




RESEARCH ARTICLE

Perceptions of opioid and other illicit drug exposure reported among first responders in the southeast, 2017 to 2018

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Abstract

Background: Opioid use has risen dramatically in recent years, and its illegal use puts first responders at risk when intervening in overdoses. Synthetic opioids, like fentanyl with a potency 50 to 100 times greater than morphine, pose a great risk and accidental exposure via ingestion, inhalation, mucosal, or percutaneous routes, can potentially lead to fatal outcomes. Anecdotal media accounts in early 2017 of accidental occupational opioid exposure among first responders generated a national concern.

Methods: To identify first responders' recollections, beliefs, and concerns about possible occupational exposure to opioids and other drugs, researchers in Kentucky, Virginia, Mississippi, and Georgia administered an emailed, anonymous convenience sample survey.

Results: A total of 5955 surveys were analyzed with 15% of respondents reporting they believed they had been exposed to opioids, and of those, less than 1% reported experiencing health effects from perceived exposure. Over half (51%) of respondents reported being “very or somewhat concerned” about developing health effects from exposure to opioids. Half of respondents reported being unaware of Centers for Disease Control and Prevention (CDC)/National Institutes for Occupational Safety and Health (NIOSH) guidelines for preventing occupational-related opioid exposures.

The findings and conclusions in this report do not necessarily represent the views of the National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention or the authors' institutions.

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Conclusions: Only a small fraction of first responders believed they had experienced symptoms related to opioid exposure in overdose response calls, but half were concerned about potential exposures and half were unaware of the educational guidance on prevention available. The high level of concern regarding potential exposure warrants the need for the development and or enhancement of targeted educational training interventions and further dissemination of pre-existing training interventions to ensure first responders have the knowledge and understanding of occupational opioid exposures and minimize stress associated with the potential rare exposures.

KEYWORDS

emergency medical services, emergency responders, fentanyl, firefighters, law enforcement officers, occupational health, opioid epidemic, opioids surveillance, prehospital emergency care

1 | INTRODUCTION

From 1999 to 2017, deaths due to illicit opioid overdose had been rising, and the epidemic has been characterized as having three waves driven by opioid type: the first wave in 1999 with prescription opioids, the second in 2010 due to heroin, and third and current in 2013 due to illicitly manufactured fentanyl and fentanyl analogues.¹⁻³ In 2018, the United States witnessed its first decline for drug overdose deaths since 1999, by 4.6% but rose again by 4% in 2019 and provisional data estimate an increase of 29.4% for 2020.⁴⁻⁶ To assess trends in nonfatal drug overdoses, in January 2018, the Centers for Disease Control and Prevention (CDC) began collecting suspected drug overdose data from emergency departments across 38 states as part of the Drug Overdose Surveillance and Epidemiology system. The most recent data from February 2019 to February 2020 indicate the overall rate of suspected drug overdose per 10 000 emergency department visits increased significantly by 14.37% among 38 states.⁷ These data reflect a potential proxy for prehospital occupational opioids and other drug encounters. From 2016 to 2019, numerous anecdotal accounts of first responders being exposed to opioids through their role emerged in the media.⁸⁻¹⁰ The current literature assessing opioid exposure and toxicity among first responders is limited. A 2018 report on protection of first responders speculated that the likelihood of ill effects experienced by prehospital providers due to opioid exposure is rare.¹¹ More recently, a study was conducted assessing the evidence of occupational opioid exposures from 214 lay media reports released from 2012 to 2018 and did not find substantial evidence of occupational-related opioid exposure.¹²

Reports by National Institutes for Occupational Safety and Health's (NIOSH) health hazard evaluation (HHE) program released between 2018 and 2019 indicate that following emergency responses involving illicit drugs including fentanyl, methamphetamine, and cocaine; first responders reported mild, nonspecific symptoms such as headache, lightheadedness, confusion, and palpitations; these symptoms were not indicative of life-threatening signs of opioid toxicity but did interfere with first responders being able to perform their work.¹³ Synthetic opioids such as fentanyl and fentanyl analogues

involved in overdoses may pose a potential hazard for first responders via inhalation, ingestion, mucosal, or percutaneous (needle stick) due to their potency; risk for these exposures may be increased if first responders are not equipped with the correct personal protective equipment (PPE) based on identification of CDC-specified risk level of the substances present.¹⁴ In efforts to identify first responders' recollections, beliefs, and concerns about possible occupational opioid exposure and health effects, their current training knowledge, use of PPE, and level of concern regarding perceived opioid exposures, four states administered an anonymous, emailed survey to a convenience sample of first responders.

