). As the numbers of deaths from heroin have grown, data on death rates have become increasingly available: 2016 death rates from heroin overdoses are available for 45 states, including the District of Columbia, and 23 of these 45 states have overdose death rate data available as far back as 2006 as well, so it is possible to test for statistically significant changes over the decade from 2006 to 2016 in these cases. Among these states, all 23 experienced statistically significant increases in death rates from heroin from 2006 to 2016 (see Appendix Table 3).[34]

In 2016, death rates from heroin overdoses ranged from a low of 1.2 per 100,000 people in Kansas and Mississippi to a high of 17.3 per 100,000 in the District of Columbia—more than 14 times higher than the lowest rate.

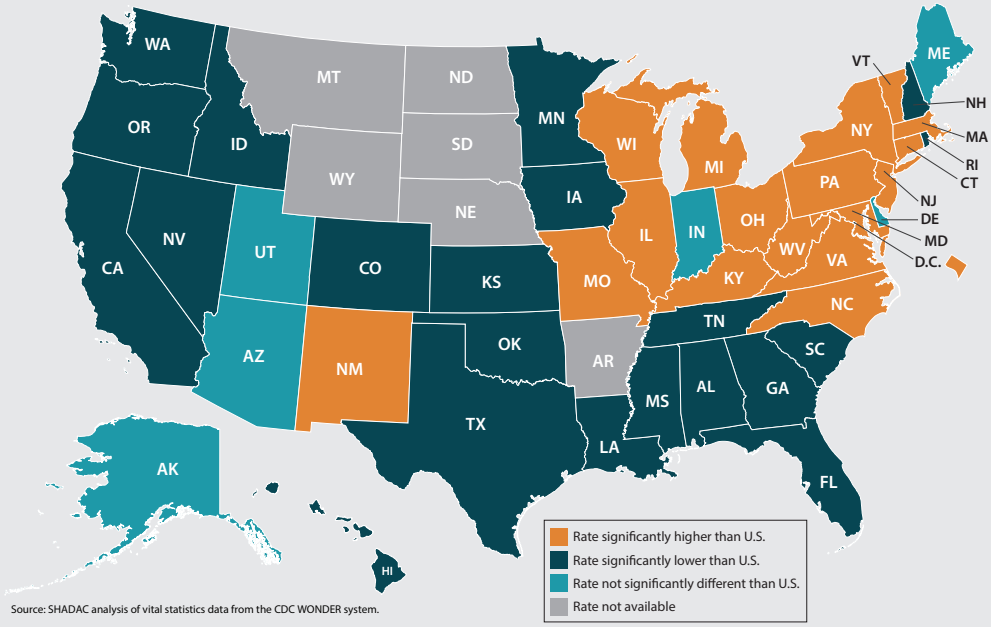
Figure 6: Heroin Death Rates Per 100,000 People, 2016



Source: SHADAC analysis of vital statistics data from the CDC WONDER system.

The national map showing states with heroin death rates closely resembles the map of synthetic opioid death rates. That similarity hints at a close relationship between overdoses from heroin and synthetic opioids. According to the U.S. Drug Enforcement Agency, illegal drug cartels now frequently traffic synthetic opioids such as fentanyl along with heroin, and they sometimes mix synthetic opioids into heroin to increase the potency.[35]

Figure 7: State Rates of Heroin-related Deaths, 2016



Source: SHADAC analysis of vital statistics data from the CDC WONDER system.

Discussion

Since 2000, the U.S. has experienced statistically significant increases in opioid-related overdose deaths. While the opioid crisis began with natural and semi-synthetic opioids, such as prescription painkillers, in the past several years it has evolved, with deaths from heroin and synthetic opioids now outpacing natural and semi-synthetic opioids. Although data are more limited at the state level than at the national level, they illustrate a similar story to the U.S. epidemic: Nearly every state has been measurably affected by the opioid crisis, and the crisis appears to be evolving in most states. Whereas in 2000, deaths from heroin and synthetic opioid overdoses were so uncommon that reliable data weren't available for most states, by 2016 deaths from heroin and synthetic opioids had increased to the point that overdose data are available for almost all states.

Our analysis found that some states have been more severely affected than others by high rates of opioid overdose deaths, especially by heroin and synthetic opioids, as the crisis has developed. But even those states that have been less severely affected should remain vigilant. The first hints of today's national opioid crisis first appeared two decades ago with natural and semi-synthetic opioids, mostly in a relatively small Appalachian region of Kentucky, Ohio, Virginia and West Virginia. But that initially small and concentrated regional crisis has since expanded to virtually all corners of the U.S. Based on that history, it is reasonable to believe that without policy intervention heroin and synthetic opioid deaths may continue to expand nationally.

As overdose deaths and awareness of the opioid crisis have grown, many states have adopted policies aimed at restricting access to prescription opioids. For example, 49 states have created prescription drug monitoring programs, which allow health care professionals to identify patients who may be "doctor shopping" to obtain multiple opioid prescriptions from different providers and which allow regulators and law enforcement to identify physicians or clinics that inappropriately prescribe large quantities of opioids, commonly known as "pill mills." Many states also have adopted policies aimed specifically at preventing opioid overdoses, such as expanding access to the medication naloxone, which can reverse the toxic effects of an opioid overdose. And some states are working to improve opioid painkiller prescribing by incorporating measures of appropriate opioid prescribing into health care payment reform efforts.

