HHE Health Hazard® Evaluation Program

Evaluation of Occupational Exposures to Illicit Drugs During an Emergency Medical Services Response

HHE Report No. 2018-0067-3312

September 2020

Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health

Authors: **Sophia Chiu, MD, MPH**

Jennifer Hornsby-Myers, MS, CIH

Chad Dowell, MS, CIH

Douglas Trout, MD, MHS

Desktop Publisher: Aja Powers

Editor: Cheryl Hamilton

Keywords: North American Industry Classifiation System (NAICS) 922160 (Fire Protection), Virginia, Emergency Medical Services, Firefighter, Illicit Drug, Opioid, Fentanyl

Disclaimer

The Health Hazard Evaluation Program investigates possible health hazards in the workplace under the authority of the Occupational Safety and Health Act of 1970 [29 USC 669a(6)]. The Health Hazard Evaluation Program also provides, upon request, technical assistance to federal, state, and local agencies to investigate occupational health hazards and to prevent occupational disease or injury. Regulations guiding the Program can be found in Title 42, Code of Federal Regulations, Part 85; Requests for Health Hazard Evaluations [42 CFR Part 85].

Availability of Report

Copies of this report have been sent to the employer and a union representative at the fire department. The state and local health departments and the Occupational Safety and Health Administration Regional Office have also received a copy. This report is not copyrighted and may be freely reproduced.

Recommended Citation

NIOSH [2020]. Evaluation of occupational exposures to illicit drugs during an emergency medical services response. By Chiu S, Hornsby-Myers J, Dowell C, Trout D. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, Health Hazard Evaluation Report 2018-0067-3312, https://www.cdc.gov/niosh/hhe/reports/pdfs/2018-0067-3312.pdf.

Table of Contents

Main Report

Supporting Technical Information

This page left intentionally blank

Introduction

Request

A city fire department requested a health hazard evaluation (HHE) concerning unintentional exposure to illicit drugs (including fentanyl and analogues) during a response to a drug overdose. One firefighter-emergency medical services (EMS) provider developed adverse health effects during the incident.

Background

According to the Centers for Disease Control and Prevention (CDC), the rate of overdose deaths involving synthetic opioids (which includes fentanyl and its analogues) in the United States in 2018 was more than three times the rate in 2015. Finding illicit fentanyl and its analogues mixed with other drugs, especially cocaine, is becoming more common. This trend has raised concerns about the potential for unintentional exposure to illicit drugs among law enforcement officers, firefighter-EMS providers, and other emergency responders in the course of their work.

To learn more about the workplace, go to Section A in the Supporting Technical Information

Our Approach

The drug overdose response happened on January 28, 2018. On January 31 and February 1, 2018, we visited the fire department and conducted these activities:

- We interviewed three firefighter-EMS providers and one police officer who were present at the drug overdose response. This included the firefighter-EMS provider who developed adverse health effects (Responder A).
- We spoke with emergency department (ED) staff at the hospital where Responder A and the overdose victim were evaluated.

We also reviewed relevant records:

- Police department's incident/investigation report
- Medical records related to the incident for Responder A and the overdose victim
- Video footage of the response from one police officer's body camera

To learn more about our methods, go to Section B in the Supporting Technical Information

Our Key Findings

Police officers and firefighter-EMS providers responded to a 911 call about an overdose

- On January 28, 2018, six firefighter-EMS providers and five police officers responded to a 911 call. The call was about an unconscious person (victim) in a hotel room.
- The victim likely experienced an opioid overdose.
    - Police officers found signs of recent drug use in the hotel room.
    - The victim's vital signs improved after receiving intranasal and intraosseous naloxone.
    - A urine sample collected in the ED tested "presumptive positive" for opiates and cannabinoids.
- Responders began resuscitation efforts in the hotel room before firefighter-EMS providers transported the victim to the ED for further care.

One firefighter-EMS provider experienced work-related health effects

- Responder A developed warmth, lightheadedness, palpitations, increased perspiration, and numbness and tingling of the cheek and tongue while in the ED.
- Initial medical assessment of Responder A showed mild respiratory distress and pale, diaphoretic skin.
- Responder A received three doses of naloxone over approximately 1.5 hours in the ED with improvement in status.
- Other than a decreased respiratory rate on one occasion, Responder A did not have documented objective signs of serious (life-threatening) opioid toxicity.
- Responder A was monitored in the ED for several hours. Symptoms improved over that time.
- The cause of the health effects could not be identified. Nonetheless, the health effects significantly interfered with Responder A's ability to carry out essential job duties.

