



Interim Report: Evaluation of Occupational Exposures to Opioids, Mental Health Symptoms, Exposure to Traumatic Events, and Job Stress in a City Fire Department

HHE Report No. 2018-0015b

February 2019



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Introduction

Request

In October 2017, a city in Ohio requested a health hazard evaluation (HHE) concerning possible unintentional exposure to opioids among police officers and fire fighters during first responder activities. As one part of the overall HHE request, city and fire department officials were concerned about how responding to the opioid epidemic might affect the mental health of fire fighters, who also provide emergency medical services (EMS) for the city.

Background

Ohio experienced 4,162 opioid-related overdose deaths in 2017, a 19% increase compared with 2016. The number of emergency department visits for suspected opioid overdose in Ohio has also increased in 2016–2017. These trends suggest that fire fighters-EMS providers might face increased call volumes during the current opioid epidemic, which may lead to increased and/or different kinds of workplace stressors on responders. This component of the HHE focuses on a questionnaire designed to gather information about fire fighters and their involvement in opioid overdose responses. A previous interim report focused on evaluations of incidents where police officers developed symptoms after potential exposures to suspected opioids.

To learn more about the workplace, go to [Section A in the Supporting Technical Information](#)

Our Approach

We invited all on-duty fire fighters during our visits to fire stations to complete an anonymous written questionnaire in May 2018. We then analyzed the questionnaire responses. The questionnaire included questions about

- Potential exposure to opioids
- Personal protective equipment availability and use
- Health effects related to opioid exposure
- Job stress and potentially traumatic events related to opioid overdose responses
- Mental health symptoms and perceived stigma, barriers, and use of resources for coping with stress and mental health symptoms

To learn more about our methods, go to [Section B in the Supporting Technical Information](#)

Our Key Findings

The majority of fire fighters reported opportunities for exposure to opioids. Two fire fighters reported symptoms, which were nonspecific, after contact with suspected opioids.

- Of the 189 fire fighters who participated in the questionnaire, 173 (92%) reported that they participated in an opioid overdose response in the past 6 months.
- In total, 118 fire fighters (62%) reported that suspected opioids were visible during the course of their work in the past 6 months.
- Approximately 19% of fire fighters reported one or more potential routes of exposure to suspected opioids in the past 6 months.
- All fire fighters reported gloves were available when suspected opioids were visible, and 92% reported wearing them.
- In contrast, most fire fighters reported never using a respirator (90%) or eye protection (79%) when suspected opioids were visible, even though more than 90% of fire fighters reported that they were available. Commonly cited reasons for not wearing personal protective equipment when suspected opioids were visible included “I did not think it was necessary” and “It was not required.”
- On the questionnaire, two fire fighters reported health symptoms after coming into contact with suspected opioids. The symptoms reported, headache and numbness or tingling, were nonspecific and relatively mild. They were not consistent with severe (life-threatening) opioid toxicity. It was not possible to definitively say if they were related to exposure to opioids or other drugs, or other causes.

Some fire fighters reported symptoms consistent with accepted case definitions of post-traumatic stress disorder, depression, and generalized anxiety.

- Overall, screening thresholds were met for
 - Post-traumatic stress disorder (PTSD)—by 3% of those surveyed;
 - Moderate to severe depression—by 5%; and
 - Moderate to severe anxiety—by 5%.
- In general, fire fighters did not report a perception of stigma or barriers to seeking mental health care, although only 11% indicated they had sought mental health care for work-related stress.
- Most fire fighters (97%) reported experiencing one or more potentially traumatic events while responding to an opioid overdose in the past 6 months.

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.

Benefits of Improving Workplace Health and Safety:	
↑ Improved worker health and well-being	↑ Improved image and reputation
↑ Better workplace morale	↑ Better products, processes, and services
↑ Better employee recruiting and retention	↑ Could 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.



We encourage the city and the fire department to use a health and safety committee to discuss our recommendations and develop an action plan. Both employee representatives from the local chapter of the International Association of Fire Fighters and management representatives should be included on the committee to set priorities and assess the feasibility of our recommendations for the specific situation at the fire department.

Helpful guidance can be found in *Recommended Practices for Safety and Health Programs*:
<https://www.osha.gov/shpguidelines/index.html>.

NIOSH has issued interim guidance on how to protect emergency responders from exposures to fentanyl and its analogues. We believe the current NIOSH guidance is applicable to this evaluation because fentanyl is increasingly being found mixed with illicit drugs. As a result, responders should assume fentanyl to be present in situations involving powders suspected to be illicit drugs. Current NIOSH guidance is intended to apply to a range of emergency responders. Recommendations provided below in some cases expand upon the current NIOSH guidance.

Recommendation 1: Provide periodic training to fire fighters on how to prevent occupational exposures to illicit drugs. Training topics should include standard safe operating procedures, personal protective equipment, and decontamination.

Why? Fentanyl and other drugs pose a hazard to responders (such as fire fighters, EMS personnel, and law enforcement officers) who come into contact with these drugs while working. 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.

Most fire fighters in our questionnaire reported being in situations where suspected opioids were visible during the course of their work in the past 6 months. About 20% of reported one or more potential routes of exposure to suspected opioids.

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



Follow guidance in the NIOSH Topic Page entitled *Fentanyl: Preventing Occupational Exposure to Emergency Responders*.

Although the NIOSH Topic Page specifically refers to fentanyl and fentanyl analogues, 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. Specific recommendations that are most relevant to this fire department include

- Do not touch the eyes, mouth, and nose after touching any surface that might be contaminated with illicit drugs.
- Avoid tasks or activities that may make illicit drugs airborne.
- Wash hands with soap and water immediately after a potential exposure and after leaving a scene where illicit drugs are known or suspected to be present to avoid potential exposure and cross-contamination. Do not use hand sanitizers or bleach solutions to clean contaminated skin when fentanyl or its analogues are suspected to be present because it might increase absorption through the skin.
- Wear nitrile gloves when illicit drugs are suspected to be present. Train responders (1) on how to remove gloves safely and (2) to change gloves and properly dispose of gloves when they become contaminated as soon as practical during response activities. Gloves should be changed periodically during response activities even without evident contamination.

Recommendation 2: Work with 911 dispatch coordinators to identify possible improvements in information gathering and communication 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: Encourage fire fighters to report possible exposures to illicit drugs and any potential health effects that result to their supervisors.

Why? The city and fire department can periodically review this information to help determine whether changes in current procedures are needed. They 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.

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



Reinforce to fire fighters that exposures can occur through inhalation, mucous membrane contact (eye, nose, or mouth), ingestion, and skin.



Emphasize to fire fighters that reporting potential exposures and symptoms contributes to a healthy and safe workplace.

Recommendation 4: Continue to provide fire fighters with mental health resources and encourage their use.

Why? Research shows that mental health treatment helps to lessen job stress and other mental and behavioral problems. Research also shows that workers who receive mental health treatment reduce their overall need for other health services over time. Inform fire fighters of the resources available to them through their workplace (i.e., employee assistance program) and their community (e.g., local practitioners, religious leaders, support groups) so they may seek care if experiencing symptoms of depression, anxiety, or stress.

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



Provide annual training by a mental health professional on topics like suicide prevention and recognizing and managing signs of stress.