In addition to policies such as those, the CDC recommends improving access to substance abuse treatment services.[36] Some policy changes at the U.S. level are aimed at increasing access to substance abuse treatment services. For example, in addition to expanding health insurance coverage, the ACA required that plans sold in the individual and small-group markets covered substance abuse treatment in parity with other health conditions, and it also required states expanding their Medicaid programs under the ACA to cover substance abuse treatment for newly eligible beneficiaries.[37] Additionally, the U.S. Substance Abuse and Mental Health Services Administration (SAMHSA) recently revised regulations allowing some physicians to treat more patients with buprenorphine, a medication similar to methadone that can be used to treat opioid addiction.[38] However, SAMHSA also has acknowledged other limitations in the availability of treatment, such as shortages of substance abuse treatment professionals, especially in rural areas.[39] And states also have taken steps to increase access to treatment. For example, West Virginia and Kentucky have recently obtained Medicaid waivers to cover residential treatment of substance use disorders in institutions of mental disease (IMD), which typically is not allowed under the Medicaid IMD exclusion, and several other states have applied for similar waivers.

References

[1] U.S. Centers for Disease Control and Prevention, National Center for Health Statistics. "Drug Poisoning Mortality: United States, 1999-2015." 2017. Available at: https://www.cdc.gov/nchs/data-visualization/drug-poisoning-mortality

[2] U.S. Centers for Disease Control and Prevention. "Overdose Deaths Involving Opioids, Cocaine, and Psychostimulants — United States, 2015–2016" Morbidity and Mortality Weekly Report. 2018. Available at: https://www.cdc.gov/mmwr/volumes/67/wr/mm6712a1.htm?s_cid=mm6712a1_w

[3] U.S. Centers for Disease Control and Prevention. "Increases in Drug and Opioid-Involved Overdose Deaths — United States, 2010–2015." Morbidity and Mortality Weekly Report. 2016. Available at: https://www.cdc.gov/mmwr/volumes/65/wr/mm655051e1.htm

[4] The issue of legal status of opioid drugs is complex. Heroin, as a Schedule 1 controlled substance, is treated as an "illegal" drug with a high risk for abuse and no medicinal value. Most other opioids, such as oxycodone and hydrocodone, are considered Schedule 2 controlled substances, meaning they have substantial potential for abuse but also have medicinal value. The legality of Schedule 2 opioids depends on how they are manufactured and distributed. If a person takes an opioid painkiller that was properly prescribed and dispensed by licensed health care provider, then that would generally be legal. However, opioid painkillers are sometimes fraudulently prescribed or diverted from their intended patients, which is illegal. Additionally, criminal drug traffickers also manufacture counterfeit opioids that are chemically similar to prescription painkillers (e.g., fentanyl) and sell them illegally on the black market.

[5] Merrer, J., Becker, J., Befort, K., Kieffer, B. "Reward Processing by the Opioid System in the Brain." Physiological Reviews. 2009; 89(4): 1,379-1,412. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4482114/

[6] American Academy of Addiction Medicine. "Public Policy Statement: Definition of Addiction." 2011. Available at: https://www.asam.org/docs/default-source/public-policy-statements/1definition_of_addiction_long_4-11.pdf?sfvrsn=2

[7] Keyes, K., Cerda, M., Brady, J., Havens, J., & Galea, S. "Understanding the Rural-Urban Differences in Nonmedical Prescription Opioid Use and Abuse in the United States." The American Journal of Public Health. 2014; 104(2): e52-e59. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3935688/#bib68

[8] Canfield, M., Keller, C., Frydrych, L., Ashrafioun, L., Purdy, C., & Blondell, R. "Prescription opioid use among patients seeking treatment for opioid dependence." Journal of Addiction Medicine. 2010; 5(1):86. Available at: https://www.ncbi.nlm.nih.gov/pubmed/20543897

[9] Muhuri, P., Gfroerer, J. & Davies, C. "Associations of Nonmedical Pain Reliever Use and Initiation of Heroin Use in the United States." SAMHSA Center for Behavioral Health Statistics and Quality Data Review. 2013. Available at: http://www.samhsa.gov/data/sites/default/files/DR006/DR006/nonmedical-pain-reliever-use-2013.htm#endnote2

[10] Canfield, M., Keller, C., Frydrych, L., Ashrafioun, L., Purdy, C., & Blondell, R. "Prescription opioid use among patients seeking treatment for opioid dependence." Journal of Addiction Medicine. 2010; 5(1):86. Available at: https://www.ncbi.nlm.nih.gov/pubmed/20543897

[11] Frakt, A. "Painkiller Abuse, a Cyclical Challenge." The New York Times. 2014. Available at: https://www.nytimes.com/2014/12/23/upshot/painkiller-abuse-a-cyclical-challenge.html

[12] DuPont, S., Bezaitis, A., Ross, M. "Stemming The Tide Of Prescription Opioid Overuse, Misuse, And Abuse." Health Affairs Blog. 2015. Available at: http://healthaffairs.org/blog/2015/09/22/stemming-the-tide-of-prescription-opioid-overuse-misuse-and-abuse/

[13] Portenoy, R., Foley, K. "Chronic use of opioid analgesics in non-malignant pain: report of 38 cases." Pain. 1986; 25(2): 171-186.