Potential routes of exposure to illicit drugs remain unclear

- During the response, Responder A primarily managed the victim's airway, including bag-valve-mask ventilation and intubation.
- Firefighter-EMS providers wore gloves and long-sleeved uniforms during the response.
- None of the responders or ED staff we interviewed reported seeing any powders that might be illicit drugs on or near the victim.

- Police officers found items in the hotel room associated with drug use. These items were reportedly sent to the state forensic laboratory for testing, but results were not available for review.
- Potential routes of exposure could not be definitively identified. Inhalation and mucous membrane (eyes, nose, or mouth) contact are possible routes of exposure, but exposure through the victim's exhaled breath was unlikely.

To learn more about our results, go to Section B in the Supporting Technical Information

Our Recommendations

The Occupational Safety and Health Act requires employers to provide a safe workplace.

Potential Benefits of Improving Workplace Health and Safety:

- ↑ Improved worker health and well-being
- ↑ Better workplace morale
- ↑ Easier employee recruiting and retention
- ↑ Enhanced image and reputation
- ↑ Superior products, processes, and services
- ↑ May increase overall cost savings

The recommendations below are based on the findings of our evaluation. For each recommendation, we list a series of actions you can take to address the issue at your workplace. The actions at the beginning of each list are preferable to the ones listed later. The list order is based on a well-accepted approach called the "hierarchy of controls." The hierarchy of controls groups actions by their likely effectiveness in reducing or removing hazards. In most cases, the preferred approach is to eliminate hazardous materials or processes and install engineering controls to reduce exposure or shield employees. Until such controls are in place, or if they are not effective or practical, administrative measures and personal protective equipment might be needed. Read more about the hierarchy of controls at https://www.cdc.gov/niosh/topics/hierarchy/.

We encourage the company to use a health and safety committee to discuss our recommendations and develop an action plan. Both employee representatives and management representatives should be included on the committee. Helpful guidance can be found in *Recommended Practices for Safety and Health Programs* at https://www.osha.gov/shpguidelines/index.html.

Recommendation 1: Provide periodic training to firefighter-EMS providers on how to prevent occupational exposure to illicit drugs

Why? Illicit drugs pose a hazard to responders (such as firefighters, EMS personnel, and law enforcement officers) who may come into contact with them while working. Training can increase responders' understanding of these topics, which can help prevent unintentional exposures. Training topics should include standard safe operating procedures, personal protective equipment (PPE), and decontamination.

Fentanyl is commonly mixed with illicit drugs. Possible exposure routes to fentanyl and other drugs can vary based on the source and form of the drug. Responders are most likely to encounter fentanyl and its analogues in powder (including compressed powder), tablet, and/or liquid form. Potential exposure routes of greatest concern include inhalation, mucous membrane contact, ingestion, and percutaneous exposure (e.g., needlestick). Any of these exposure routes can potentially result in toxic effects. Brief skin contact with powdered fentanyl or its analogues is not expected to lead to toxic effects if any visible contamination is promptly removed.

The fire department's volume of calls related to drug overdoses or with suspected opioids visible on-scene has increased during the current drug overdose epidemic. One responder developed health effects during this incident that prevented continued performance of essential job duties.

How? At your workplace, we recommend these specific actions:

Follow guidance in the NIOSH Topic Page entitled *Illicit Drugs, Including Fentanyl: Preventing Emergency Responders' Exposures to Illicit Drugs*.

- It is often difficult to know at the time of an incident whether a substance suspected to be an illicit drug contains fentanyl or its analogues. The following specific recommendations are most relevant to this fire department:
  - Do not touch the eyes, mouth, and nose after touching any potentially contaminated surface.
  - Avoid tasks or activities that may cause illicit drugs to enter the air.
  - Wash hands (or other unprotected skin) with soap and water immediately after coming into contact with illicit drugs or after leaving an area where illicit drugs may have been present to avoid potential exposure and cross-contamination.
  - Do not use hand sanitizer, alcohol-based cleaner, or bleach to clean skin that might have come into contact with illicit drugs.
  - Always wear nitrile gloves when illicit drugs may be present. Train responders (1) how to remove gloves safely and (2) to change gloves when they become contaminated as soon as practical during response activities. Gloves should also be changed periodically during response activities even without evident contamination.

Recommendation 2: Work with 911 dispatch coordinators to identify possible improvements in gathering and communicating pertinent information before emergency responders arrive at scenes where illicit drugs are suspected

Why? Receiving information from dispatchers about the possible presence of illicit drugs before arriving on the scene can help first responders prepare accordingly and protect themselves, before conducting their own on-scene risk assessment.