- Consult with the city's employee assistance program to see if these services are available or can otherwise be developed.
- Supplement training with information from the Suicide Prevention Resource Center at <http://www.sprc.org>.
- Provide fire fighters with suicide prevention resources from the National Institute of Mental Health at <http://www.nimh.nih.gov/health/topics/suicide-prevention/index.shtml>.
- Teach fire fighters how to recognize and manage stress using information from the American Psychological Association's topic page on stress found at <http://www.apa.org/topics/stress/index.aspx>.



Encourage employees to seek help from a qualified health professional if they are experiencing symptoms of depression, anxiety, stress (including PTSD), or other mental health disorders that interfere with the social, occupational, or other areas of their lives.

- Remind fire fighters that the city's employee assistance program is available to them. The program can be reached at (513) 421-7600 and (866) 485-0274 (toll free; 24/7).
- Reassure fire fighters that the mental health symptoms they may be experiencing are not their fault, are reversible, and will improve with proper treatment.



Include mental health assessments as part of the medical evaluation and follow-up when fire fighters experience a work-related needlestick injury.

- Provide mental health assessments by a trained physician or mental health professional.
- Consider using brief screening tools or interviews (structured or unstructured) to probe for additional details during mental health assessments when deemed necessary by the physician or mental health professional.

Supporting Technical Information

Interim Report: Evaluation of Occupational Exposures
to Opioids, Mental Health Symptoms, Exposure to
Traumatic Events, and Job Stress in a City Fire
Department

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Section A: Fire Department

Fire department management and union representatives, along with city management representatives, expressed concerns that led to this evaluation as part of the overall HHE request. At the time of this evaluation, the fire department had approximately 800 full-time, uniformed fire fighters. Of these, 193 were on duty at any given time at 26 fire stations. Fire fighters were organized into companies. Some fire stations had more than one company. In general, fire fighters were scheduled to work a 24-hour shift every third day. Most fire fighters had one assigned primary company, but some fire fighters rotated between different fire stations as “travelers.” Fire fighters could work overtime, possibly at a different fire station.

Section B: Methods, Results, and Discussion

The objectives of this component of our evaluation were to

- Assess whether fire fighters were exposed to drugs including opioids and whether such exposures were associated with any health effects.
- Evaluate fire fighters' use of personal protective equipment (PPE) on responses where substances suspected to be opioids were visible. Determine if PPE use patterns were consistent with NIOSH guidance for preventing fentanyl exposure.
- Determine whether fire fighters reported exposures to suspected opioids to the fire department. If not, identify barriers that prevented fire fighters from reporting exposures.
- Assess fire fighters' perceived job stress as related to opioid overdose responses.
- Screen for symptoms of post-traumatic stress disorder (PTSD), depression, and anxiety using case definitions based on validated screening tools.
- Assess whether having a positive screen for PTSD, depression, and anxiety was associated with experiencing various types of potentially traumatic events while responding to an opioid overdose.
- Determine fire fighters' perceptions of stigma and barriers to seeking mental health care.
- Recommend ways to improve working conditions and practices associated with fire fighters' safety and health.

Methods: Questionnaire

On May 16–17, 2018, we visited 16 fire stations to invite all on-duty fire fighters at the time of each visit to complete an anonymous written questionnaire. We arranged for on-duty fire fighters from the 10 stations that we did not visit to gather at the visited stations. We invited the equivalent of one shift of on-duty fire fighters, or approximately one third of the department's fire fighters, to complete the questionnaire.

The questionnaire consisted of validated scales as well as questions developed specifically for this evaluation. It included questions on job and demographic characteristics, possible exposure to opioids, PPE availability and use, health effects related to opioid exposure, job stress, exposure to potentially traumatic events during opioid overdose responses, mental health symptoms, resources used to address mental health symptoms and stress, and perceived stigma and barriers to seeking care for psychological problems. The questionnaire also included a list of local and national resources for suicide prevention and mental health care. Sections of the questionnaire are described below.

Possible Exposure to Opioids and PPE Availability and Use

We asked fire fighters whether they had been in situations where suspected opioids (powders or liquids) were visible during the course of their work in the past 6 months. If so, we asked about the frequency of being in such situations and the potential routes of exposure to suspected opioids. Potential routes of exposure to suspected opioids included contact with uncovered skin, gloved hands, eye or mouth, or through airborne substances.

Fire fighters were asked about PPE availability and use when suspected opioids were visible. If PPE was available but not used, we asked about reasons why PPE was not used.

Health Effects Related to Opioid Exposure

We asked fire fighters if they had come into contact with suspected opioids during the course of their work in the past 6 months before asking them about possible health effects. On the questionnaire, we specified that “come into contact” corresponded to the potential routes of exposure. This question was posed to all participants, whereas in the previous section, we had only asked participants who reported that suspected opioids were visible during the course of their work about potential routes of exposures. For the purposes of this report, we defined opioid exposure as a “yes” or “not sure” response to this question. If fire fighters reported opioid exposure, they were asked about health effects, types of medical evaluation and treatment received, and whether they reported the exposure to the fire department.

Some fire fighters gave discordant (i.e., conflicting) answers to questions in this section. For example, eight fire fighters who reported no opioid exposure during the course of their work provided responses to the subsequent questions. We excluded this pattern of responses from the analysis.

In addition, some fire fighters gave discordant answers to questions about coming into contact with suspected opioids when they were visible versus more generally during the course of their work in the past 6 months. If a fire fighter responded “yes” to one or more potential routes of exposure to suspected opioids (uncovered skin, gloved hands, eyes or mouth, or airborne) but “no” or “not sure” to opioid exposure, we included the responses about potential routes of exposure and excluded responses to health effects, medical evaluation and treatment, and reporting. There were 17 fire fighters with this pattern of responses.

If a fire fighter had one or more “not sure” but no “yes” responses to potential routes of exposure to suspected opioids and “no” to opioid exposure, we included the responses about potential routes of exposure and excluded responses to health effects, medical evaluation and treatment, and reporting. There were 16 fire fighters with this pattern of responses.

Job Stress and Exposure to Potentially Traumatic Events During Opioid Responses

We asked fire fighters to rate their overall level of job stress with the following survey item: “How would you rate your level of job stress caused by responding to opioid overdoses over the past 6 months?” They were asked to use a rating scale from 0 (as low as it can be) to 10 (as high as it can be). Responses of 0–3 indicated low job stress, 4–6 indicated moderate job stress, and scores of 7 or greater indicated high job stress [Clark et al. 2011].

We asked fire fighters to indicate “yes” or “no” to a list of potentially traumatic events that they may have experienced while responding to an opioid overdose in the past 6 months. We also asked whether someone close to them (e.g., family or friends) had experienced an opioid overdose. This was intended to be an indicator of personal impact beyond the fire fighters’ job duties.

Mental Health Symptoms

Post-traumatic Stress Disorder

We used the U.S. Department of Veterans Affairs' PTSD Checklist for the Diagnostic and Statistical Manual for Mental Disorders, 5th Edition (PCL-5) [Weathers et al. 2013] screening tool for PTSD. A PCL-5 score of 31–33 has shown a sensitivity of 88% and a specificity of 69% for PTSD [Bovin et al. 2015].