[14] Porter, J., Jick, H. "Addiction Rare in Patient Treated With Narcotics." New England Journal of Medicine. 1980; 302(2): 123.

[15] U.S. Department of Veterans Affairs. "Pain as the 5th Vital Sign Toolkit." 2000. Available at: https://www.va.gov/PAINMANAGEMENT/docs/Pain_As_the_5th_Vital_Sign_Toolkit.pdf

[16] Mularski, R., White-Chu, F., Overbay, D., Miller, L., Asch, S., Ganzini, L. "Measuring Pain as the 5th Vital Sign Does Not Improve Quality of Pain Management." Journal of General Internal Medicine. 2006; 21(6): 607-612. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1924634/

[17] Garcia, A. "State Laws Regulating Prescribing of Controlled Substances: Balancing the Public Health Problems of Chronic Pain and Prescription Painkiller Abuse and Overdose." Journal of Law, Medicine and Ethics. 2013. Available at: https://www.aslme.org/media/downloadable/files/links/j/l/jlme-41_1-garcia_supp2.pdf

[18] U.S. Food and Drug Administration. "Timeline of Selected FDA Activities and Significant Events Addressing Opioid Misuse and Abuse." 2017. Available at: https://www.fda.gov/Drugs/DrugSafety/InformationbyDrugClass/ucm338566.htm

[19] U.S. Department of Justice. "Justice Department Recovers $2 Billion for Fraud Against the Government in Fy 2007; More Than $20 Billion Since 1986." 2007. Available at: https://www.justice.gov/archive/opa/pr/2007/November/07_civ_873.html

[20] Meier, B. "U.S. maker of OxyContin painkiller to pay $600 million in guilty plea." The New York Times. 2007. Available at: http://www.nytimes.com/2007/05/11/business/worldbusiness/11iht-oxy.1.5665287.html

[21] Stempel, J. "Endo to flag Opana ER painkiller's risks, under NY settlement." Reuters. 2016. Available at: http://www.reuters.com/article/us-endo-new-york-settlement-idUSKCN0W51YI

[22] New York State Office of the Attorney General. "A.G. Schneiderman Announces Settlement With Endo Health Solutions Inc. & Endo Pharmaceuticals Inc. Over Marketing Of Prescription Opioid Drugs." 2016. Available at: https://ag.ny.gov/press-release/ag-schneiderman-announces-settlement-endo-health-solutions-inc-endo-pharmaceuticals

[23] State Health Access Data Assistance Center (SHADAC). "The Opioid Epidemic: National Trends in Opioid-Related Overdose Deaths from 2000 to 2015." 2017. Accessible at: www.shadac.org/2016OpioidBriefs

[24] Cicero, T., Ellis, M., & Harney, J. "Shifting Patterns of Prescription Opioid and Heroin Abuse in the United States." The New England Journal of Medicine. 2015; 373(18): 1789-1790. Available at: http://www.nejm.org/doi/pdf/10.1056/NEJMc1505541

[25] Unick, G., Rosenblum, D., Mars, S., Ciccarone, D. "Intertwined Epidemics: National Demographic Trends in Hospitalizations for Heroin- and Opioid-Related Overdoses, 1993–2009." PLOS One. 2013; 8 (2): e54496. Available at: http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0054496

[26] Muhuri, P., Gfroerer, J., Davies, C. "Associations of Nonmedical Pain Reliever Use and Initiation of Heroin Use in the United States." U.S. Substance Abuse and Mental Health Services Administration (SAMHSA) Center for Behavioral Health Statistics and Quality Data Review. 2013. Available at: http://archive.samhsa.gov/data/2k13/DataReview/DR006/nonmedical-pain-reliever-use-2013.pdf

[27] Jones, C. "Heroin use and heroin use risk behaviors among nonmedical users of prescription opioid pain relievers – United States, 2002–2004 and 2008–2010." Drug and Alcohol Dependence. 2013; 132(1-2): 95-100. Available at: http://www.sciencedirect.com/science/article/pii/S0376871613000197

[28] Alpert, A., Powell., D., Liccardo Pacula, R. "Supply-Side Drug Policy in the Presence of Substitutes: Evidence from the Introduction of Abuse-Deterrent Opioids." National Bureau of Economic Research. 2017. Available at: http://www.nber.org/papers/w23031

[29] Cicero, T., & Ellis, M. "Abuse-Deterrent Formulations and the Prescription Opioid Abuse Epidemic in the United States: Lessons Learned from OxyContin." Journal of the American Medical Association Psychiatry. 2015;72(5): 424-30. Available at: https://www.ncbi.nlm.nih.gov/pubmed/25760692

[30] Dart, R., Surratt, H., Cicero, T., Parrino, M., Severtson, S., Bucher-Bartelson, B., Green, J. "Trends in Opioid Analgesic Abuse and Mortality in the United States." New England Journal of Medicine. 2015; 372: 241-248. Available at: http://www.nejm.org/doi/full/10.1056/NEJMsa1406143#t=article

[31] The CDC suppresses rates based on 20 or fewer deaths.

[32] Our analysis does not correct for overlap between individual states' and the U.S. overdose death rates. This results in a more-conservative estimate of statistical significance (e.g., less likely to find a statistically significant difference).