2 | METHODS

Through the Central Appalachian Regional Education Research Center (CARERC), an Education Research Center funded by CDC's NIOSH, Kentucky, Virginia, Mississippi, and Georgia was provided pilot grant funds to assess occupational opioid exposure among first responders. The survey included four areas related to responders: (1) demographic information, (2) occupation-related information, (3) perceived exposure and health effects, and (4) opioid exposure prevention training. The survey questions were developed by the Kentucky group, pilot tested with a group of first responders and a group of subject matter experts, and then revised with feedback prior to study launch. Institutional review board (IRB) approval was received by designated IRB entities in the four states prior to survey launch.

Dissemination of the survey varied slightly from state to state; in general, email addresses of first responders were obtained through state agencies, and surveys were sent using links from REDCap (<https://www.project-redcap.org/>) or SurveyMonkey (<https://www.surveymonkey.com/>). Among the four states, approximately, 67 281 surveys were distributed, and 6234 responses were received (not including sent and received surveys from "other" states out of the four main states), yielding a weighted response rate of 10%. The weighted response rate was calculated using response rates by each of the four states. Individual state rates were then multiplied by their

TABLE 1 Characteristics of first responders by perceived opioid exposure (N = 5955)—Kentucky, Virginia, Mississippi, and Georgia, 2017 to 2018

Characteristic	Total, N (%)	Exposed, N (%)	Confidence interval for population proportion	P value for chi-square test statistic
Total	5955 (100)	903 (15.2)	-	
Responder type				
EMS	2788 (46.8)	469 (16.8)	(15.4, 18.2)	.001
Fire	2199 (36.9)	265 (12.1)	(10.6, 13.5)	
Police	803 (13.5)	154 (19.2)	(16.5, 22)	
Rescue	127 (2.1)	12 (9.4)	(9.0, 9.8)	
Missing	38 (0.6)	-	-	
State of residence				
Georgia	2125 (35.7)	412 (19.4)	(17.7, 21.1)	.001
Kentucky	1655 (27.8)	254 (15.3)	(13.6, 17)	
Virginia	1608 (27.0)	110 (6.8)	(5.6, 8)	
Mississippi	325 (5.5)	96 (29.5)	(24.6, 34.5)	
Other	164 (2.8)	22 (13.4)	(8.2, 18.6)	
Missing	78 (1.3)	-	-	
Gender				
Male	4189 (70.3)	631 (15.1)	(14, 16.2)	.455
Female	1025 (17.2)	164 (16)	(13.8, 18.2)	
Missing	741 (12.4)	-	-	
Race/ethnicity				
White	4587 (77.0)	705 (15.4)	(14.4, 15.4)	.251
African American	173 (2.9)	25 (14.1)	(8.9, 19.3)	
Mixed	39 (0.7)	10 (25.6)	(11.9, 39.3)	
Asian	33 (0.6)	3 (9.1)	(-0.7, 18.9)	
Native American	25 (0.4)	4 (16)	(-12.5, 28.5)	
Hispanic	18 (0.3)	3 (16.7)	(1.4, 32)	
Unknown	104 (1.7)	19 (18.3)	(10.9, 25.7)	
Missing	976 (16.4)	-	-	
Age (years)				
16-20	90 (1.5)	10 (11.1)	(4.6, 17.6)	.071
21-30	902 (15.1)	121 (13.4)	(11.2, 15.6)	
31-40	1440 (24.2)	212 (14.7)	(12.9, 16.5)	
41-50	1627 (27.3)	265 (19.5)	(17.6, 21.4)	
51-60	918 (15.4)	165 (18)	(1.6, 20.1)	
≥61	242 (4.1)	25 (10.3)	(6.2, 14.1)	
Missing	736 (12.4)	-	-	
Work status				
Full-time	4504 (75.6)	732 (16.3)	(15.2, 17.3)	.001
Part-time	443 (7.4)	79 (17.8)	(14.3, 21.4)	
Volunteer	884 (14.8)	80 (9)	(8.4, 9.6)	
Other work status	60 (1.0)	8 (13.3)	(4.7, 21.9)	
Missing	64 (1.1)	-	-	
Rurality				
Urban/metro	2446 (41.1)	374 (15.3)	(13.9, 16.7)	.484
Suburban	499 (8.4)	78 (15.6)	(12.4, 18.8)	
Merged	885 (14.9)	130 (14.7)	(12.4, 17)	