Recommendation 3: Develop new or modify existing policies and procedures for emergency response work involving illicit drugs for situations where the anticipated level of exposure is "moderate" or greater

Why? Current NIOSH guidance is intended to apply to a range of emergency responders. At each specific workplace, those involved in the work can best determine how to apply the guidance to the specific conditions they face. A "moderate" exposure level refers to situations where small amounts of products that might contain illicit drugs are visible.

How? At your workplace, we recommend these specific actions:

Review and consider existing guidance for first responders.

In addition to NIOSH recommendations, additional guidance includes

- Recommendations from the state's Department of Health: http://www.vdh.virginia.gov/content/uploads/sites/23/2018/01/Fentanyl-FAQ-opioid-exposure-among-va-first-responder-survey.pdf.
- Recommendations from the Interagency Board for Equipment Standardization and Interoperability on first responder PPE and decontamination: https://www.interagencyboard.org/content/first-responder-ppe-and-decontamination-recommendations-fentanyl-august-2017.

Consider working with occupational safety and health professionals and/or experts on PPE and emergency response work on a job safety analysis.

Address these specific topics in the safety analysis:

- Conducting an on-scene risk assessment.
- Communicating about the discovery of suspected illicit drugs with all responders on the scene and managing access to that area of the scene.

- Timing for putting on PPE in unsecured or unsafe conditions when illicit drugs might be present.
- Maintaining clear and effective communication, particularly over radios or similar devices, while wearing PPE.
- Changing gloves and disposing of used gloves after performing tasks with potential for contamination with illicit drugs. Tasks include providing emergency medical care to potential overdose victims and handling illicit drugs or drug paraphernalia.

Train firefighter-EMS providers on all new policies and procedures.

Recommendation 4: Coordinate with local hospitals to have soap and water available after EMS responses for firefighter-EMS providers' use

Why? Firefighter-EMS providers often transport patients to the hospital ED before returning to the fire station or responding to another call. When the presence of illicit drugs is suspected, responders can use soap and water to wash their hands upon arrival to the ED. The soap and water can also be used for surfaces and equipment before those are disinfected.

To avoid potential exposure and cross-contamination, washing hands with soap and water and decontaminating surfaces and equipment after leaving a scene where illicit drugs are known or suspected to be present are recommended.

Recommendation 5: Develop standard ways to share information about forensic laboratory results, if performed, among agencies that jointly participate in responses involving illicit drugs

Why? If substances are identified as being present at the scene of response activities, that documentation should be placed in the occupational health or personnel records of applicable law enforcement staff and firefighter-EMS providers.

Agencies that jointly participate in responses (e.g., police and fire departments) can periodically review this information to help determine whether changes in current procedures are needed. The agencies can use this information, together with employee reports of possible exposures and health effects, to find any trends affecting the risk of unintentional work-related exposure to illicit drugs.

Recommendation 6: Encourage firefighter-EMS providers to report possible exposures to illicit drugs and any potential health effects to their supervisors

Why? The fire department can use this information, along with forensic testing results, to look for trends affecting the risk of unintentional work-related exposure to illicit drugs and the associated health effects. These trends can help determine whether changes in current procedures are needed.

How? At your workplace, we recommend these specific actions:

Reinforce to firefighter-EMS providers that exposures can occur through inhalation, mucous membrane contact (eye, nose, or mouth), ingestion, and contact with the skin.

Emphasize to firefighters-EMS providers that reporting potential exposures and symptoms contributes to a healthy and safe workplace.

This page left intentionally blank

Supporting Technical Information

Evaluation of Occupational Exposures to Illicit Drugs During an Emergency Medical Services Response

HHE Report No. 2018-0067-3312

September 2020

Section A: Workplace Information

At the time of the evaluation, the fire department had approximately 65 full-time career firefighters cross-trained to provide EMS at the emergency medical technician level or above and 6–7 office-based employees. The fire department had two fire stations. In addition to three engine and ladder/tower companies, the fire department staffed two ambulances. One ambulance was continuously staffed by firefighter-EMS responders. The second ambulance was staffed by firefighter-EMS responders during daytime hours and a volunteer rescue squad at night. Firefighters also provided EMS from fire vehicles as needed, for example, when ambulances were responding to other calls. Firefighters worked in 24-hour shifts on days 1, 3, and 5 of a 9-day cycle and were off on days 2, 4, and 6–9 of the cycle.