[33] Although we tested for changes in heroin and synthetic opioid overdose death rates from 2006 to 2016, we do not discuss the same testing for natural and semi-synthetic opioids. That is because death rates from natural and semi-synthetic opioids were already available for most states in 2000 and because they began increasing earlier than heroin and synthetic opioids.

[34] Although we tested for changes in heroin and synthetic opioid overdose death rates from 2006 to 2016, we do not discuss the same testing for natural and semi-synthetic opioids. That is because death rates from natural and semi-synthetic opioids were already available for most states in 2000 and because they began increasing earlier than heroin and synthetic opioids.

[35] U.S. Drug Enforcement Administration. "Fentanyl FAQs." Available at: https://www.dea.gov/druginfo/fentanyl-faq.shtml

[36] U.S. Centers for Disease Control and Prevention. "Promising State Strategies." 2016. Available at: https://www.cdc.gov/drugoverdose/policy/index.html

[37] State Health Access Data Assistance Center (SHADAC). "Substance use and the ACA in Kentucky." 2016. Accessible at: http://www.shadac.org/publications/substance-use-and-aca-kentucky-study-impact-aca-implementation-ky

[38] Johnson, K. Untitled SAMHSA Dear Colleague letter. 2016. Available at: https://www.samhsa.gov/sites/default/files/programs_campaigns/medication_assisted/dear_colleague_letters/2016-colleague-letter-275-limit.pdf

[39] U.S. Substance Abuse and Mental Health Services Administration. "Report to Congress on the Nation's Substance Abuse and Mental Health Workforce Issues." 2013. Available at: https://store.samhsa.gov/shin/content/PEP13-RTC-BHWORK/PEP13-RTC-BHWORK.pdf

