

Adverse Health Effects Associated with Opioid Abuse and Non-Fatal Overdose



**New Mexico Statewide Epidemiological Outcomes Workgroup
White Paper Series**

February 15, 2018

*Produced by Coop Consulting, Inc. on behalf of the
New Mexico Statewide Epidemiological Outcomes Workgroup*

Mission New Mexico’s Statewide Epidemiological and Outcomes Workgroup (SEOW) reviews and disseminates data about substance abuse and misuse and their consequences. It also identifies best practice information about evidence-based prevention strategies, policies and practices that can lead to successful outcomes for New Mexicans. The purpose of this two-fold work is to inform communities so that they can better target behaviors and risk factors that can be positively impacted by the implementation of well-chosen, evidence-based prevention approaches that are appropriate for the population. The important work of the SEOW is directed by the Office of Substance Abuse Prevention (Behavioral Health Services Division, Human Services Department) and supported by federal funding from the Center for Substance Abuse Prevention, Substance Abuse and Mental Health Services Administration.

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Introduction

Much of the focus on the adverse effects of opioids has been on preventing fatal overdoses as the opioid epidemic continues to claim ever more lives. Opioid-related morbidity has received less scrutiny, although the economic and social costs associated with other opioid-related health problems warrant the attention of public health officials. In this brief, we examine in depth specific types of opioid-related morbidity, their economic costs, and how to reduce the harm associated with opioid abuse beyond fatal overdose prevention.

Routes of Administration

Severe adverse health effects arising from opioid abuse are largely associated with people using injection as a primary route of administration. Injecting heroin or prescription opioids causes blood concentrations to rise the most quickly, greatly increasing the risk of an overdose, and provides an opportunity for infectious diseases to enter the bloodstream. From a public health perspective, non-injection routes of administration tend to be less harmful due to lesser morbidity and mortality risks.

People who use opioids may choose various routes of administration, which can be influenced by the type of opioid as well as personal and environmental factors. Among people who misuse prescription opioids, swallowing and snorting are the most common routes of administration, while it is estimated that approximately half of heroin users choose intravenous injection.^{1,2}

The likelihood of transitioning to injection drug use from other routes of administration are associated with personal factors such as unemployment³, homelessness⁴, and the frequency of substance abuse⁵. A number of ecological factors also play a role, including social norms surrounding injection drug use⁶, drug availability⁷, as well as drug price and cost-effectiveness⁸.

¹ Young, April M., Jennifer R. Havens, and Carl G. Leukefeld. "Route of administration for illicit prescription opioids: a comparison of rural and urban drug users." *Harm Reduction Journal* 7.1 (2010): 24.

² Novak, Scott P., and Alex H. Kral. "Comparing injection and non-injection routes of administration for heroin, methamphetamine, and cocaine users in the United States." *Journal of Addictive Diseases* 30.3 (2011): 248-257.

³ Neaigus, Alan, et al. "Potential risk factors for the transition to injecting among non-injecting heroin users: a comparison of former injectors and never injectors." *Addiction* 96.6 (2001): 847-860.

⁴ Neaigus, Alan, et al. "Transitions to injecting drug use among noninjecting heroin users: social network influence and individual susceptibility." *Journal of Acquired Immune Deficiency Syndromes* 41.4 (2006): 493-503.

⁵ Roy, Élise, et al. "Drug injection among street youths in Montreal: predictors of initiation." *Journal of Urban Health* 80.1 (2003): 92-105.

⁶ Neaigus, Alan, et al. "Transitions to injecting drug use among noninjecting heroin users: social network influence and individual susceptibility." *Journal of Acquired Immune Deficiency Syndromes* 41.4 (2006): 493-503.

⁷ Firestone, Michelle, and Benedikt Fischer. "A qualitative exploration of prescription opioid injection among street-based drug users in Toronto: behaviours, preferences and drug availability." *Harm Reduction Journal* 5.1 (2008): 30.

⁸ Strang, John, et al. "The study of transitions in the route of drug use: the route from one route to another." *Addiction* 87.3 (1992): 473-483.

A recent nationwide survey of individuals entering treatment programs for opioid use disorder found that between 2008 and 2014, the number of people using only prescription opioids had an annual percentage decline of 6%, while those using only heroin had an annual percentage increase of 14%, suggesting that heroin use may be increasing at approximately twice the rate of prescription opioid misuse is declining.⁹ While prescription opioid continue to kill more people than heroin, since 2011 the number of deaths from prescription opioids has remained relatively stable while the number of deaths involving heroin have soared.¹⁰ These numbers indicate a greater exposure to heroin among people who abuse opioids, which has serious implications for rates of opioid-related morbidity.