(Continues)

TABLE 1 (Continued)

Characteristic	Total, N (%)	Exposed, N (%)	Confidence interval for population proportion	P value for chi-square test statistic
Rural	1875 (31.5)	274 (14.6)	(13, 16.2)	
Other	205 (3.4)	43 (21)	(15.4, 26.6)	
Missing	45 (0.8)	-	-	
Years of experience as first responder				
<2 years	1114 (18.7)	129 (11.6)	(9.7, 13.4)	.001
2-5 years	930 (15.6)	123 (13.2)	(11, 15.4)	
>5 years	3513 (59.0)	546 (15.5)	(14.3, 16.7)	
Missing	398 (6.7)	-	-	
Highest education completed				
High school/General Education Development (GED)	439 (7.4)	58 (13.2)	(10, 16.4)	.573
Some college	1839 (30.9)	288 (15.7)	(14, 17.4)	
Associate degree	1062 (17.8)	161 (15.2)	(13, 36.8)	
4-year college degree	1273 (21.4)	192 (15.1)	(13.1, 17.1)	
Graduate degree	423 (7.1)	74 (17.5)	(21, 13.9)	
Other education	228 (3.8)	32 (14)	(2, 26)	
Missing	691 (11.6)	-	-	

associated survey percentage of the overall total surveys received resulting in weighted rates. The weighted rates of the four states were summed equating to a total weighted response rate. Data collection took place during August 2017 to May 2018, and responses were anonymous. Eligible participants were those currently working as first responders (police, fire, Emergency Medical Services [EMS], rescue, or other) within Kentucky, Virginia, Mississippi, or Georgia. Self-reported opioid exposure was ascertained by responses to the question, "During the course of your work have you ever had skin or respiratory contact with or been exposed to opioids, such as heroin, synthetic opiates such as fentanyl and fentanyl analogs (eg, carfentanil, W-18, or krokodil)?" Potential routes of exposure include inhalation, mucous membrane contact, skin contact, ingestion, and percutaneous exposure¹⁴; these routes were assessed among respondents who reported perceived opioid exposure. Respondents who reported they believed they had been exposed to opioids were asked "Has exposure to opioids, heroin or synthetic opiates caused you to have any health effects?" and were asked to indicate the health effects they experienced from these exposures. Training and personal protection-related behavior were assessed through responses to questions about policies and training related to personal protection and availability and use of PPE. Because findings were similar across the four states, survey data from all states were combined for the univariate analysis. Statistical analyses were conducted using IBM SPSS for Macintosh, Version 26. Univariate analysis was conducted for each question to generate frequencies and proportions as well as distributions. Confidence intervals for the population proportion were calculated for each characteristic. Covariates were cross-tabulated with the outcome and self-reported exposure variable (exposed/not exposed to opioids). Differences

were evaluated using chi-square tests. *P*-values <.05 were defined as being statistically significant.