At the time of this evaluation, the fire department responded to approximately 6,500 fire and EMS calls each year. Recently, the fire department had received an increased volume of calls related to drug overdoses or in which suspected opioid drugs were visible on-scene. This trend was consistent with the increased number of drug overdose fatalities related to fentanyl, fentanyl analogues, and heroin in the Commonwealth of Virginia. No incidents of firefighter-EMS responders developing symptoms after exposure to opioids in this fire department had been reported prior to the January 2018 incident. However, in 2017, a first responder in a neighboring jurisdiction reportedly developed symptoms after potential exposure to an opioid.

Section B: Methods, Results, and Discussion

Our evaluation objectives were the following:

- Assess how firefighter-EMS responders might have been exposed to illicit drugs during the January 2018 incident.
- Make recommendations on how to prevent exposures to illicit drugs among firefighter-EMS responders.

Methods: Description of the January 2018 Incident

We visited the fire department over a two-day period right after the incident. During the visit, we conducted voluntary, confidential interviews. We spoke with one of the first police officers present during the incident and all three firefighter-EMS responders (Responders A, B, and C) who provided direct care to the overdose victim. In total, six firefighter-EMS providers and five police officers were at the scene. During the interviews, we discussed the January 2018 incident, work history and practices, training, and PPE use. In addition, we spoke with the ED physician and members of the nursing staff who treated the victim and Responder A, the symptomatic firefighter-EMS responder, at the hospital during the incident.

To better understand the incident, we reviewed video footage of the January 2018 incident from the body camera of an attending police officer. We reviewed the police department's incident/investigation report and toured the ED where the victim and Responder A underwent medical evaluation and treatment.

Results: Description of the January 2018 Incident

Description of the Emergency Response

The following summary of the incident is based on the interviews, video footage, and police incident/investigation report that we reviewed. On January 28, 2018, responders from the police and fire departments were dispatched for a 911 call concerning an unconscious victim in a hotel room. Firefighter-EMS responders reported that this call category, especially in young persons, often involves drug overdoses. Hotel staff reportedly heard a call for help and saw the victim on the floor of a hotel room. Hotel staff informed the police that they were told that the victim had overdosed. Police officers arrived on the scene first and began cardiopulmonary resuscitation. The 911 call was upgraded to "cardiopulmonary resuscitation in progress." Police officers rearranged the furniture in the room to give the fire department team more space to attend to the victim. When Responders A–C arrived, they assumed responsibility for resuscitation activities.

During a preliminary search of the hotel room, a police officer found signs of recent drug use, including "pulled cotton from a cigarette filter" next to the bed, a "spoon with burn marks underneath," and a lighter in the hotel bathroom. The police department submitted the spoon for forensic testing by the state laboratory. In a subsequent search, the police found a used syringe and "a plastic bag with visible residue," which were also submitted to the state laboratory for forensic testing. The police received

reports that items were removed from the room before first responders arrived. None of the first responders whom we interviewed reported seeing any powder suspected to be opioids on or near the victim. Forensic test results for items from the hotel room were not available for review.

During the EMS response in the hotel room, Responder A was primarily managing the victim's airway, including providing bag-valve-mask ventilation and intubating the victim. Responder A reported getting down on knees and elbows on the hotel room floor to achieve the positioning necessary for intubation and placing gloved fingers in the victim's mouth during intubation. In addition, Responder A moved the victim's extremities to assess for muscle rigidity and checked for a carotid pulse. All three responders wore gloves and long-sleeved uniforms during the response.

In the hotel room, Responders B and C performed manual chest compressions until they connected the victim to a mechanical chest compression device. The victim's hands were secured to the front of the device. In addition, Responders B and C established interosseous access (access to the circulatory system via a bone marrow cavity), monitored the victim's condition, and administered epinephrine and multiple doses of intranasal and intraosseous naloxone.

The victim was then transported to an ED via ambulance. On the way to the ED, Responder A managed the victim's airway, while another firefighter-EMS responder administered additional naloxone, obtained an electrocardiogram, and established intravenous access.

Description of Events in the Emergency Department

None of the hospital staff reported seeing any powder suspected to be illicit drugs on or near the victim. After care of the victim was transferred to hospital staff, the firefighter-EMS responders gave report to the ED physician. Responder A removed their gloves shortly before ED staff handed Responder A the mechanical chest compression device. Responder A then began to experience warmth, lightheadedness, and palpitations. Responder A reported being soaked with perspiration when moved to an ED bed and experiencing numbness and tingling of the cheek and tongue.

In our interview, Responder A reported feeling well prior to and during the entire work shift before arriving in the hospital ED. Responder A also reported a recent upper respiratory infection (a "cold"), and when asked, did not recall touching their face during the incident, for example, to wipe their nose or eyes.