Infectious Opioid-Related Morbidity

Injection drug users are at high risk for many adverse health effects associated with this route of administration. Many do not take necessary safety precautions when injecting and sharing needles, which can lead to exposure to blood-borne pathogens such as hepatitis B and C, HIV/AIDs, and tuberculosis. Furthermore, injection drug users may unknowingly inject heroin contaminated with bacteria that can cause serious infections.¹¹

Because the repeated injection of heroin often leads to collapsed veins, and therefore a loss of veins to inject in, users will often switch to injecting intramuscularly (into a muscle) or subcutaneously (under the skin) as opposed to intravenously (into a vein). Intramuscular and subcutaneous injection, especially of black tar heroin which has a viscous consistency, is associated with a greater likelihood of:

- Necrotizing fasciitis¹² - A skin infection caused by bacteria that kills tissue in the body and can lead to the loss of a user's limbs.
- Wound botulism¹³ – A bacterial infection that enters a wound caused by a needle puncture which can cause paralysis and death.
- Tetanus¹⁴ – A bacterial infection that enters a wound caused by a needle puncture which can cause painful muscle spasms and death.

⁹ Cicero, Theodore J., Matthew S. Ellis, and Jessie Harney. "Shifting patterns of prescription opioid and heroin abuse in the United States." *New England Journal of Medicine* 373.18 (2015): 1789-1790.

¹⁰ National Institute on Drug Abuse. *Overdose Death Rates*. September 2017.

¹¹ Palmateer, Norah E., et al. "Infections with spore-forming bacteria in persons who inject drugs, 2000–2009." *Emerging Infectious Diseases* 19.1 (2013): 29.

¹² Kimura, Akiko C., et al. "Outbreak of necrotizing fasciitis due to *Clostridium sordellii* among black-tar heroin users." *Clinical Infectious Diseases* 38.9 (2004): e87-e91.

¹³ Anderson, Michael W., Kanika Sharma, and Colin M. Feeney. "Wound botulism associated with black tar heroin." *Academic Emergency Medicine* 4.8 (1997): 805-809.

¹⁴ Hahné, Susan JM, et al. "Tetanus in injecting drug users, United Kingdom." *Emerging Infectious Diseases* 12.4 (2006): 709.

- Endocarditis¹⁵ – Inflammation of the inner layer of the heart which can also include a bacterial infection and lead to heart or kidney failure.
- Sepsis¹⁶ - A serious condition in which the body is fighting a severe infection that has spread via the bloodstream, causing life-threatening organ dysfunction and failure.

Neurological Opioid-Related Morbidity

Long-term opioid abuse can cause a number of neurological changes to the brain. Permanent and temporary changes to its structure and functioning can affect one’s decision-making and ability to regulate behavior, contributing to addiction and making further abuse more likely.

- Gray matter, which serves to process information in the brain from sensory organs and directs the central nervous system, can develop abnormalities due to opioid abuse.¹⁷
- Opioid abuse is associated with the deterioration of white matter, which connects and transmits information from different regions of the brain to each other.¹⁸
 - Long-term deterioration of brain white matter caused by opioid abuse can lead to toxic leukoencephalopathy, which is characterized by inattention, dementia, and slurred speech. There is no known cure or treatment for the disease.¹⁹
- In recent years, a number of medical researchers have published reports of unusual amnesia caused by lesions to the hippocampus among people who abuse opiates.²⁰
- People who inject opioids are up to three times more likely to exhibit a level of brain damage similar to the early stages of Alzheimer's disease.²¹

Non-Fatal Opioid Overdose Morbidity

A lack of oxygen in the bloodstream caused by respiratory depression, as well as the comatose state that occurs during an overdose, can cause a number of adverse health effects:

¹⁵ Ciccarone, Dan, and Philippe Bourgois. "Explaining the geographical variation of HIV among injection drug users in the United States." *Substance Use & Misuse* 38.14 (2003): 2049-2063.

¹⁶ Yeager, Richard A., et al. "Vascular complications related to drug abuse." *The Journal of Trauma* 27.3 (1987).

¹⁷ Wang, Xuyi, et al. "Changes in brain gray matter in abstinent heroin addicts." *Drug & Alcohol Dependence* 126.3 (2012): 304-308.

¹⁸ Li, Wei, et al. "White matter impairment in chronic heroin dependence: a quantitative DTI study." *Brain Research* 1531 (2013): 58-64.

¹⁹ Buxton, Jane A., et al. "Chasing the dragon-characterizing cases of leukoencephalopathy associated with heroin inhalation in British Columbia." *Harm Reduction Journal* 8.1 (2011): 3.

²⁰ Barash JA, Somerville N, DeMaria A Jr. "Cluster of an Unusual Amnestic Syndrome — Massachusetts, 2012–2016" *Morbidity and Mortality Weekly Report* 2017 66:76–79.