APPENDIX TABLE 1: NATURAL AND SEMI-SYNTHETIC OPIOID OVERDOSE DEATHS PER 100,000 PEOPLE

State	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2000 2016 test	2006 2016 test
Alabama	0.6	0.5	0.7	0.5	0.7	0.5	1.0	1.4	1.6	2.0	1.8	1.9	1.3	1.3	1.8	1.8	2.0	*	*
Alaska	3.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	7.2	8.1	5.4	4.8	5.7	5.2	5.6	6.5	6.1	*	--
Arizona	1.9	1.6	2.5	2.5	2.7	3.1	3.2	3.6	4.1	5.0	5.2	4.9	5.0	3.9	4.2	4.5	4.8	*	*
Arkansas	N/A	N/A	1.6	1.9	2.4	2.2	2.5	3.2	4.0	4.5	4.2	4.2	4.2	3.8	4.3	5.1	4.0	--	*
California	1.9	0.9	2.7	2.3	2.1	2.1	2.2	2.5	2.9	3.0	2.8	3.0	2.4	2.6	2.6	2.4	2.3	*	
Colorado	1.3	2.1	1.5	1.6	1.7	2.2	2.5	3.7	3.4	3.3	2.6	3.7	4.2	4.1	4.6	4.5	3.7	*	*
Connecticut	N/A	N/A	0.7	0.7	0.8	0.8	1.1	0.9	1.0	0.9	1.1	1.2	1.0	3.8	4.3	4.8	5.5	--	*
Delaware	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3.3	4.8	5.4	7.0	4.0	4.0	4.2	3.8	3.4	--	--
DC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3.1	7.4	--	--
Florida	1.6	2.8	2.5	2.6	3.1	2.8	3.2	4.2	4.7	5.5	6.4	5.6	4.4	3.8	3.5	3.8	5.1	*	*
Georgia	0.7	1.0	1.1	1.0	1.1	1.3	1.4	1.5	2.0	2.6	3.1	3.3	3.0	3.1	3.8	4.2	4.3	*	*
Hawaii	1.8	2.2	2.2	2.0	2.4	2.9	2.2	3.6	2.4	2.5	2.8	3.3	2.6	2.7	2.4	2.4	2.9		
Idaho	N/A	2.4	2.0	2.3	1.6	1.9	2.2	2.2	3.1	2.4	2.8	3.1	2.2	3.1	2.7	3.3	3.9	--	*
Illinois	0.4	0.6	0.6	0.5	0.6	0.8	0.8	1.1	1.4	1.5	1.4	1.3	1.3	1.4	1.9	2.0	2.9	*	*
Indiana	N/A	0.4	0.4	0.6	0.8	0.9	0.8	1.3	1.7	2.3	2.2	2.7	2.1	1.7	2.3	2.2	3.5	--	*
Iowa	N/A	N/A	N/A	N/A	1.1	1.2	1.8	1.8	2.7	2.9	2.6	3.0	3.4	3.6	2.7	2.5	2.7	--	*
Kansas	N/A	0.8	1.5	1.5	2.3	2.0	2.3	2.1	1.7	2.2	1.9	2.6	3.1	3.2	3.2	2.7	2.8	--	
Kentucky	1.3	2.1	2.0	2.3	2.1	3.1	4.1	4.4	5.5	6.8	10.3	11.1	9.0	8.0	7.7	8.9	9.3	*	*
Louisiana	0.5	1.0	0.9	1.2	1.2	1.2	1.5	2.1	1.4	1.3	1.5	1.2	1.6	1.9	2.0	2.3	2.3	*	*
Maine	N/A	N/A	1.9	2.2	2.1	2.9	3.1	4.1	3.5	5.6	4.0	3.2	4.7	4.9	6.1	7.7	10.8	--	*
Maryland	0.4	0.4	0.4	0.5	1.3	1.6	1.9	2.2	2.9	3.2	3.5	4.0	4.2	4.9	6.2	6.5	10.7	*	*
Massachusetts	0.5	1.1	1.1	1.3	1.0	1.4	2.3	2.5	2.1	2.2	2.5	2.4	2.5	2.6	2.6	3.3	3.7	*	*
Michigan	0.4	0.6	0.8	0.8	1.0	1.5	1.7	1.8	2.2	2.1	2.5	2.3	2.8	2.8	3.3	3.9	5.7	*	*
Minnesota	N/A	0.8	0.8	0.8	1.2	1.2	1.1	1.5	1.6	2.1	1.8	1.8	2.0	2.0	1.9	2.2	2.5	--	*
Mississippi	N/A	N/A	N/A	N/A	N/A	N/A	1.0	1.6	2.0	1.5	1.7	1.8	2.1	1.8	2.1	2.5	3.2	--	*
Missouri	0.9	1.0	1.5	2.5	2.4	2.5	2.6	2.9	3.8	3.2	4.1	3.8	3.4	4.0	4.0	3.9	3.8	*	*
Montana	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2.6	2.8	4.3	3.7	3.4	2.4	4.6	2.2	2.7	N/A	--	--