3 | RESULTS

Among 6234 surveys received, 279 (4%) were excluded because of incomplete or missing data or completion by persons who were retired or not currently working as a first responder, leaving 5955 for analysis. Incomplete surveys had almost all (or all) data missing. Kentucky was reported as the state of residence for 1655 (28.2%) responders, Virginia for 1608 (27.4%), Mississippi for 325 (4.4%), and Georgia for 2125 (36.2%); for 242 (4%) respondents, described as "other," the state of residence was missing or was a state bordering one of the four assessed (Table 1). The majority of respondents worked in EMS (47.1%) and fire (37.2%), 80.3% were male, and 92.1% were white. More than one-third (34.9%) had some college education, and almost one-quarter (24.2%) had completed college. Responders served in both metropolitan (41.4%) and non-metropolitan areas (31.7%).

Among 5928 respondents with information on exposure, 903 (15.2%) self-reported they believed they had been exposed to opioids (Table 2). Among responders who reported they believed they had been exposed, the two most commonly reported routes of exposure reported were skin contact ($n = 682$; 54.5%) and inhalation ($n = 507$; 40.6%). The most frequently reported substances to which responders indicated perceived exposure were heroin ($n = 609$; 36.3%) and fentanyl ($n = 372$; 22.2%). Thirty-six respondents (0.6%) reported they believed they experienced health effects associated with their opioid exposure, half of whom reported they required

TABLE 2 Perceived exposure and health effect characteristics of first responders (N = 5955)—Kentucky, Virginia, Mississippi, and Georgia, 2017 to 2018

Characteristic (no. with available information)	No. (%)
Ever been exposed to opioids (n = 5955)	
No	5025 (84.4)
Yes	903 (15.2)
Missing	27 (0.4)
Types of opioids involved in perceived exposures (n = 903) ^a	
Heroin	609
Fentanyl	372
Prescription pain medications	295
Unknown opioid	150
Carfentanil	78
Methadone	75
Opioid combination	50
Opioid and nonopioid combination	48
Exposure route (n = 903) ^a	
Skin	682
Inhalation	507
Accidental ingestion	23
Accidental injection	22
Other route	16
Experienced health effects from perceived opioid exposure (n = 903)	
No	867 (96.0)
Yes	36 (4.0)
Symptoms reported regarding potential opioid exposure (n = 36) ^a	
Headache	15
Shallow, difficult breathing	13
Dizziness/fainting	9
Altered heart rate	8
Nausea/vomiting	7
Eye irritation	7
Weakness/fatigue	7
Itchy skin/rash/dermatitis	5
Confusion	5
Other	2
Treatment received (n = 18)	
Transport to Emergency Department	7 (39)
Other unspecified	7 (39)
Naloxone (NARCAN) administration	3 (17)
Intubation	1 (6)
Level of concern regarding development of health effects (N = 5955)	
Very concerned	1310 (22.0)
Somewhat concerned	1753 (29.4)
Very mildly concerned	1363 (22.9)
Not concerned at all	824 (13.8)
Haven't given it much thought	522 (8.8)

(Continues)

TABLE 2 (Continued)

Characteristic (no. with available information)	No. (%)
Missing	183 (3.1)

^aQuestions were not mutually exclusive.

medical treatment. The majority of perceived health effects reported by first responders included headache, shallow/difficult breathing, dizziness/fainting, and altered heart rate; the majority of these were consistent with the mild, nonspecific symptoms reported within the NIOSH HHE investigations.¹³ Approximately half (51.4%) of respondents said they were very or somewhat concerned about being exposed to opioids.

Respondents were asked about their training and personal protection-related behavior. More than two-thirds (n = 4996; 69.9%) indicated that PPE is provided by their employer for responding to possible drug-related incidents (Table 3). Overall, for responders who provided information on personal protection worn to prevent exposure to opioids when responding to drug-related incidents, almost all of the respondents (97%) reported wearing gloves to prevent exposure to opioids while 75%, 57%, and 47% reported not wearing respirators, protective clothing, or glasses/goggles, respectively.

Among 5401 respondents who provided information about their awareness of NIOSH's recommendations for preventing occupational exposure to opioids, 3363 (62.3%) reported that they were unaware; the proportion was similar among those who reported having been exposed and among those who reported no exposure.