Fire fighters were asked to rate how much they were bothered by each symptom in the past 4 weeks using the following frequencies: not at all (+ 0), a little bit (+ 1), moderately (+ 2), quite a bit (+ 3), and extremely (score + 4). We calculated a total symptom severity score (range 0–80) by summing the scores of the 20 items in the measure, using the recommended cut point of > 33 as a positive screen for PTSD.

Depression

We used the Patient Health Questionnaire-9 (PHQ-9) [Kroenke and Spitzer 2002] to screen for depression. A PHQ-9 score of > 10 (moderate to severe depression) has shown a sensitivity of 88% and a specificity of 88% for major depression [Kroenke et al. 2001].

Fire fighters were asked to rate how often they were bothered by each symptom in the past 4 weeks using the following frequencies: not at all (+ 0), several days (+ 1), more than half the days (+ 2), and nearly every day (+ 3). We calculated a total symptom severity score (range 0–27) by summing the scores of the nine items in the measure, using the recommended thresholds of 5 (mild), 10 (moderate), 15 (moderately severe), and 20 (severe) depression.

Anxiety

We used the General Anxiety Disorder-7 (GAD-7) [Spitzer et al. 2006] to screen for anxiety. A GAD-7 score of > 10 has shown a sensitivity of 89% and a specificity of 82% for generalized anxiety disorder [Spitzer et al. 2006].

Fire fighters were asked to rate how often they were bothered by each symptom in the past 4 weeks using the following frequencies: not at all (+ 0), several days (+ 1), more than half the days (+ 2), and nearly every day (+ 3). We calculated a total symptom severity score (range: 0–21) by summing the scores of the seven items in the measure, using the recommended thresholds of 5 (mild), 10 (moderate), and 15 (severe) anxiety.

Use of Resources to Cope with Mental Health Symptoms and Stress

We listed a variety of resources that fire fighters could use to manage stress or improve their mental health and asked them to indicate whether they had used each resource.

Perceived Stigma and Barriers to Care for Psychological Problems

We included two validated scales to assess the stigma of psychological problems in the work environment [Britt 2000] and the barriers to seeking mental health care [Hoge et al. 2004]. We asked fire fighters to rate their level of agreement with each item on a scale from 1 (strongly disagree) to 5 (strongly agree). Scores of 3 were considered neutral, scores of 1 or 2 indicated disagreement, and scores of 4 or 5 indicated agreement.

Statistical Analysis

We summarized the descriptive statistics for responses about demographic and job characteristics, possible exposure to opioids, PPE availability and use, health effects related to opioid exposure, job stress, exposure to traumatic events at work, and perceived barriers, stigma, and use of resources to manage mental health symptoms and stress.

We compared the distribution of primary company or traveler status in fire fighters who reported at least one potential route of exposure to suspected opioids to the overall distribution of primary company or traveler status using the χ^2 goodness-of-fit test. We compared the characteristics of fire fighters who reported at least one potential route of exposure to suspected opioids and fire fighters who did not report any potential routes of exposures using the Mann-Whitney U test for continuous variables and Fisher's exact test or the χ^2 test for categorical variables.

We estimated the prevalence of symptoms consistent with PTSD, depression, and GAD using the standard case definitions presented [Kroenke and Spitzer 2002; Spitzer et al. 2006; Weathers et al. 2013]. We used Fisher's exact test to determine whether exposure to potentially traumatic events, potential exposure to opioids, visibility of suspected opioids during response, and working overtime were associated with a high level of reported job stress or positive screenings of PTSD, depression, and anxiety.

Statistical tests were two-tailed, and statistical significance was set at $P < 0.05$. Statistical analyses were performed using SPSS version 18 and R version 3.3.2 software programs.

Results: Questionnaire

Characteristics of Participating Fire Fighters

Of the 190 fire fighters working during the 2 days we visited the fire stations, 189 (99%) completed a questionnaire. Table C1 describes the demographic characteristics of the participants. Most were male (95%). The most common age category was 36–45 years. Table C2 summarizes the job characteristics of the participants. The most common job tenure of those who completed the questionnaire was 1–5 years.

Potential Exposure to Opioids

Of the 189 respondents, 173 (92%) participants reported that they participated in an opioid overdose response in the past 6 months. In total, 118 fire fighters (62%) reported having been in situations where suspected opioids were visible during the course of their work over the past 6 months. The most frequently reported category was 2–5 times in the past 6 months (Table C3).

Of the 118 fire fighters who reported suspected opioids were visible, 35 (30%) indicated “yes” to one or more potential routes of exposure to suspected opioids (Figure 1). This corresponds to 19% of all fire fighters who participated in the survey. Some fire fighters reported more than one route of exposure. Gloved hand contact was the category with the highest number of “yes” responses ($n = 33$). None responded “yes” to having their eyes or mouth coming into contact with suspected opioids.

The distribution of primary company or traveler status among fire fighters who reported one or more potential routes of exposure to suspected opioids was similar to that among all respondents ($P = 0.96$).

In addition, fire fighters who reported one or more potential routes of exposure to suspected opioids were similar to fire fighters who did not report any potential routes of exposure in terms of job tenure ($P = 0.06$), whether they worked overtime or not ($P = 0.31$), total number of hours worked per week ($P = 0.28$), and current highest EMS training level ($P = 0.21$).

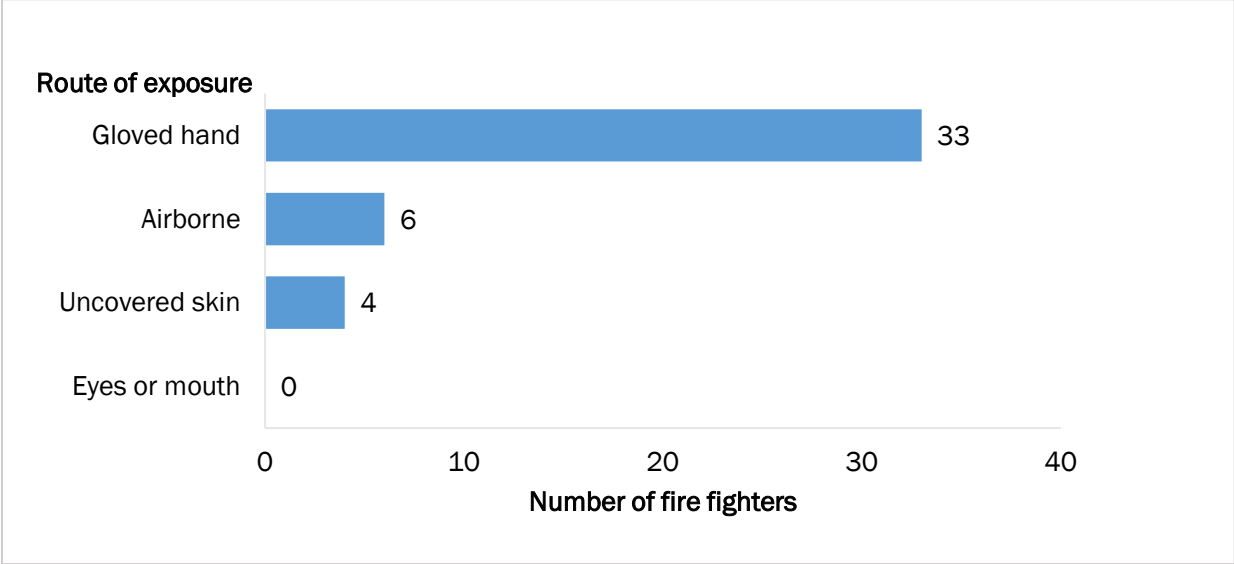


Figure 1. Number of fire fighters reporting “yes” to various potential routes of exposure to suspected opioids (n = 118).