Responder A developed symptoms in the large ED trauma area and was treated in the same area. The ED physician requested that all other fire and police department personnel who participated in this EMS response be observed in an adjacent trauma area. After approximately 45 minutes of observation, none of the other 10 first responders had developed symptoms, and all were released from the ED. The ambulance was wiped down with disposable wipes. Long-sleeved uniforms worn during the incident were placed in plastic bags and transported to the fire station, where they were laundered using standard detergent.

Methods: Medical Record Review

We reviewed hospital medical records related to the January 2018 incident for the overdose victim and Responder A. We also reviewed the fire department's prehospital care report for the overdose victim.

Results: Medical Record Review

According to the medical records reviewed, Responder A began to experience symptoms within 12 minutes of the victim being triaged by the ED. Findings from Responder A's initial medical assessment included mild respiratory distress and pale, diaphoretic skin. No miosis (small or "pinpoint" pupils) was documented. Vitals signs over a period of approximately 2 hours included normal temperature, normal to elevated heart rate, normal to elevated blood pressure, and decreased respiratory rate (8 respirations per minute) on one occasion. Other documented respiratory rates were normal or elevated.

Blood and urine samples were collected for testing. Urine collected approximately 1 hour after the start of symptoms tested negative in a standard seven-panel urine drug screen. The seven-panel urine drug screen consisted of cannabinoids, phencyclidine, cocaine, opiates, amphetamines, benzodiazepines, and barbiturates. Responder A received intravenous fluids and three 2-milligram doses of naloxone over a period of approximately 1.5 hours. The first dose was given immediately upon triage and gaining intravenous access. The second dose was given 15 minutes after the first dose. The third dose was given 92 minutes after the first dose.

After the second dose of naloxone, the chart noted "overall patient [Responder A] status improved, patient [Responder A] feeling better." The third dose was given in response to Responder A reporting feeling dizzy again, having numbness in the face, and feeling an increase in heart rate. The respiratory rate of 8 breaths per minute mentioned previously was noted just prior to the third dose of naloxone. Reassessment 40 minutes after the third dose noted a respiratory rate of 26 respirations per minute. Approximately 50 minutes after the third dose, the chart noted "overall patient [Responder A] status improved, patient [Responder A] feeling better." Responder A was discharged from the ED approximately 4.5 hours after symptoms began. The ED physician's clinical impression was "near syncope and accidental overdose."

During the EMS response, the victim's vital signs improved after administration of naloxone. The victim's ED admission diagnosis was "suspected opiate overdose and acute cardiopulmonary arrest." A urine drug screen collected in the ED tested as "presumptive positive" for cannabinoids and opiates with the cut-off for opiates noted to be 100 nanograms per milliliter. No ethanol was detected in blood samples collected in the ED. Clinical impression upon admission to the intensive care unit was "cardiac arrest, respiratory arrest, and overdose." The final diagnosis in the medical records for the victim, who subsequently died, listed multiple diagnoses including "anoxic injury and narcotic overdose."

Discussion

In 2018, the rate of overdose deaths involving synthetic opioids (which includes fentanyl and its analogues) in the United States was more than three times the rate in 2015 [CDC 2018b,c, 2020]. This has raised concerns about the potential for exposure to illicit drugs among emergency responders, who might come into contact with them in the course of their work [Howard and Hornsby-Myers 2018].

Issues Related to Health Effects

The current drug overdose epidemic often involves situations where multiple drugs are used, and the identity of the substances cannot be determined without laboratory analysis [Liu et al. 2018]. In this

incident, one responder reported a range of nonspecific symptoms shortly after transporting the victim to the ED. No records from forensic laboratory testing were available for review.

Classic signs and symptoms of severe opioid toxicity include lethargy or other indications of central nervous system depression, shallow or slow breathing, miosis (small or "pinpoint" pupils), slow heart rate, and low body temperature [Boyer 2012; Ropper et al. 2014]. The continuum of signs and symptoms experienced upon opioid exposure can include nausea and lightheadedness [Lynch et al. 2018; Suzuki and El-Haddad 2017]. However, not all patients with opioid intoxication consistently experience all of these components [Boyer 2012]. Low-dose exposure to opioids might result in milder symptomology. Over approximately 2 hours of monitoring, Responder A experienced one documented transient decrease in respiratory rate and reported feeling better after receiving naloxone during the course of ED treatment. Overall, Responder A's clinical manifestations are not classic for severe opioid toxicity, but could be consistent with milder toxicity related to illicit drugs.