4 | DISCUSSION

Among this sample of southeast-based first responders, approximately 15% reported believed that they had been exposed to opioids; less than 1% (0.6%) reported experiencing perceived exposure-related health effects. Although a small portion of responders reported they believed that they had been exposed to opioids, the 903 respondents that reported this belief warrants further education on opioid exposure effects including comparisons of opioid exposure symptoms vs symptoms of panic attacks after perceived occupational exposures, as well as general training on strategies to mitigate exposure to opioids and other drugs of concern for this occupational group. The most frequently perceived route of exposure reported was dermal exposure, representing 54% of occurrences. This route of exposure is of least concern as dermal absorption of fentanyl and fentanyl analogs take considerable time in order to be passed through the skin.¹⁵

Highly potent synthetic opioids have been the cause of numerous drug overdose deaths nationwide.¹⁶ These potent drugs pose challenges for first responders if uninformed on appropriate PPE use recommended. Although protective gloves are generally provided by employers and are worn by responders, use of other PPE such as respirators or protective clothing when responding to an opioid overdose

TABLE 3 Characteristics of training and current protection practices by perceived opioid exposure among first responders (N = 5955)—Kentucky, Virginia, Mississippi, and Georgia, 2017 to 2018

Question	Total, N	Exposed, N (%)	Unexposed, N (%)	P-value for chi-square test statistic
Does your employer have a written Protection Program Policy (PPP) on drug overdose responses (eg, opiates)?				
Yes	3324	504 (15.2)	2820 (84.8)	.013
No	1332	233 (17.5)	1099 (82.5)	
Do not know	1032	135 (13.1)	897 (86.9)	
Missing	267	-	-	
Does your employer offer employee training on how to properly use personal protective equipment and procedures to prevent exposure to opioids during your work?				
Yes	4164	620 (14.9)	3544 (85.1)	.008
No	1079	199 (22.8)	880 (18.3)	
Do not know	448	53 (11.8)	395 (88.2)	
Missing	264	-	-	
Does your employer provide personal protection equipment to use while responding to possible drug-related incidents?				
Yes	4996	742 (14.9)	4254 (85.1)	.058
No	419	87 (20.8)	332 (79.2)	
Do not know	169	20 (11.8)	149 (88.2)	
Missing	371	-	-	
How often are you required to attend training about protecting yourself from opioid exposure?				
Once at hire and then annually	2666	384 (14.4)	2282 (85.6)	.042
Once at hire, then as required by MD	134	21 (15.7)	113 (84.3)	
Once at hire only	331	77 (23.3)	254 (76.7)	
Other frequency	109	15 (13.8)	94 (86.2)	
No requirements	559	133 (23.8)	426 (76.2)	
Do not know	238	45 (18.9)	193 (81.1)	
Missing	1918	-	-	
Do you wear any of the following personal protection to prevent exposure to opioids during drug overdose response calls or drug-related incidents?				
Respirators—no	3475	491 (14.1)	2984 (85.9)	.192
Respirators—yes	1180	185 (15.7)	995 (84.3)	
Missing	1300	-	-	
Protective clothing—no	2727	408 (15)	2320 (85)	.734
Protective clothing—yes	2068	302 (14.6)	1766 (85.4)	
Missing	1159	-	-	
Safety glasses/goggles—no	2339	330 (14.1)	2009 (85.9)	.353
Safety glasses/goggles—yes	2599	391 (15)	2208 (85)	
Missing	1017	-	-	
Gloves—no	157	24 (15.3)	133 (84.7)	.993
Gloves—yes	5303	812 (15.3)	4491 (84.7)	
Missing	495	-	-	
What is the minimum level of respiratory protection you are required to use when in close contact with a person who is suspected of experiencing an overdose of opioids?				
N95 filtering face piece respirator	1275	193 (15.1)	1082 (84.9)	.02
Surgical mask	563	102 (18.1)	461 (81.9)	
Elastomeric half-face N95 respirator	84	13 (15.5)	71 (84.5)	
PAPR [†]	16	7 (43.8)	9 (56.3)	
Other respiratory protection	95	15 (15.8)	80 (84.2)	
Do not know	588	60 (10.2)	528 (89.8)	