PPE Availability and Use

The percentage of fire fighters who reported that PPE was available when suspected opioids was visible was 63% for wrist/arm protection (uniform with long sleeves, sleeve covers, gowns, or coveralls), 91% for respirators, 92% for safety glasses or goggles, and 100% for gloves. None of the respondents reported that all these types of PPE were available when suspected opioids were visible at a response site as recommended by current NIOSH guidance.

Figure 2 shows the proportion of fire fighters who reported that various PPE components were used when suspected opioids were visible by frequency. All respondents reported “always” or “sometimes” wearing gloves. Even when available, most respondents reported never wearing respirators, safety glasses, or goggles when suspected opioids were visible at a response site. Wrist/arm protection use was more variable. Three respondents reported always wearing all the forms of PPE available to them.

Figure 3 summarizes the reasons given for not wearing PPE when suspected opioids were visible among 111 respondents who reported “sometimes” or “never” wearing PPE when it was available. The most commonly reported reasons were “I did not think it was necessary” (66%), “it was not required” (28%), “I initially did not have enough information to suggest that suspected opioids were present” (11%), and “I was too rushed at the scene” (11%).

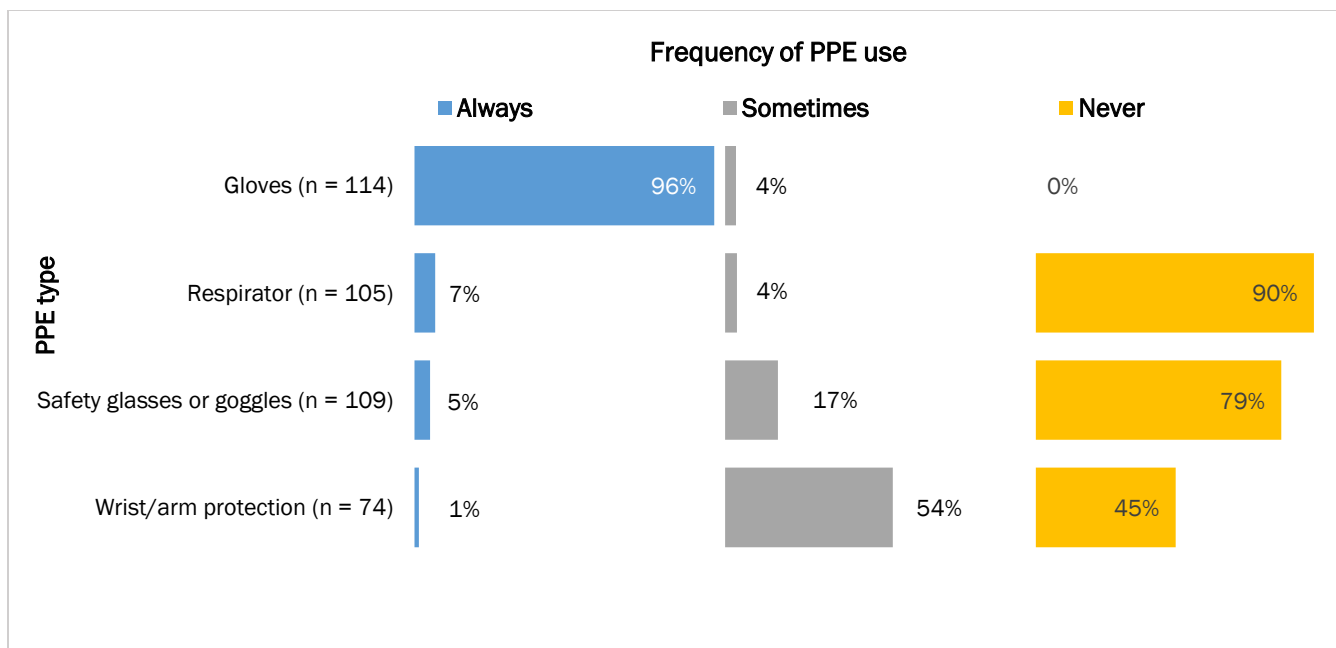


Figure 2. Frequency of PPE use reported by fire fighters who reported each type of PPE was available when suspected opioids were visible (n = 74–114). Percentages might not sum to 100% because of rounding.

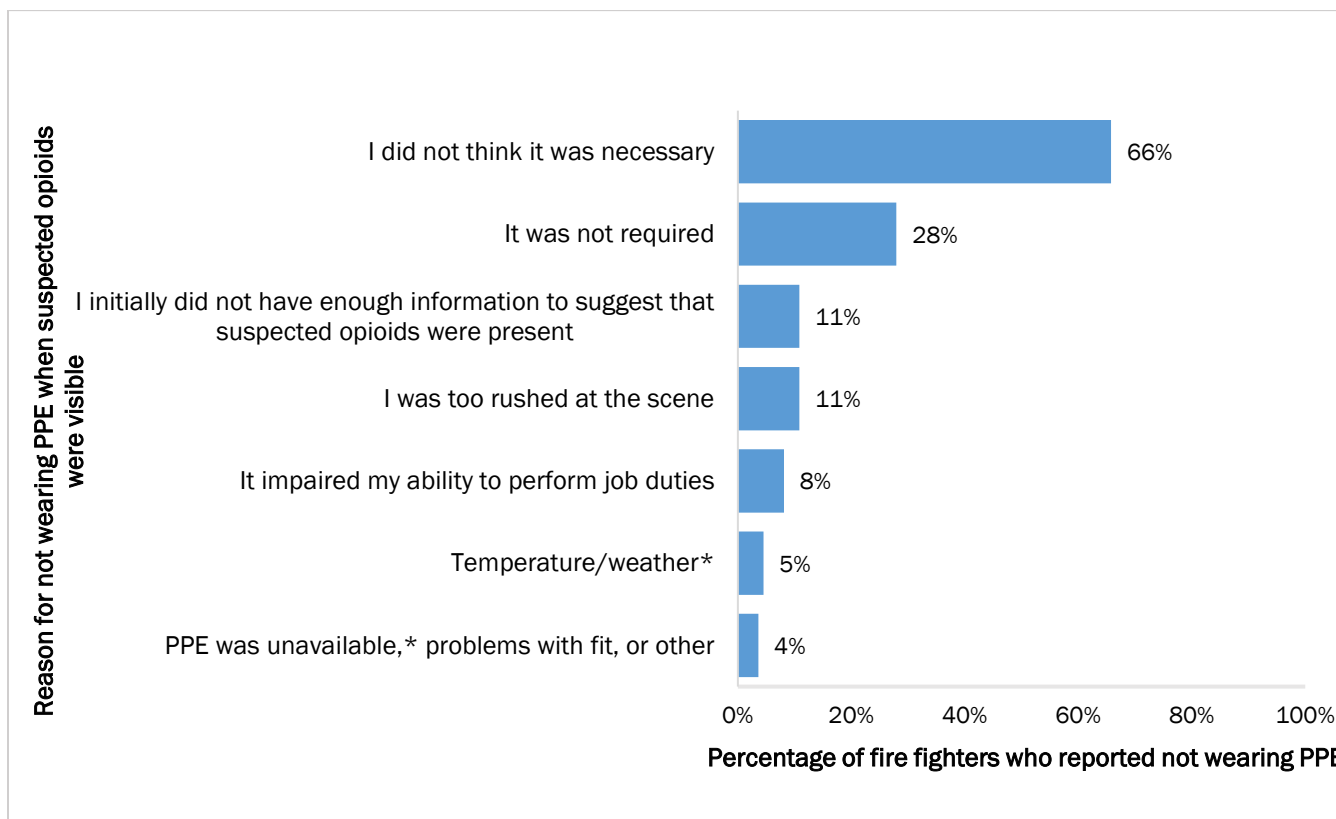


Figure 3. Reported reasons for not wearing PPE when suspected opioids were visible at response scenes (n = 111).