Various types of stimulant drugs such as cocaine and methamphetamine may lead to similar nonspecific symptoms as Responder A experienced. Illicit fentanyl and its analogues are increasingly being mixed with other drugs, particularly cocaine [CDC 2018a]. Classically, toxicity from stimulants involves elevated heart rate and blood pressure, increased alertness, sweating, nausea and vomiting, and hallucinations. Nonspecific health effects associated with stimulant drugs may include shortness of breath, dizziness, confusion, and headache [Albertson et al. 1999; Brody et al. 1990; Egred and Davis 2005; Haim et al. 1995]. Cocaine has local anesthetic effects such as numbness and tingling [Aronson 2016; Brody et al. 1990].

The ED assessment included evaluating Responder A for other medical causes that might explain the health effects experienced. However, there was no evidence that volume depletion, hypoglycemia, arrhythmia, or seizure might have contributed to the health effects observed. In our evaluation, it is not possible to determine if other clinical factors or perceived risk might have impacted the observed health effects. The concept of "perceived risk," or the subjective judgement that individuals make about the type and severity of any risk, has been associated with increased anxiety and symptom reporting separate from physical exposure to a hazard [Gallacher et al. 2007]. The possible relationships between perceived risk, the types of exposures, and the clinical status of the responders discussed in this report were not assessed in this evaluation.

Another consideration is that illicit drugs might contain adulterants or contaminants that might lead to symptoms [Behrman 2008; Cole et al. 2011]. This possibility is difficult to assess because the exact composition of such drugs likely vary by batch and all the components are not well characterized.

Issues Related to Potential Exposure

Many factors suggested the victim experienced an opioid overdose in the hotel room. The hotel staff informed police that they were told that the victim had overdosed and signs of recent suspected opioid use were found in the hotel room. The victim's urine drug screening test results was presumptively positive for opiates and cannabinoids. However, these tests cannot pinpoint whether the substances were used during the overdose that occurred shortly before urine collection or at a time before the overdose. No forensic testing results were available to provide more information about the substances involved in the victim's overdose to which emergency responders were potentially exposed.

Although the victim likely overdosed on opioids, the potential routes of exposure to Responder A remain unclear. Responder A was closer to the victim's head and torso both in the hotel room and during transport to the hospital than other firefighter-EMS responders. On the basis of the interviews and body camera video footage, the firefighter-EMS responders (including Responder A) wore gloves during the incident, which is consistent with current NIOSH guidance [NIOSH 2020]. The firefighter-EMS responders also wore long-sleeved uniforms, which offer an additional level of dermal protection [NIOSH 2020]. Further, the emergency responders and hospital staff we interviewed reported no powder suspected to be opioids on or near the victim.

Although Responder A was positioned close to the victim's head, it is unlikely that exposure to opioids occurred through the victim's exhaled breath. During cardiovascular surgery in operating room suites, NIOSH researchers did not find any fentanyl in the air during assessments of possible second-hand exposure to fentanyl when patients received fentanyl intravenously [Law et al. 2010a,b]. However, these findings might not be directly applicable because the assessments did not involve fentanyl in a powder form that might have been "snorted" or "sniffed" through the nasal passages.

In general, inhalation, mucus membrane contact, ingestion, and percutaneous exposure (e.g., needlestick) are important potential routes of exposure. Brief skin contact with fentanyl or its analogues are not expected to lead to toxic effects if visible contamination is promptly removed [Moss et al. 2018].

We cannot rule out several possible exposure scenarios. First, a small amount of illicit drugs might have been on the carpeting of the hotel room floor or within the victim's respiratory tract and close to Responder A's breathing zone when the victim was being intubated. Second, there was the possibility that Responder A's gloves became cross-contaminated with small amounts of illicit drugs, and subsequent hand-to-face contact or aerosolization occurred upon glove removal. Third, a small amount of illicit drugs could have been transferred from the victim's hand to the mechanical chest compression device that was then transferred to Responder A's ungloved hands in the ED. In these possible scenarios, mucosal membrane contact via inadvertent hand-to-face contact and/or inhalation are possible routes of exposure.

Responder A's negative urine drug screen result does not rule out the possibility of opioid exposure [Nagpal et al. 2017]. The ability to detect synthetic opioids in blood (or serum) and urine is an area of active investigation, with known limitations [Armenian et al. 2017; Suzuki and El-Haddad 2017]. First, commonly used urine drug screening panels are designed to screen for a variety of opiates (a subset of opioids). Screening assays do not detect all opioids equally well. Fentanyl is sufficiently different in chemical structure from the opiate morphine that tests specifically looking for fentanyl are required to detect it [Keary et al. 2012; Milone 2012; Suzuki and El-Haddad 2017]. Other uncertainties include the timing of testing relative to potential exposure and the sensitivity of various tests. In addition, established cutoff levels for urine drug screening tests take into consideration the desirability of avoiding false-positive tests [Moeller et al. 2017]; therefore, results lower than established cutoff levels are reported as negative.