Nebraska	N/A	N/A	N/A	N/A	1.2	1.5	N/A	1.4	N/A	2.1	2.0	1.7	1.6	1.8	1.8	1.7	1.2	--	--
Nevada	4.9	4.0	4.2	5.0	4.0	6.2	6.8	7.1	7.9	9.3	10.8	10.7	10.6	8.3	7.4	8.6	7.6	*	
New Hampshire	N/A	N/A	N/A	1.6	2.1	1.7	2.7	3.8	3.5	3.4	4.6	4.9	4.2	4.3	5.8	4.4	5.0	--	*
New Jersey	0.9	1.1	1.1	1.3	1.0	1.4	1.6	1.5	1.4	N/A	2.0	2.5	2.4	2.6	2.7	2.6	3.8	*	*
New Mexico	5.5	4.7	7.6	8.0	5.3	7.0	8.6	8.9	10.4	6.0	5.6	6.1	9.0	10.1	10.9	8.1	7.5	*	
New York	0.2	0.4	0.2	0.3	0.4	0.5	1.4	2.0	2.3	2.3	2.6	3.1	3.0	3.1	3.0	3.4	4.4	*	*
North Carolina	1.4	1.8	1.6	1.6	1.9	2.4	2.7	3.3	4.4	4.5	4.4	4.5	4.2	4.1	4.7	5.5	6.1	*	*
North Dakota	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	--	--
Ohio	0.9	1.3	1.7	1.4	1.6	1.8	2.2	2.5	2.9	2.6	4.5	5.1	4.4	4.5	5.4	6.1	6.9	*	*
Oklahoma	2.0	2.8	2.4	4.2	4.2	4.9	6.0	8.0	6.9	9.4	9.3	9.4	10.1	9.8	9.6	7.2	7.4	*	*
Oregon	0.8	1.2	1.4	2.2	1.8	2.1	3.2	2.4	2.4	3.2	3.4	4.0	3.6	2.9	3.2	3.6	3.0	*	
Pennsylvania	0.8	0.6	0.8	1.1	1.3	1.3	1.2	1.7	2.1	2.4	2.6	2.6	2.9	3.2	3.3	3.7	5.2	*	*
Rhode Island	N/A	N/A	N/A	N/A	N/A	2.2	3.0	N/A	2.7	2.1	4.2	5.8	6.5	7.4	6.7	8.3	8.1	--	*
South Carolina	1.0	1.3	0.9	1.3	1.4	1.4	2.6	2.5	2.6	2.7	3.2	3.2	3.2	3.0	6.5	6.5	7.0	*	*
South Dakota	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2.9	2.8	N/A	3.5	2.4	N/A	2.8	--	--
Tennessee	1.0	1.5	1.4	2.4	3.1	3.7	3.5	3.8	4.2	5.4	6.7	7.2	7.7	8.1	8.6	9.7	10.2	*	*
Texas	0.7	1.0	1.4	1.6	1.6	1.8	2.5	2.2	1.8	2.2	2.2	2.0	1.8	1.7	1.7	1.7	1.8	*	*
Utah	5.3	4.9	5.9	7.1	6.7	8.0	8.1	9.8	9.1	10.3	8.5	10.8	12.6	13.3	13.6	12.7	11.5	*	*
Vermont	N/A	N/A	N/A	4.7	3.9	N/A	4.1	4.6	4.7	3.6	4.3	4.7	4.0	5.9	3.4	3.9	3.9	--	
Virginia	1.4	1.9	1.9	1.9	2.3	2.0	2.1	2.7	2.7	2.6	2.4	3.9	3.4	3.5	3.9	3.3	4.0	*	*
Washington	1.6	2.0	2.2	2.6	3.3	3.6	4.0	4.1	4.4	4.7	4.1	4.5	4.6	3.7	3.8	3.5	3.7	*	
West Virginia	1.3	4.1	5.0	6.8	6.5	3.1	8.6	10.2	12.4	5.5	19.4	25.2	20.0	19.3	20.2	19.8	18.5	*	*
Wisconsin	0.9	1.2	1.7	1.9	1.9	2.4	2.9	3.2	3.1	3.3	4.0	3.9	3.9	4.8	4.8	4.3	5.7	*	*
Wyoming	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	5.6	4.8	4.3	5.9	4.6	5.0	4.4	--	--
United States	**1.0**	**1.2**	**1.5**	**1.7**	**1.8**	**1.9**	**2.3**	**2.7**	**3.0**	**3.1**	**3.5**	**3.7**	**3.5**	**3.5**	**3.8**	**3.9**	**4.4**	*	*

N/A: Death rate is suppressed because it is based on 20 or fewer deaths.
-- Significance testing not possible because rate from 2000 was suppressed.
* Difference between 2000/2006 and 2016 rates is statistically significant at the 95% level.