*Respondents wrote in this reason.

Health Effects Related to Opioid Exposure

Excluding 41 discordant answers among the 189 survey participants left 148 responses to the question about opioid exposure included in the analysis. Of these 148 participants, 25 (17%) reported opioid exposure. Of these 25 fire fighters, two reported health effects after coming into contact with suspected opioids, which they did not report to the fire department. None of the 25 fire fighters reported someone else telling them that they had small or pinpoint pupils after the exposure.

Regarding health effects, one fire fighter described headache and numbness or tingling in an unspecified body part. This fire fighter responded “not sure” to suspected opioids coming into contact with uncovered skin, with the eyes or mouth, or through the air. There was no response to whether there was contact with suspected opioids with gloved hands. The other fire fighter reported numbness or tingling in the fingertips. This fire fighter reported suspected opioids coming into contact with gloved hands and uncovered skin. These two fire fighters who reported health effects stated that they did not receive naloxone or evaluation or treatment in an emergency department.

Two of the 25 fire fighters who reported contact with suspected opioids responded that they informed the fire department—these were not the two fire fighters who reported health effects discussed in the previous paragraph. Among the 23 fire fighters who did not report their opioid exposure to the fire department, reasons for not reporting are summarized in Figure 4. The most common reason cited for not reporting opioid exposure was “I wasn’t sure that I was exposed” (n = 15). Among fire fighters who cited this reason, contact with gloved hands was the route of exposure with the highest number of “yes” responses (n = 8), and airborne had the highest number of “not sure” responses (n = 9). Two fire fighters who cited “I wasn’t sure that I was exposed” reported only coming into contact with suspected opioids with gloved hands. When the responses of these two fire fighters were excluded, the ordering of reasons for not reporting did not change.

Of the two fire fighters who reported health effects from opioid exposure, one cited “I did not think anything could be done to fix the problem” as the reason for not reporting exposure. The other fire fighter endorsed all of the reasons on the questionnaire except for “other” (Figure 4).

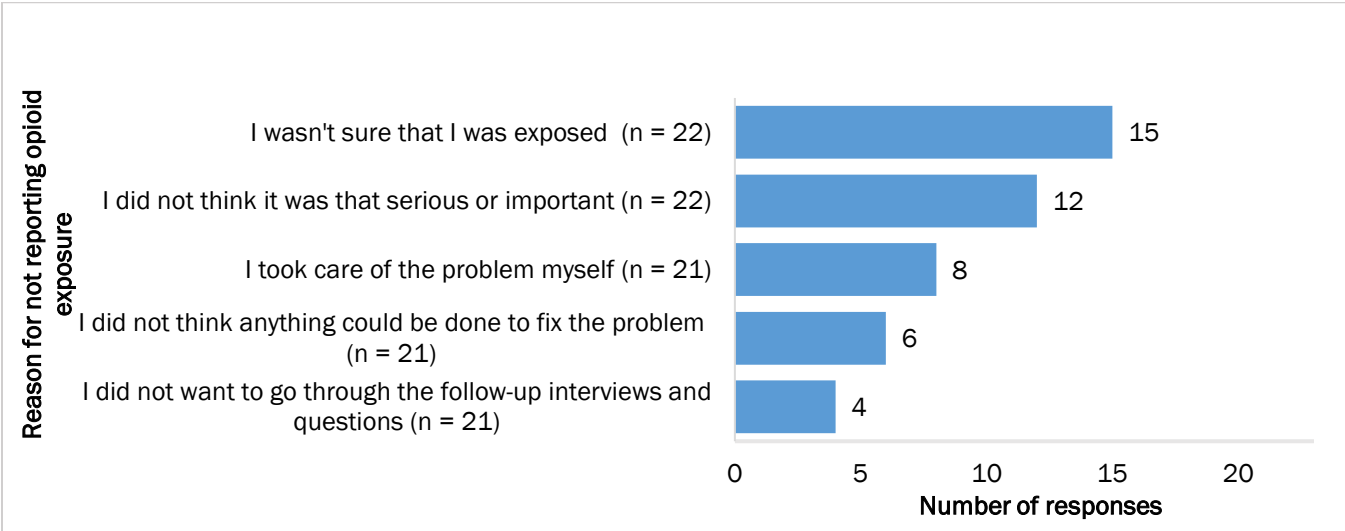


Figure 4. Reasons given for not reporting opioid exposure to the fire department (n = 21–22).

Job Stress and Exposure to Potentially Traumatic Events During Opioid Responses

The average job stress score for the 189 participating fire fighters was 2.9, indicating low job stress caused by responding to opioid overdoses over the past 6 months. On the basis of individual stress scores, 124 (66%) fire fighters indicated low job stress, 40 (21%) indicated moderate job stress, and 25 (13%) indicated high job stress as a result of responding to opioid overdoses in the past 6 months.

Table C4 shows the frequency and percentage of fire fighters who reported experiencing a potentially traumatic event while responding to an opioid overdose in the past 6 months. Most (97%) fire fighters reported experiencing one or more potentially traumatic events, with the most common being administering naloxone/Narcan (87%), seeing dead adults (75%), and seeing neglected or unaccompanied children (69%). Thirteen fire fighters (8%) reported in the questionnaire that they received a needlestick injury while responding to an opioid overdose in the past 6 months. According to the city's database of work-related injuries and illnesses, there were no reported needlestick injuries or other types of bloodborne pathogen exposure among fire fighters during this time period.

Fire fighters who reported a high level of job stress were more likely than those reporting mild/moderate job stress to have experienced the following potentially traumatic events during an opioid overdose response

- Seeing neglected or unaccompanied children (90.9% vs. 65.6%; $P = 0.015$)
- Being physically attacked/assaulted (50% vs. 14.6%; $P < 0.001$)
- Being in a situation where they believed they would be killed by another person (27.3% vs. 5.3%; $P = 0.003$)
- Being injured by a needlestick (22.7% vs. 5.3%; $P = 0.014$)
- Reviving the same person(s) from an opioid overdose on more than one occasion (90.9% vs. 64.0%; $P = 0.013$)
- Being in a situation where suspected opioids were visible (83.3% vs. 59.9%; $P = 0.04$)

Fire fighters who reported a high level of job stress were similar to those reporting mild/moderate job stress in terms of whether they had opioid exposure ($P = 0.46$) and whether they worked overtime or not ($P = 0.14$).