Firefighter-EMS responders and hospital staff raised questions about decontamination procedures during our discussions. The practice of removing potentially contaminated clothing and carefully placing them in bags until laundering, as well as having laundry services at the worksite to avoid take-

home contamination, are consistent with recommended work practices to avoid cross-contamination. Responders who come into contact with materials that might be contaminated with illicit drugs should immediately wash the affected skin with soap and water. Alcohol-based gels (e.g., hand sanitizers) should be avoided because alcohol can increase absorption of fentanyl through the skin [Interagency Board 2017; Moss et al. 2018]. Bleach, which is often used for decontamination in other settings, should not be used [Interagency Board 2017].

Limitations

This evaluation is subject to several limitations. First, the evaluation was retrospective in nature; however, we interviewed responders approximately 3 days after the incident. Second, forensic laboratory testing results for substances collected as evidence from the hotel room were not available for review. Other limitations related to fully characterizing the exposures are discussed above. Finally, although we reviewed the ED records for Responder A, we cannot completely rule out the possibility that unrecognized medical conditions might have contributed to the health effects observed.

Conclusions

During an EMS response incident in January 2018, Responder A developed health effects after treating a victim experiencing a suspected opioid overdose. The cause of Responder A's health effects and the potential source of exposure could not be definitively identified. Responders wore PPE that followed current NIOSH guidance [NIOSH 2020] in situations where illicit drugs are suspected to be present but not visible. Further evaluations and research are needed to improve understanding of the routes of exposure and potential health effects among first responders potentially exposed to illicit drugs (including opioids such as fentanyl and fentanyl analogues) in the course of their work. Preventing illicit drug exposures and potential health effects among first responders might be achieved through further training about the routes of exposure likely to cause symptoms and how to protect against those exposures.

Section C: References

Illicit Drugs

Albertson TE, Derlet RW, Van Hoozen BE [1999]. Methamphetamine and the expanding complications of amphetamines. West J Med *170*(4):214–219, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1305551/.

Aronson JK, ed. [2016]. Cocaine. In: Meyler's side effects of drugs. 16th ed. Waltham, MA: Elsevier.

Behrman AD [2008]. Luck of the draw: common adulterants found in illicit drugs. J Emerg Nurs *34*(1):80–82, http://dx.doi.org/10.1016/j.jen.2007.10.001.

Brody SL, Slovis CM, Wrenn KD [1990]. Cocaine-related medical problems: consecutive series of 233 patients. Am J Med *88*(4):325–331, https://doi.org/10.1016/0002-9343(90)90484-U.

Cole C, Jones L, McVeigh J, Kicman A, Syed Q, Bellis M [2011]. Adulterants in illicit drugs: a review of empirical evidence. Drug Test Anal *3*(2):89–96, http://dx.doi.org/10.1002/dta.220.

Egred M, Davis GK [2005]. Cocaine and the heart. Postgrad Med J *81*(959):568–571, https://doi.org/10.1136/pgmj.2004.028571.

Haim DY, Lippmann ML, Goldberg SK, Walkenstein MD [1995]. The pulmonary complications of crack cocaine: a comprehensive review. Chest *107*(1):233–240, https://doi.org/10.1378/chest.107.1.233.

Liu L, Wheeler SE, Venkataramanan R, Rymer JA, Pizon AF, Lynch MJ, Tamama K [2018]. Newly emerging drugs of abuse and their detection methods: an ACLPS critical review. Am J Clin Pathol *149*(2):105–116, https://doi.org/10.1093/ajcp/aqx138.

Moeller KE, Kissack JC, Atayee RS, Lee KC [2017]. Clinical interpretation of urine drug tests: what clinicians need to know about urine drug screens. Mayo Clin Proc *92*(5):774–796, https://doi.org/10.1016/j.mayocp.2016.12.007.

Nagpal G, Heiman H, Haymond S [2017]. Interpretation of urine drug screens: metabolites and impurities. JAMA *318*(17):1704–1705, http://dx.doi.org/10.1001/jama.2017.10910.

Opioids

Armenian P, Vo KT, Barr-Walker J, Lynch KL [2017]. Fentanyl, fentanyl analogs and novel synthetic opioids: a comprehensive review. Neuropharmacology *134*(Part A):121–132, https://dx.doi.org/10.1016/j.neuropharm.2017.10.016.