TABLE 3 (Continued)

Question	Total, N	Exposed, N (%)	Unexposed, N (%)	P-value for chi-square test statistic
None	2883	455 (15.8)	2428 (84.2)	
Missing	451	-	-	
Are you aware of the NIOSH/CDC recommendations for preventing occupational opioid/heroin/synthetic opiate exposures of first responders, emergency personnel, and law enforcement employees?				
No	3363	512 (15.2)	2851 (84.8)	.933
Yes	2038	312 (15.3)	1726 (84.7)	
Missing	554	-	-	

Abbreviations: CDC, Centers for Disease Control and Prevention; MD, physician; NIOSH, National Institutes for Occupational Safety and Health; PAPR, powered air-purifying respirator.

is less prevalent, and the majority of survey respondents were not aware of recommended protective measures when responding to opioid-related overdoses. Improved implementation of NIOSH recommendations for preventing opioid exposures is needed to promote the knowledge and skills necessary to protect first responders. Further, the landscape of drug use across the United States is changing. Currently, methamphetamine is on the rise in terms of contributions to overdose deaths and supply.^{17,18} In particular, there is evidence that a large majority of overdose deaths points to a mixture of methamphetamine, benzodiazepines, and/or cocaine with opioids. Results from a 2019 analysis involving drug overdose death data from CDC's State Unintentional Drug Overdose Reporting System from 25 states indicated that from July-December 2017 to January-June 2018, the majority of drug opioid overdose deaths (63%) co-occurred with either benzodiazepines, cocaine, or methamphetamine. In 12.1% of opioid overdose deaths, methamphetamine was present. The evolving drug landscape and new emerging risks for first responders will continue to necessitate the use of PPE. Current recommended guidelines and educational tool-kits provided by CDC NIOSH cover "illicit drugs" and is likely sufficient for protecting first responders for other new emerging drugs.¹⁹ Ensuring that educational interventions to protect first responders produced by national, trusted organizations like CDC NIOSH reach first responders and are developed is important.

It has been estimated that 30% of first responders develop behavioral health problems compared to 20% of the general population.²⁰ Despite the low incidence of reported perceived opioid exposure found in this study, the majority of respondents reported having a high level of concern about the development of health effects from opioid exposure, indicating a need for education on the risk of occupational exposure and associated health effects and also the steps that can be taken to reduce risk based on the risk level of the situation. With the rise of drug-related calls brought by the opioid epidemic, along with the finding from this study indicating a high level of "concern about the development of health effects from opioid exposure," there may be a need to further assess the psychosocial impact of the increase of illicit drug-related work first responders have been inundated with. In a cross-sectional study conducted among 187 firefighters in Ohio as part of a CDC HHE assessment, the

majority of respondents reported experiencing one or more potentially traumatic events while responding to an opioid overdose and a little more than a third (34%) indicated moderate or high job stress due to responding to opioid overdoses.²¹ Continued research is needed to better understand the potential psychosocial stressors experienced by first responders due to the opioid epidemic.

The findings in this report are subject to several limitations. First, because these data are self-reported, they are subject to recall and social desirability biases. Second, the survey response rate was low (10%), and it is possible that systematic differences existed between respondents and nonrespondents, introducing the potential of selection bias. First responders that did not participate may differ in some way compared to first responders that did participate. It is possible that a greater proportion of first responders that responded to the survey had perceived experiences of occupational-related opioid exposure and were more interested in the survey and relaying their experiences vs first responders who had not perceived experiences of occupational-related opioid exposure. Third, this low response rate may have induced a potential response bias, overestimating the reported perceived exposure estimates of occupational opioid exposure. Fourth, information on medical diagnosis among respondents who sought medical care for a reported perceived exposure-associated health effect was not available. Fifth, when responding to the exposure question, participants' perceptions of exposure might have differed, resulting in misclassification: for example, some participants might have classified themselves as being exposed if they were in the presence of opioids, whereas others might have unknowingly been exposed to opioids and classified themselves as unexposed. Sixth, the type or types of opioids that responders report perceptions of exposure to might be inaccurate, particularly in light of the fact that various mixtures of drugs may be present. Seventh, the survey questions inquiring about PPE use when responding to drug-related incidents did not ask about PPE use based on risk level of the scenario. Different PPE is recommended to be worn for different risk scenarios. Interpretation from the results for those questions should take that limitation into consideration. Finally, this study was conducted among first responders in four states; therefore, the results may not be generalizable to all US first responders.