As a measure of the personal impact the opioid epidemic has had on fire fighters, 49 of 189 (26%) participants reported that someone close to them (family member or friend) had overdosed on an opioid in the past. This item was not associated with a high level of reported job stress.

Mental Health Symptoms

Post-traumatic Stress Disorder

In total, 187 fire fighters completed the items necessary to screen for symptoms of PTSD. Of these, 6 (3%) screened positive for possible PTSD. Fire fighters who had been in a situation where they believed they could be killed by another person during an opioid overdose response had a significantly higher prevalence of positive PTSD screenings than those who had not been in a situation where they thought they could be killed (21.4% vs. 1.3%; $P = 0.004$). Fire fighters who had been injured by a needlestick during an opioid overdose response had a significantly higher prevalence of positive PTSD

screenings than those who had not been injured by a needlestick (15.4% vs. 1.9%; $P = 0.047$). No other types of potentially traumatic events experienced while responding to an opioid overdose response, nor personal impact of the opioid epidemic, were associated with a positive PTSD screen.

Depression

In total, 188 fire fighters completed the items necessary to screen for symptoms of depression. Of these, 149 (79%) screened negative, 30 (16%) met the screening criterion for mild depression, 5 (3%) met the screening criterion for moderate depression, 3 (2%) met the screening criterion for moderately severe depression, and 1 (< 1%) met the screening criterion for severe depression. Three fire fighters (2%) reported having suicidal ideation. The questionnaire was anonymous, so we could not directly intervene with these individuals to ensure they received mental health care. However, we immediately alerted the district fire chief and the city's office of risk management about the suicidal ideation responses, again providing local and national resources for suicide prevention and mental health. We encouraged the district fire chief and the city's office of risk management to distribute information about these resources to all of the fire fighters.

Fire fighters who reported experiencing the following potentially traumatic events during an opioid overdose response in the previous 6 months had a significantly higher prevalence of moderate to severe depression symptoms (as opposed to a negative or mild depression screening) than those who did not report experiencing the event

- Being physically attacked/assaulted (55.5% vs. 17%; $P = 0.013$)
- Being in a situation where they believed they could be killed by another person (33.3% vs. 6.7%; $P = 0.027$)
- Being injured by a needlestick (33.3% vs. 6.1%; $P = 0.022$)
- Opioid exposure (50% vs. 15%; $P = 0.028$)

No other types of potentially traumatic events experienced while responding to an opioid overdose response, nor personal impact of the opioid epidemic, were associated with moderate to severe depression.

Generalized Anxiety Disorder

Of the 187 fire fighters who completed the items necessary to screen for symptoms of GAD, 161 (86%) screened negative, 17 (9%) met the screening criterion for mild anxiety, 8 (4%) met the screening criterion for moderate anxiety, and 1 (< 1%) met the screening criterion for severe anxiety. Fire fighters who had been injured by a needlestick had a significantly higher prevalence of moderate to severe anxiety screenings (as opposed to negative or mild) than those who had not been injured by a needlestick (33.3% vs. 6.1%; $P = 0.022$). No other types of potentially traumatic events experienced while responding to an opioid overdose response, nor personal impact of the opioid epidemic were associated with moderate to severe anxiety.

Use of Resources to Address Mental Health Symptoms and Stress

Twenty (11%) fire fighters reported seeking mental health care for work-related stress. Table C5 describes resources fire fighters may use to help them manage stress and mental health symptoms.

Among the 20 fire fighters, the employee assistance program (7%) was the most frequently used resource for coping with stress and mental health, followed by a mental health professional (3%) and primary care physician (3%).

Perceived Stigma and Barriers to Care for Psychological Problems

Table C6 shows the frequency and percentage of fire fighters who responded at each level of agreement for the perceived stigma and barriers to care items. Most responding fire fighters disagreed with the perceived stigma and barriers to care items. Of those that did perceive some stigma or barriers to seeking care, the greatest perceptions of stigma were concerns that they would “be seen as weak” (20%) or that “members in my unit might have less confidence in me” (15%). The greatest barrier reported to seeking mental health care was the cost of services (14%).

Most fire fighters (93%) indicated that completing the questionnaire was not at all upsetting to them, while 11 (6%) reported it was a little bit upsetting, 2 (1%) said it was somewhat upsetting, and 1 (< 1%) said it was extremely upsetting.

Discussion

From 2015 to 2016, there was a 100% increase in the rate of overdose deaths involving synthetic opioids (which includes fentanyl and its analogues) in the United States [Centers for Disease Control and Prevention 2018a]. Ohio, a state severely affected by the opioid epidemic and where this fire department is located, experienced 4,162 opioid-related overdose deaths in 2017, a 19% increase compared with 2016 [Ohio Department of Health 2018]. The number of emergency department visits for suspected opioid overdose in Ohio has also increased in 2016–2017 [Centers for Disease Control and Prevention 2018b].

These trends have raised concerns about the possibility of unintentional work-related opioid exposure among fire fighter-emergency medical service providers, as well as other emergency responders (e.g., law enforcement officers). Inhalation, mucous membrane contact, ingestion, and percutaneous exposure (e.g., needlestick) are primary potential routes of exposure. Brief skin contact with powdered fentanyl or its analogues is not expected to lead to toxic effects if visible contamination is promptly removed [Interagency Board 2017; Moss et al. 2018; NIOSH 2017].

In this city fire department, almost all fire fighters (92%) responding to the questionnaire reported participating in opioid overdose responses in the past 6 months. This period roughly corresponds to the first half of 2018. During opioid overdose responses, 87% reported administering naloxone. Approximately 62% of fire fighters reported work situations where suspected opioids were visible, which corresponds to at least a moderate anticipated level of exposure in the current NIOSH guidance [NIOSH 2017].

Approximately 19% of all respondents reported one or more potential routes of exposure to suspected opioids; however, we did not identify any work characteristics that were associated with exposure. No eye or mouth contact with suspected opioids was reported, but transfer from bare or gloved hands to the eyes or mouth is more likely to go unnoticed than direct contact. Because of this possibility, we asked about gloved hand contact with suspected opioids that might lead to mucous membrane exposure via subsequent inadvertent hand-to-face contact. The potential for exposure via gloved hand contact

highlights the need for training about proper glove removal procedures and glove changes upon contamination or after tasks with potential for contamination.

Two fire fighters reported symptoms after opioid exposure. The low prevalence of symptoms after exposure to suspected opioids relative to the proportion of fire fighters who reported work situations involving suspected opioids and potential routes of exposure in this questionnaire might indicate that a relatively high level of exposure is needed to develop symptoms. The symptoms reported, numbness or tingling and headache, were nonspecific and mild. Low-dose exposure to opioids may result in milder symptomatology. A continuum of signs and symptoms experienced upon exposure to opioids has been described, but does not specifically include headache, numbness, or tingling [Lynch et al. 2018; Suzuki and El-Haddad 2017]. None of the respondents reported signs and symptoms of severe (life-threatening or late-stage) opioid toxicity. These include profound lethargy or other indications of central nervous system depression; shallow, slow, or absent breathing; miosis (small or pinpoint pupils); slow heart rate; and low body temperature [Boyer 2012; Ropper et al. 2014].