APPENDIX TABLE 2: SYNTHETIC OPIOID OVERDOSE DEATHS PER 100,000 PEOPLE

State	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2000 2016 test	2006 2016 test
Alabama	N/A	N/A	N/A	N/A	N/A	N/A	0.5	0.4	N/A	0.7	0.7	N/A	N/A	0.6	1.0	1.6	3.5	--	*
Alaska	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2.9	N/A	N/A	N/A	N/A	N/A	N/A	N/A	--	--
Arizona	N/A	0.4	0.4	0.4	0.5	0.6	0.9	0.6	0.8	0.9	1.0	0.6	0.6	0.8	0.8	1.1	1.8	--	*
Arkansas	N/A	N/A	0.9	1.0	1.1	1.0	1.1	1.0	1.6	2.1	2.1	1.0	0.7	1.1	1.2	1.5	1.3	--	
California	0.2	0.1	0.3	0.4	0.4	0.3	0.4	0.4	0.4	0.5	0.5	0.4	0.4	0.4	0.5	0.5	0.9	*	*
Colorado	0.6	N/A	0.7	0.5	0.5	0.7	0.5	0.9	0.8	1.3	1.1	1.6	0.9	1.2	1.5	1.2	1.3	*	*
Connecticut	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.6	N/A	0.5	0.6	N/A	N/A	1.4	2.7	6.1	14.8	--	--
Delaware	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2.5	3.0	4.3	8.7	--	--
DC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3.9	19.2	--	--
Florida	0.5	0.7	0.8	1.1	0.9	0.8	0.7	0.7	0.7	0.9	0.8	0.7	0.8	1.0	1.8	3.2	8.3	*	*
Georgia	N/A	0.3	0.4	0.4	0.4	0.5	0.6	0.7	0.6	0.9	1.0	0.9	0.6	0.8	1.7	2.8	2.7	--	*
Hawaii	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	--	--
Idaho	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.3	--	--
Illinois	0.2	0.3	0.3	0.3	0.3	0.5	3.0	0.8	0.7	0.9	0.9	0.7	0.6	0.6	1.0	2.2	7.2	*	*
Indiana	N/A	N/A	N/A	0.4	0.4	0.4	0.8	0.8	0.9	1.0	0.8	0.6	0.7	0.5	1.3	1.9	4.9	--	*
Iowa	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.8	1.2	1.5	1.0	1.3	1.0	1.0	1.5	2.0	--	--
Kansas	N/A	N/A	N/A	N/A	0.8	N/A	N/A	N/A	N/A	1.3	N/A	0.8	1.6	1.3	1.4	1.3	1.0	--	--
Kentucky	N/A	N/A	0.7	0.7	0.8	0.7	1.2	0.9	1.0	1.5	1.3	1.7	1.6	1.7	4.3	7.9	11.5	--	*
Louisiana	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.5	N/A	N/A	0.5	0.4	N/A	0.6	0.7	0.8	2.0	--	--
Maine	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.7	N/A	N/A	1.8	5.2	9.9	17.3	--	--
Maryland	N/A	N/A	N/A	N/A	N/A	0.4	0.9	0.6	0.6	0.9	0.9	1.0	0.8	1.5	3.8	5.8	17.8	--	*
Massachusetts	N/A	N/A	0.3	0.4	0.5	0.6	1.4	1.1	0.8	0.9	1.0	0.9	1.0	1.4	6.9	14.4	23.5	--	*
Michigan	N/A	N/A	0.4	0.3	0.5	0.9	2.0	0.7	0.7	0.9	0.9	0.9	0.7	0.9	1.9	4.8	9.8	--	*
Minnesota	N/A	N/A	N/A	N/A	N/A	N/A	0.5	0.5	0.6	0.7	0.7	0.6	0.7	0.6	0.8	1.0	1.9	--	*
Mississippi	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.7	1.2	1.1	0.8	N/A	0.7	0.9	0.8	1.3	1.6	--	--
Missouri	0.5	0.7	0.5	0.6	0.9	0.8	2.5	1.2	1.0	1.2	1.5	1.1	1.0	1.6	1.9	3.1	7.8	*	*
Montana	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	--	--
Nebraska	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.2	N/A	N/A	N/A	N/A	N/A	N/A	--	--
Nevada	N/A	0.9	1.0	N/A	1.0	1.2	1.1	0.9	1.0	1.5	1.4	1.6	0.9	0.9	1.0	1.1	1.7	--	
New Hampshire	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.6	1.5	1.9	1.8	2.4	12.4	24.1	30.3	--	--
New Jersey	N/A	0.4	0.3	0.3	0.3	0.3	0.4	0.4	N/A	N/A	0.4	0.3	0.4	0.6	1.2	2.8	7.9	--	*
New Mexico	1.1	N/A	N/A	1.2	N/A	N/A	1.2	N/A	1.2	1.1	0.9	0.9	1.9	1.1	3.3	2.1	4.0	*	*
New York	N/A	0.2	0.1	0.1	N/A	0.1	0.7	0.6	0.6	0.9	0.9	0.8	0.8	1.1	1.4	3.3	8.3	--	*
North Carolina	0.6	0.7	0.6	0.8	1.3	1.3	1.2	1.2	1.3	1.8	1.8	1.6	1.4	1.2	2.2	3.1	6.2	*	*
North Dakota	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	--	--
Ohio	0.3	0.5	0.5	0.4	0.7	0.9	1.1	1.0	0.9	0.8	1.5	1.4	1.2	1.4	5.5	11.4	21.1	*	*
Oklahoma	0.8	0.6	0.7	1.3	1.3	1.6	1.3	1.8	2.0	4.4	3.0	2.2	2.9	2.3	1.9	2.4	2.5	*	*
Oregon	N/A	N/A	N/A	N/A	N/A	0.6	0.7	N/A	0.6	0.8	0.7	0.7	0.7	0.6	0.8	0.9	1.1	--	
Pennsylvania	0.3	0.2	0.4	0.6	0.7	0.6	0.8	0.7	0.8	0.9	0.8	0.9	0.8	0.9	1.8	3.5	10.9	*	*
Rhode Island	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2.9	7.9	13.2	17.8	--	--
South Carolina	N/A	N/A	0.5	N/A	0.8	0.7	0.9	0.8	0.9	1.2	1.2	1.0	1.0	1.1	2.3	3.3	5.0	--	*
South Dakota	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	--	--
Tennessee	N/A	N/A	0.3	1.1	1.3	1.3	1.1	1.4	1.6	1.2	1.1	1.0	1.2	1.5	2.1	4.0	6.2	--	*
Texas	0.2	0.4	0.6	0.4	0.4	0.4	0.5	0.5	0.4	0.7	0.6	0.5	0.5	0.4	0.6	0.7	0.9	*	*
Utah	N/A	N/A	N/A	1.1	N/A	1.7	1.7	1.4	1.0	2.4	2.0	2.1	2.2	2.2	2.5	2.3	2.5	--	
Vermont	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3.6	5.6	10.1	--	--
Virginia	0.4	0.4	0.6	0.6	0.8	0.6	0.8	0.9	1.1	1.0	1.0	0.9	1.1	1.5	2.1	3.3	7.9	*	*
Washington	0.4	0.5	0.8	0.5	0.7	0.8	0.8	0.5	0.7	1.0	0.9	0.7	0.8	0.8	0.8	0.9	1.3	*	*
West Virginia	N/A	2.1	2.2	2.5	3.7	2.4	2.9	4.6	5.0	2.4	5.8	5.6	5.0	5.6	7.2	12.7	26.3	--	*
Wisconsin	0.4	0.4	0.5	0.8	0.8	0.9	1.0	1.0	1.0	1.3	1.2	1.1	0.9	1.4	1.6	2.1	5.3	*	*
Wyoming	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	--	--
United States	**0.3**	**0.3**	**0.4**	**0.5**	**0.6**	**0.6**	**0.9**	**0.7**	**0.8**	**1.0**	**1.0**	**0.8**	**0.8**	**1.0**	**1.8**	**3.1**	**6.2**	*	*