²¹ Anthony, Iain C., et al. "Predisposition to accelerated Alzheimer-related changes in the brains of human immunodeficiency virus negative opiate abusers." *Brain* 133.12 (2010): 3685-3698.

- Hypoxic brain damage²² - A lack of oxygen supply to the brain during an overdose can lead to brain damage causing significant and enduring cognitive problems, including difficulties with problem solving and social interaction.
- Ischemic stroke²³ – A lack of oxygen to the brain during an overdose can also cause a sudden loss of blood circulation to an area of the brain, leading to a stroke. Poorly crushed prescription opioids that are then injected into the bloodstream also carry a high risk of causing a blood clot in the brain leading to embolic stroke.²⁴
- Pulmonary edema²⁵ - Hypoxia may also cause fluid accumulation in the tissue of the lungs for a prolonged period during and after awaking from an overdose, which can be life-threatening if not properly monitored.
- Rhabdomyolysis²⁶ – A condition in which damaged muscles break down rapidly due to prolonged pressure on the limbs while someone overdosing is in a coma. This can cause a damaging protein to be released into the blood that can lead to kidney failure.
- Acute compartment syndrome²⁷ – A condition in which prolonged pressure on body tissue while someone is unresponsive causes an insufficient blood supply which can cause permanent muscle or nerve damage.

In addition to direct overdose-related morbidity, indirect morbidity is also very common. In one study of heroin users who had survived at least one overdose, 40% had sustained physical injuries such as broken limbs or head injuries when falling as they overdosed, 24% had sustained burns while comatose, such as from cigarettes and heaters, and 14% had been assaulted while unconscious.²⁸

The Costs of Non-Fatal Opioid Abuse

Two recent studies have estimated the costs of non-fatal opioid abuse. Researchers at the Centers for Disease Control and Prevention calculated cost estimates of prescription opioid

²² O'Brien, Patricia, and Jenny Todd. "Hypoxic brain injury following heroin overdose." *Brain Impairment* 10.2 (2009): 169-179.

²³ Vila, Nicolás, and Angel Chamorro. "Ballistic movements due to ischemic infarcts after intravenous heroin overdose: report of two cases." *Clinical Neurology and Neurosurgery* 99.4 (1997): 259-262.

²⁴ Lim, CC Tchoyoson, et al. "Embolic stroke associated with injection of buprenorphine tablets." *Neurology* 73.11 (2009): 876-879.

²⁵ Duberstein, Joel L., and David Myland Kaufman. "A clinical study of an epidemic of heroin intoxication and heroin-induced pulmonary edema." *The American Journal of Medicine* 51.6 (1971): 704-714.

²⁶ Mrsić, V., et al. "Acute rhabdomyolysis: a case report and literature review." *Acta Medica Croatica: Casopis Hrvatske Akademije Medicinskih Znanosti* 62.3 (2008): 317-322.

²⁷ Adrish, Muhammad, et al. "Opioid overdose with gluteal compartment syndrome and acute peripheral neuropathy." *The American Journal of Case Reports* 15 (2014): 22.

²⁸ Warner-Smith, Matthew, Shane Darke, and Carolyn Day. "Morbidity associated with non-fatal heroin overdose." *Addiction* 97.8 (2002): 963-967.

abuse and dependence based on its estimated prevalence in 2013.²⁹ They estimated the costs of non-fatal opioid abuse to account for 73% of all annual opioid-related economic costs in the United States, which totaled \$78.5 billion. The total \$56.9 billion annual estimated costs of non-fatal opioid abuse break down into:

- \$26.1 billion spent on health care
- \$2.8 billion spent on substance abuse treatment
- \$7.6 billion spent on criminal justice
- \$20.4 billion spent on lost productivity

Researchers from the White House Council of Economic Advisers built upon the estimates by Florence et al. by obtaining a per-person measure of costs of opioid abuse and multiply that cost by the number of individuals with an opioid use disorder in 2015, including both heroin users and prescription opioid misusers.³⁰ By their estimate, there was a total cost of \$72.3 billion for non-fatal consequences of opioid abuse in 2015.

Conclusion

The primary concern for opioid harm reduction is the prevention of fatal opioid overdoses. The opioid epidemic caused more than 42,000 drug overdose deaths in 2016 – five times the overdose rate in 1999 and deadlier than the AIDS epidemic was at its peak. However, economists estimate that non-fatal consequences of opioid abuse account for nearly three-fourths of the economic cost of opioid abuse in the United States. Efforts such as needle exchange programs to address non-fatal consequences are equally important in reducing the harm associated with opioid abuse.

²⁹ Florence, Curtis S., et al. "The economic burden of prescription opioid overdose, abuse, and dependence in the United States, 2013." *Medical Care* 54.10 (2016): 901-906.

³⁰Council of Economic Advisers. *The Underestimated Cost of the Opioid Crisis*, November 2017.