Headache is an extremely prevalent symptom and has many other potential causes. Illicit fentanyl and its analogues are increasingly being mixed with other drugs, particularly cocaine [Centers for Disease Control and Prevention 2018c]. Cocaine has local anesthetic effects such as numbness and tingling [Aronson 2016], but we cannot conclude that the numbness or tingling reported in the survey was specifically related to cocaine or other drugs. We did not ask about the identity of substances fire fighters might have come into contact with during the course of their work. Visual inspection does not confirm or rule out the presence of fentanyl or fentanyl analogues [Suzuki and El-Haddad 2017].

The low prevalence of symptoms after opioid exposure reported in this questionnaire is consistent with preliminary findings from studies of first responders in Virginia and Kentucky. Although methods differed from ours, approximately 3% of first responders in Virginia and Kentucky who responded to that survey reported health effects associated with exposure to opioids [Thompson et al. 2018; Tran 2018].

Ideally, the fire department would receive information about scenarios in which fire fighters were exposed to hazardous substances and “near-misses.” This information can be incorporated into policies and work processes to prevent future incidents. Only two fire fighters reported opioid exposure to the fire department, but 25 fire fighters’ questionnaire responses indicated that they had opioid exposure. The fire fighters who experienced health effects reported that they did not tell the fire department about their exposures and subsequent symptoms.

Uncertainty about exposure was the most commonly cited reason for not reporting. Possible explanations include that some routes of exposures are harder to detect than others and uncertainty about what constitutes an exposure that should be reported. For example, it might be more difficult to know about substances being airborne as opposed to visible contamination on gloves or skin. In addition, fire fighters who only had suspected opioids come into contact with their gloves might have not considered themselves exposed at the time of the contact; however, we instructed fire fighters that, for the purposes of the questionnaire, exposure included contact with gloved hands.

The ordering of reasons for not reporting did not change when we excluded fire fighters with only gloved hand contact to address this potential difference in perceptions about being exposed. A

perception that the exposure was not serious or not important was the second most commonly cited reason for not reporting. Specifying what constitutes an exposure to be reported and emphasizing the importance of reporting exposure to suspected opioids and other hazardous substances might encourage fire fighters to report future incidents.

All fire fighters reported compliance with glove use when suspected opioids were visible, which is consistent with NIOSH guidance for situations with a moderate anticipated level of exposure. While more than 90% of fire fighters reported respirators and eye protection were available when suspected opioids were visible, most reported never using these types of PPE. Reported wrist/arm protection availability was lower and use was more variable. These other types of PPE are also recommended for a moderate anticipated level of exposure [NIOSH 2017].

We did not ask about reasons for not wearing each specific type of PPE, but the two most frequently reported reasons for not wearing PPE in general were “I did not think it was necessary” and “it was not required.” Fire department guidelines on what types of PPE should be worn in various situations involving illicit drugs could help employees increase PPE use. Two common reasons (“I initially did not have enough information to suggest that suspected opioids were present” and “I was too rushed at the scene”) might be addressed through having more information available before fire fighters arrive at scenes where illicit drugs might be present.

Fire fighting is an inherently stressful occupation. For example, the CareerCast [2017] annual report on stressful occupations lists fire fighting as the second most stressful job in the United States, following active duty military personnel. Fire fighters are in a high-risk occupation. Their lives are endangered regularly and they have a variety of life-saving duties beyond fire suppression. These include responding to medical crises, explosions, spills, and disasters.

NIOSH [2011] defines job stress as the harmful physical and emotional responses that occur when job demands do not match the capabilities, resources, or needs of employees. Stress is complicated and multifaceted for fire fighters. A mixture of traumatic experiences and daily working conditions such as administrative and organizational factors can affect fire fighters’ mental health, job satisfaction, and morale [Beaton and Murphy 1993; Corneil et al. 1999].

As a group, the fire fighters in our evaluation reported low job stress when asked specifically about responding to opioid overdoses. The overall level of job stress might have been different had we asked about job stress in general, perhaps because responding to opioid overdoses may represent a relatively low stress situation for those who experience death and other traumatic events regularly. We did find that a high job stress rating was associated with experiencing some of the potentially traumatic incidents we described in our questionnaire like administering naloxone and seeing dead adults. These findings indicate that it is important for fire fighters to monitor their stress levels following opioid overdose responses and to engage in stress reduction techniques to improve psychological well-being.

In our evaluation, we found that 3% of fire fighters screened positive for PTSD, 5% screened positive for moderate to severe depression, and 5% screened positive for moderate to severe anxiety. The 12-month prevalence of these clinical disorders among U.S. adults is 3.5% for PTSD, 7% for depression, and 2.9% for anxiety [American Psychiatric Association 2013]. These rates, however, cannot be directly compared with our findings because they are based on actual diagnosed cases, whereas our

findings were based on a screening tool. We did not assess how mental health symptoms influence functioning, which is an important consideration for making a true clinical diagnosis for these conditions. Thus, it is possible that while fire fighters may be experiencing symptoms of depression and anxiety, their performance at work or in social or other settings may be unaffected.

In a similar HHE focusing on the opioid epidemic with fire fighters in West Virginia ($n = 53$), we found higher percentages of positive screenings for PTSD (13%), moderate to severe depression (23%), and moderate to severe anxiety (25%) using the same screening tools [NIOSH 2017]. This was a relatively small community located in one of five states with the highest rates of death from drug overdose that experienced a mass overdose event involving 26 people at the same location over several hours. Other research using different screening tools with fire fighters reported PTSD rates of 4%–37% [Bryant and Harvey 1996; Corneil et al. 1999; Meyer et al. 2012; Wagner et al. 1998]. In other studies, depression and anxiety findings have been similar to those found in this HHE. Carey et al. [2011] found a moderate to severe depression prevalence of 4.6%, and Meyer et al. [2012] reported a 3.5% prevalence of moderate to severe depression and a 4.2% prevalence of moderate to severe anxiety symptoms among fire fighters serving large metropolitan areas of the United States.

Of the fire fighters in this evaluation who reported experiencing a potentially traumatic event at work, most reported multiple events. PTSD symptoms usually do not begin until at least 3 months after the trauma, but in some cases, it may take many months or years after a trauma before a person experiences symptoms of the disorder [American Psychiatric Association 2013]. Therefore, fire fighters should seek and give support and psychological first aid following any traumatic incident [Norwood and Rascati 2012]. For example, our results showed that situations where a fire fighter believed he or she could be killed by another person and experiencing needlestick injuries are specific traumatic events during an opioid overdose response that are each associated with PTSD symptoms. Fire fighters who experience these types of events should speak with someone they trust shortly after the event and determine whether further assistance is necessary to help them mentally and emotionally process the event and begin to cope.

Needlestick injury was a potentially traumatic event that was associated with high job stress and a higher prevalence of mental health outcomes. These findings were consistent with results from prior studies of health care workers who reported feeling symptoms of anxiety, depression, and PTSD following a needlestick injury [Cooke and Stephens 2017]. In this evaluation, although 13 (8%) fire fighters reported a needlestick injury during an opioid overdose response in the past 6 months, no needlestick injury reports were recorded in the city's database during that period. Similarly, a higher incidence of needlestick injuries was found in a survey of EMS providers [Alhazmi et al. 2018] than in another study based on incident reports [El Sayed et al. 2011].