N/A: Death rate is suppressed because it is based on 20 or fewer deaths.
-- Significance testing not possible because rate from 2000 was suppressed.
* Difference between 2000/2006 and 2016 rates is statistically significant at the 95% level.

APPENDIX TABLE 3: HEROIN OVERDOSE DEATHS PER 100,000 PEOPLE

State	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2000 2016 test	2006 2016 test
Alabama	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.8	0.8	2.7	2.5	2.8	--	--
Alaska	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2.9	3.2	3.3	4.7	6.5	--	--
Arizona	N/A	0.5	0.5	1.2	0.8	0.6	0.9	0.9	1.1	1.4	1.5	1.9	1.6	2.3	3.1	3.8	4.5	--	*
Arkansas	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	--	--
California	1.0	0.7	1.0	1.0	0.8	0.7	0.8	0.8	0.9	0.9	0.8	0.9	0.9	1.2	1.4	1.5	1.4	*	*
Colorado	0.8	0.5	0.6	0.4	0.5	0.8	0.8	0.8	0.9	1.4	0.9	1.5	1.8	2.3	2.9	2.8	4.2	*	*
Connecticut	3.2	2.8	2.6	3.2	2.8	2.2	2.5	3.5	3.2	2.9	2.3	2.5	2.9	6.5	8.9	11.3	13.1	*	*
Delaware	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2.4	4.5	6.3	7.1	6.1	--	--
DC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3.6	4.4	5.1	5.5	9.9	17.3	--	--
Florida	1.1	1.3	1.3	1.3	0.9	0.7	0.5	0.5	0.6	0.5	0.3	0.4	0.6	1.0	1.9	3.1	3.6	*	*
Georgia	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.2	0.2	N/A	0.3	0.4	0.7	1.6	2.2	2.2	--	--
Hawaii	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.4	--	--
Idaho	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.6	--	--
Illinois	0.3	0.3	0.4	0.2	0.3	0.4	0.5	0.5	0.8	0.9	1.2	1.3	2.1	4.5	5.6	6.7	8.2	*	*
Indiana	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.9	1.0	0.9	1.1	1.8	2.6	2.8	3.9	4.7	--	--
Iowa	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.0	1.3	1.6	1.7	--	--
Kansas	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.7	1.2	--	--
Kentucky	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.6	0.9	1.3	3.4	5.1	5.5	7.4	7.6	--	--
Louisiana	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.1	2.7	2.4	2.9	3.4	--	--
Maine	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3.1	4.5	4.7	--	--
Maryland	N/A	N/A	0.5	0.5	1.3	1.4	1.9	2.3	1.8	2.7	1.6	1.8	2.9	3.6	5.2	6.6	10.7	--	*
Massachusetts	N/A	N/A	N/A	0.4	N/A	0.3	0.6	1.1	0.9	0.9	1.1	2.2	3.8	4.4	7.2	9.6	9.5	--	*
Michigan	0.9	0.8	0.6	0.7	0.9	1.5	1.5	1.1	2.2	2.6	2.2	2.8	2.8	4.5	5.5	6.8	7.6	*	*
Minnesota	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.8	0.9	1.7	1.9	2.2	2.8	--	--
Mississippi	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.8	1.4	1.2	--	--
Missouri	0.9	0.4	1.0	0.7	1.0	0.9	1.1	1.1	2.1	2.8	3.2	4.4	3.7	4.6	5.8	5.3	6.7	*	*
Montana	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	--	--
Nebraska	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	--	--
Nevada	1.9	1.1	1.8	1.6	1.2	1.9	1.4	1.6	1.2	0.8	N/A	1.5	1.6	1.7	2.2	2.7	2.9	*	*
New Hampshire	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2.0	N/A	3.4	3.5	5.5	8.1	6.5	2.8	--	--
New Jersey	2.4	2.3	2.7	2.5	1.4	2.0	1.2	1.2	1.3	N/A	1.1	1.5	3.6	4.4	4.8	5.8	9.7	*	*
New Mexico	2.2	1.2	1.3	1.4	1.8	2.5	1.1	1.4	3.3	2.4	1.1	3.4	5.2	4.6	7.2	8.1	8.2	*	*
New York	0.1	0.3	0.3	0.3	0.2	0.2	0.6	1.0	1.1	1.3	1.0	1.7	2.6	3.3	4.2	5.4	6.5	*	*
North Carolina	0.5	0.6	0.5	0.6	0.6	0.7	0.6	0.6	0.7	0.8	0.4	0.9	1.6	2.0	2.8	4.1	5.7	*	*
North Dakota	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	--	--
Ohio	0.7	0.8	1.0	0.8	1.1	1.2	1.1	1.4	2.1	2.0	3.3	4.0	6.4	9.1	11.1	13.3	13.5	*	*
Oklahoma	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.7	0.6	0.7	1.0	1.4	--	--
Oregon	0.9	1.0	1.2	1.0	1.3	1.1	1.6	3.0	2.5	3.1	2.0	3.5	3.5	2.7	3.2	2.5	2.9	*	*
Pennsylvania	1.2	1.0	1.1	1.4	1.1	1.1	0.8	0.7	1.3	1.4	1.1	2.0	2.7	3.4	4.3	5.6	7.8	*	*
Rhode Island	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2.9	6.5	6.8	4.3	2.5	--	--
South Carolina	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.7	1.4	2.2	2.5	--	--
South Dakota	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	--	--
Tennessee	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.4	N/A	N/A	0.8	1.1	2.3	3.3	4.1	--	--
Texas	0.5	0.8	0.8	0.9	0.9	0.9	0.9	0.9	1.0	1.2	1.0	1.4	1.4	1.4	1.6	1.9	1.9	*	*
Utah	2.3	1.9	1.2	1.3	0.9	1.9	1.8	1.9	2.7	2.1	1.9	2.7	3.0	4.2	3.8	4.3	5.6	*	*
Vermont	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3.5	5.8	5.8	8.7	--	--
Virginia	0.9	1.2	1.2	1.2	0.9	0.8	0.9	1.2	1.1	1.3	0.5	1.3	1.4	2.5	3.1	4.3	5.4	*	*
Washington	0.9	0.8	1.1	1.0	0.9	0.8	0.8	1.2	1.0	1.0	0.9	2.2	2.5	2.9	4.1	4.2	3.9	*	*
West Virginia	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.2	2.1	N/A	1.7	2.0	3.8	8.7	9.8	11.8	14.9	--	--
Wisconsin	0.5	0.4	0.5	0.5	0.4	0.6	0.5	0.6	1.2	1.4	1.7	2.5	3.4	4.3	4.9	5.3	7.3	*	*
Wyoming	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	--	--
United States	**0.7**	**0.6**	**0.7**	**0.7**	**0.6**	**0.7**	**0.7**	**0.8**	**1.0**	**1.1**	**1.0**	**1.4**	**1.9**	**2.7**	**3.4**	**4.1**	**4.9**	*	*

N/A: Death rate is suppressed because it is based on 20 or fewer deaths.
-- Significance testing not possible because rate from 2000 was suppressed.
* Difference between 2000/2006 and 2016 rates is statistically significant at the 95% level.