5 | CONCLUSIONS

Approximately, one in seven first responders believed they had experienced occupational-related opioid exposure. More than half of respondents reported being unaware of the CDC/NIOSH guidelines for preventing occupational-related opioid exposures, and half of respondents reported being “very” or “somewhat concerned” regarding potential health effects from occupational-related opioid exposure. Expanded training interventions on PPE use for drug-related calls and continued dissemination of preexisting information are recommended to protect first responders from potential opioid and other drug exposures.

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CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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TRANSPARENCY STATEMENT

Robin A. Thompson affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no aspects of the study have been omitted; and that any discrepancies from the study as planned have been explained.

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All authors have read and approved the final version of the manuscript.

All authors contributed to editing and refining the final version of the manuscript for submission and agree to be accountable for all aspects of the work and will ensure all questions related to the

accuracy and integrity of any part of the work are appropriately investigated and resolved.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ETHICS STATEMENT

This study was reviewed and approved by the University of Kentucky Office of Research Integrity, Virginia Department of Health, Georgia Department of Health, and Mississippi State Department of Health. A waiver of documentation of informed consent was approved for this study due to the anonymity of participation; no names or personal identifying information was collected.

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REFERENCES

- Kolodny A, Courtwright D, Hwang C, et al. The prescription opioid and heroin crisis: a public health approach to an epidemic of addiction. *Annu Rev Public Health*. 2015;36:559-574. <https://doi.org/10.1146/annurev-publhealth-031914-122957>
- Warner M, Trinidad JP, Bastian BA, Minino AM, Hedegaard H. Drugs most frequently involved in drug overdose deaths: United States, 2010-2014. *Natl Vital Stat Rep*. 2016;65(10):1-15. https://www.cdc.gov/nchs/data/nvsr/nvsr65/nvsr65_10.pdf
- Hedegaard H, Bastian BA, Trinidad JP, Spencer M, Warner M. Drugs most frequently involved in drug overdose deaths: United States, 2011-2016. *Natl Vital Stat Rep*. 2018;67(9):1-13. https://www.cdc.gov/nchs/data/nvsr/nvsr67/nvsr67_09-508.pdf
- Centers for Disease Control and Prevention (CDC). Opioid Overdose. <https://www.cdc.gov/drugoverdose/data/statedeaths.html>. Accessed May 26, 2020.
- Centers for Disease Control and Prevention (CDC). Drug overdose deaths. [https://www.cdc.gov/drugoverdose/data/statedeaths.html#:~:text=Drug%20Overdose%20Deaths%20Remain%20High,2019%20\(21.6%20per%20100%2C000\)](https://www.cdc.gov/drugoverdose/data/statedeaths.html#:~:text=Drug%20Overdose%20Deaths%20Remain%20High,2019%20(21.6%20per%20100%2C000).). Accessed April 12, 2021.
- Centers for Disease Control and Prevention (CDC). Provisional drug overdose death counts. <https://www.cdc.gov/nchs/nvss/vsrr/drug-overdose-data.htm>. Accessed April 12, 2021.
- Centers for Disease Control and Prevention (CDC). Nonfatal overdoses: All drugs. <https://www.cdc.gov/drugoverdose/data/nonfatal/drugs-overall.html>. Accessed April 20, 2021.
- Salter J. *New Worries for First Responders: Fentanyl Exposure*. Allentown, Pennsylvania: The Associated Press; 2016. <https://www.mcall.com/news/nation-world/mc-fentanyl-police-worries-20160626-story.html>. Accessed June 28, 2020.
- Mettler K. I Was in Total Shock: Ohio Police Officer Accidentally Overdoses after Traffic Stop. *The Washington Post* May 16, 2017. https://www.washingtonpost.com/news/morning-mix/wp/2017/05/16/i-was-in-total-shock-ohiopolic-officer-accidentally-overdoses-after-traffic-stop/?utm_term=.cc53f226d6f4. Accessed December 22, 2017.
- Bever L, Freedom du Lac J. Opioid Epidemic's hidden Hazard: SWAT officers treated for fentanyl exposure during drug raid. *The Washington Post*. 2016. <https://www.washingtonpost.com/news/post-nation/wp/2016/09/14/eleven-swat-officers-treated-for->