Underreporting of needlestick injuries is common; one study estimated a 43.4% underreporting rate among U.S. health care workers [Panlilio et al. 2004]. Encouraging prompt reporting of occupational needlestick injuries and other bloodborne pathogen exposures is important because postexposure prophylaxis for human immunodeficiency virus infection and hepatitis B works best when it is started as soon as possible after exposure [Centers for Disease Control and Prevention 2001; Kuhar et al.

2013]. In addition, mental health assessments related to the needlestick might be incorporated into medical evaluation and follow-up when fire fighters experience a work-related needlestick injury.

Most of the fire fighters in our evaluation reported that they had not sought mental health care for stress or other psychological outcomes associated with their work. When a fire fighter did seek help, of the potential mental health resources we listed, the most commonly used was the employee assistance program. Other studies have found that many people who experience psychological issues do not pursue treatment from a mental health specialist, mainly due to the stigma of mental illness and seeking treatment [Andrews et al. 2001; Corrigan 2004]. In our study, most of the fire fighters reported that they did not believe workplace stigma exists associated with receiving mental health care. However, 13%–22% of the fire fighters gave neutral responses to these items, making it unclear as to whether they did not have an opinion or if they were unsure of how to respond.

Future efforts should expand the focus to explore perceptions of stigma from society at large, from friends and family, from the fire fighting or first responder community, and self-imposed stigma for receiving mental health care. Understanding potential stigma associated with receiving mental health care and support may lead to targeted interventions for improving perceptions and utilization of mental health services [Vogel et al. 2007].

This is an interim report for this HHE. A previous interim report for the HHE involved an evaluation of incidents in which police officers were potentially exposed to opioids [NIOSH 2018]. As next steps, we plan to use a similar survey to evaluate work practices, PPE availability and use, and prevalence of exposures to suspected opioids and associated health effects among police officers. We also plan to assess surface contamination in evidence handling areas and common areas in some police district offices.

Limitations

This evaluation was subject to several limitations. The greatest limitation was that questionnaire responses were self-reported, and we were unable to verify responses using records, such as emergency response logs. There is the possibility of recall bias from the self-reported responses. Second, because the questionnaire was anonymous, we were unable to clarify responses or ask follow-up questions once the responses were analyzed. For example, we were not able to follow up with fire fighters who gave discordant responses. As a result, we excluded discordant answers from the analysis. In incidents where fire fighters reported health effects after contact with suspected opioids, we were not able to obtain additional details.

A third limitation was that we only invited about one third of the department's fire fighters to participate in the questionnaire. However, fire fighters who were on-duty during questionnaire administration were not expected to differ from fire fighters working on different shifts in ways that would systematically bias the results. All but one invited fire fighter participated in the survey. A fourth limitation was that the mental health screening tools used were not specifically validated for use with fire fighters or first responders, but instead in general populations. The last limitation was that although responses were anonymous, fire fighters may have felt the need to respond to the mental health questions in a socially desirable manner to avoid any questioning of their fitness for duty.

Preliminary Conclusions

Most fire fighters in this city fire department reported being in situations where suspected opioids were visible during the course of their work in the past 6 months. Reported glove use was high during these situations. Approximately 20% of fire fighters reported one or more potential routes of exposure to suspected opioids, although the frequency of PPE use other than gloves was low. While few fire fighters developed nonspecific symptoms after opioid exposure, it is important to continue taking steps to prevent unintentional occupational exposure to opioids and other drugs. This includes educating fire fighters on occupational safety and health topics related to the exposure to illicit drugs such as fentanyl and its analogues.

Some fire fighters reported symptoms consistent with case definitions of PTSD, depression, and anxiety. Fire fighters should be educated and trained on mental health issues such as suicide prevention, psychological first aid, and recognizing signs of stress. Furthermore, they should be encouraged to seek help from a mental health professional when faced with a traumatic event while responding to an opioid exposure call.

Section C: Tables

Table C1. Participant demographic information

Demographic characteristic	Number (%)
Male (n = 187)	178 (95)
Age in years (n = 187)	
18–25	4 (2)
26–35	45 (24)
36–45	65 (35)
46–55	54 (29)
55+	19 (10)
Race (n = 187)*	
American Indian or Alaskan Native	7 (4)
Asian	2 (1)
Black or African American	59 (32)
Native Hawaiian or other Pacific Islander	3 (2)
White	131 (70)
Hispanic or Latino ethnicity (n = 189)	5 (3)

*Participants could choose more than one option

Table C2. Participant job characteristics (n = 189)

Job characteristic	Number (%)
Years with this fire department	
< 1	0
1–5	50 (26)
6–10	15 (8)
11–15	19 (10)
16–20	37 (20)
21–25	39 (21)
25+	29 (15)
Supervisory position	51 (27)
Traveler	14 (7)
Current highest level of EMS certification	
Paramedic	85 (45)
Advanced emergency medical technician	1 (1)
Emergency medical technician	103 (54)

EMS = emergency medical services

Table C3. Frequency of being in situations where suspected opioids were visible during the course of work over the past 6 months (n = 116)*

Frequency	Number† (%)
Just once in the past 6 months	17 (15)
2–5 times in the past 6 months	54 (47)
At least once per month	31 (27)
At least once per week	13 (11)
Once per shift	0
More than once per shift	1 (1)

*Two responses about frequency were missing.

†Percentages might not sum to 100 due to rounding.

Table C4. Number of fire fighters who reported experiencing a potentially traumatic event while responding to an opioid overdose in the past 6 months (n = 173)

Potentially traumatic event	Number (%)
Administering naloxone/Narcan to someone	151 (87)
Seeing dead adults*	129 (75)
Seeing neglected or unaccompanied children	119 (69)
Having to revive the same person(s) from an opioid overdose more than once*	116 (67)
Seeing a patient die	99 (57)
Being physically attacked	33 (19)
Being in a situation where you believed you could be killed by another person	14 (8)
Being injured by a needlestick	13 (8)

*n = 172

Table C5. Use of mental health resources for work-related stress (n = 188)

Resource	Number (%)
Sought some form of mental health care	20 (11)
Employee assistance program	14 (7)
Mental health professional	5 (3)
Primary care physician	5 (3)
Religious leader	2 (1)
Support group	2 (1)

Table C6. Agreement ratings for stigma and barriers to receiving mental health care items (n = 188)

Stigma item	Agree Number† (%)	Neutral Number† (%)	Disagree Number† (%)
I would be seen as weak	37 (20)	30 (16)	121 (64)
Members in my unit might have less confidence in me	29 (15)	38 (20)	121 (64)
It would be too embarrassing	23 (12)	41 (22)	124 (66)
My unit leadership might treat me differently	23 (12)	36 (19)	129 (69)
It would harm my career*	14 (8)	33 (18)	139 (75)
My leaders would blame me for the problem	11 (6)	24 (13)	153 (81)
Barrier item	Agree Number (%)	Neutral Number (%)	Disagree Number (%)
Mental health care costs too much money	26 (14)	29 (15)	133 (71)
It would be difficult to get time off work for treatment	14 (7)	18 (10)	156 (83)
I do not think mental health care would be effective	13 (7)	49 (26)	126 (67)
It is difficult to schedule an appointment	9 (5)	20 (11)	159 (85)
I don't know where to get help	7 (4)	18 (10)	163 (87)
I don't have adequate transportation	3 (2)	7 (4)	178 (95)

*n = 186

†Percentages might not sum to 100 due to rounding.

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