Boyer EW [2012]. Management of opioid analgesic overdose. N Engl J Med *367*(2):146–155, http://dx.doi.org/10.1056/NEJMra1202561.

CDC [2018a]. Rising numbers of deaths involving fentanyl and fentanyl analogs, including carfentanil, and increased usage and mixing with non-opioids. Health Alert Network Update 413. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, Office of Public Health Preparedness and Response, https://emergency.cdc.gov/han/han00413.asp.

CDC [2018b]. Overdose deaths involving opioids, cocaine, and psychostimulants—United States, 2015–2016. MMWR *67*(12):349–358, http://dx.doi.org/10.15585/mmwr.mm6712a1.

CDC [2018c]. Drug and opioid-involved overdose deaths—United States, 2013–2017. MMWR *67*(5152):1419–1427, http://dx.doi.org/10.15585/mmwr.mm675152e1.

CDC [2020]. Drug and opioid-involved overdose deaths—United States, 2017–2018. MMWR *69*(11):290–297, http://dx.doi.org/10.15585/mmwr.mm6911a4.

Howard J, Hornsby-Myers J [2018]. Fentanyls and the safety of first responders: science and recommendations. Am J Ind Med *61*:633–639, https://doi.org/10.1002/ajim.22874.

Interagency Board [2017]. Recommendations on selection and use of personal protective equipment and decontamination products for first responders against exposure hazards to synthetic opioids, including fentanyl and fentanyl analogues. Arlington, VA: Interagency Board, https://www.interagencyboard.org/content/first-responder-ppe-and-decontamination-recommendations-fentanyl-august-2017.

Keary CJ, Wang Y, Moran JR, Zayas LV, Stern TA [2012]. Toxicologic testing for opiates: understanding false-positive and false-negative test results. Prim Care Companion CNS Disord *14*(4), http://dx.doi.org/10.4088/PCC.12f01371.

Law BF, Hettick JM, Hornsby-Myers J, Siegel PD [2010a]. Analytical methodology and assessment of potential second-hand exposure to fentanyl in the hospital surgical setting. J Addict Dis *29*(1):51–58, http://dx.doi.org/10.1080/10550880903438933.

Law BF, Hettick JM, Hornsby-Myers J, Siegel PD [2010b]. Reservations concerning second-hand fentanyl exposure in the operating room. J Addict Dis *29*(3):282–283, http://dx.doi.org/10.1080/10550887.2010.490467.

Lynch MJ, Suyama J, Guyette FX [2018]. Scene safety and force protection in the era of ultra-potent opioids. Prehosp Emerg Care *22*(2):157–162, https://doi.org/10.1080/10903127.2017.1367446.

Milone MC [2012]. Laboratory testing for prescription opioids. J Med Toxicol *8*(4):408–416, http://dx.doi.org/10.1007/s13181-012-0274-7.

Moss MJ, Warrick BJ, Nelson LS, McKay CA, Dubé P-A, Gosselin S, Palmer RB, Stolbach AI [2018]. ACMT and AACT position statement: preventing occupational fentanyl and fentanyl analog exposure to emergency responders. Clin Toxicol *56*(4):297–300, http://dx.doi.org/10.1080/15563650.2017.1373782.

NIOSH [2020]. Illicit drugs, including fentanyl: preventing emergency responders' exposures to illicit drugs. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, https://www.cdc.gov/niosh/topics/fentanyl/risk.html.

Ropper AH, Samuels MA, Klein JP, eds. [2014]. Adams and Victor's principles of neurology. 10th ed. New York: McGraw-Hill Education.

Suzuki J, El-Haddad S [2017]. A review: fentanyl and non-pharmaceutical fentanyls. Drug Alcohol Depend *171*:107–116, https://dx.doi.org/10.1016/j.drugalcdep.2016.11.033.

Other

Gallacher J, Bronstering K, Palmer S, Fone D, Lyons R [2007]. Symptomatology attributable to psychological exposure to a chemical incident: a natural experiment. J Epidemiol Community Health *61*(6):506–512, https://dx.doi.org/10.1136/jech.2006.046987.

Delivering on the Nation's promise: Promoting productive workplaces through safety and health research

Get More Information

Find NIOSH products and get answers to workplace safety and health questions:

1-800-CDC-INFO (1-800-232-4636) | TTY: 1-888-232-6348
CDC/NIOSH INFO: cdc.gov/info | cdc.gov/niosh
Monthly *NIOSH eNews*: cdc.gov/niosh/eNews