- exposure-to-fentanyl-and-heroin-in-drug-raid/. Accessed December 22, 2017.
11. Lynch MJ, Suyama J, Guyette FX. Scene safety and force protection in the era of ultra-potent opioids. *Prehosp Emerg Care*. 2018;22:157-162. <https://doi.org/10.1080/10903127.2017.1367446>
 12. Herman PA, Brenner DS, Dandorf S, et al. Media reports of unintentional opioid exposure of public safety first responders in North America. *J Med Toxicol*. 2020;16:112-115.
 13. Centers for Disease Control and Prevention (CDC). The National Institute for Occupational Safety and Health (NIOSH). New final and interim health hazard evaluation reports. <https://www.cdc.gov/niosh/topics/fentanyl/resources.html>. Accessed April 13, 2018.
 14. Centers for Disease Control and Prevention (CDC). National Institutes for Occupational Safety and Health (NIOSH). Preventing occupational exposure to emergency responders. <https://www.cdc.gov/niosh/topics/fentanyl/risk.html>. Accessed March 5, 2019.
 15. American College of Medical Toxicology. ACMT and AACT position statement: Preventing occupational fentanyl and fentanyl analog exposure to emergency responders. https://www.acmt.net/_Library/Positions/Fentanyl_PPE_Emergency_Responders_.pdf Accessed April 10, 2021.
 16. Scholl L, Seth P, Kariisa M, Wilson N, Baldwin G. Drug and opioid-involved overdose deaths – United States, 2013-2017. *MMWR Morb Mortal Wkly Rep*. 2019;67(5152):1419-1427. <https://www.cdc.gov/mmwr/volumes/67/wr/mm675152e1.htm>. Accessed March 5, 2019
 17. Kariisa M, Scholl L, Wilson N, Seth B, Hoots B. Drug overdose deaths involving cocaine and psychostimulants with abuse potential – United States, 2003-2017. *Morb Mortal Wkly Rep*. 2019;68(17):388-395.
 18. Gladden MR, O'Donnell J, Mattson CL, Seth P. Changes in opioid-involved overdose deaths by opioid type and presence of benzodiazepines, cocaine, and methamphetamine – 25 states, July-December 2017 to January – June 2018. *Morb Mortal Wkly Rep*. 2019;68(34):737-744.
 19. Centers for Disease Control and Prevention (CDC). National Institutes for Occupational Safety and Health (NIOSH). Illicit drug tool-kit for first responders. 2019. <https://www.cdc.gov/niosh/topics/fentanyl/toolkit.html>. Accessed June 20, 2020
 20. Abbot C, Barber E, Harvey J, Newland C, Rose M, Young A. What's killing out medics? Ambulance service manager program. Conifer, CO: Reviving Responders. 2015. <http://www.revivingresponders.com/originalpaper>
 21. NIOSH. Interim report: Evaluation of occupational exposure to opioids, mental health symptoms, exposure to traumatic events, and job stress in a city fire department. By Chiu S, Wiegand DM, Broadwater K, and Li JF. 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 Interim Report 2018-0015b. 2019. <https://www.cdc.gov/niosh/hhe/reports/pdfs/2018-0015b.pdf>

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