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Location of fatal prescription opioid-related deaths in 12 states, 2008–2010: Implications for prevention programs☆,,☆☆

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Abstract

Introduction—Prescription opioid pain reliever overdose is a major public health issue in the United States. To characterize the location of drug-related deaths, we examined fatal prescription opioid and illicit drug-related deaths reported in 12 states.

Methods—Data are from the Substance Abuse and Mental Health Services Administration's Drug Abuse Warning Network (DAWN). Medical examiners or coroners in 12 states (MA, MD, ME, NH, NM, OK, OR, RI, UT, VA, VT, WV) reported details of state-wide drug-related mortality during 2008–2010. DAWN data included location and manner of death, age, race, and drugs involved. Deaths were coded into three categories: prescription opioid-related, illicit drug-related, and cases that involved both a prescription opioid and an illicit drug.

☆All work for this manuscript was done by federal employees, and none of the authors had conflicts of interest.

☆☆Disclaimer: The findings and conclusions in this manuscript are those of the authors and do not necessarily represent the views of the Centers for Disease Control and Prevention or the U.S. Department of Health and Human Services.

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The Journal of Safety Research has partnered with the Office of the Associate Director for Science, Division of Unintentional Injury Prevention in the National Center for Injury Prevention & Control at the Centers for Disease Control and Prevention (CDC) in Atlanta, Georgia, USA, to briefly report on some of the latest findings in the research community. This report on prescription drug overdose deaths is the 41st in a series of CDC articles.

Prior publication of results

None of the results have been previously published.

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Contributors

Dr. Jones conceived of the study. Drs. Easterling and Mack designed the study methods. Dr. Easterling performed the statistical analysis and wrote the draft text. Dr. Mack supervised all aspects of the study completion and manuscript development. All authors contributed to writing and approved the final manuscript.

Conflicts of interest

All authors declare that they have no conflicts of interest to disclose.

Results—During a 3-year period, there were 14,091 opioid or illicit drug-related deaths in 12 states. More than half of the prescription opioid-related deaths in all states, except Maryland, occurred at home, rather than in public or in a health care facility. Although it was still the predominant category, lower percentages of illicit drug-related deaths occurred at home.

Conclusion—Prescription opioid overdoses have increased substantially, and the location of the person at the time of death can have important public health implications for interventions.

Practical applications—This paper highlights that bystander support can be a critical lifesaving factor in drug related deaths but may be more likely for illicit drug-related deaths than for prescription opioid-related deaths.

Keywords

Drug Abuse Warning Network (DAWN); Mortality; Overdose; Opioid; Heroin

1. Introduction

Drug overdoses are a major public health issue in the United States (Paulozzi, 2012). Prescription opioid pain relievers (OPR) alone or in combination with benzodiazepines or other drugs account for nearly half of all drug overdose deaths (Jones, Mack, & Paulozzi, 2013). The percentage increase in prescription OPR deaths since 1999 is startling—a 265% increase among men and a 415% increase among women (Mack, Jones, & Paulozzi, 2013).

The location of drug use, the presence of others at the scene, and the actions of bystanders (e.g., calling for help) could determine whether an overdose becomes a fatality (Darke & Zador, 1996). Certain location characteristics, such as homelessness (Fischer et al., 2004) or residential isolation, have been extensively characterized among cases of drug overdoses (Cooper, Friedman, Tempalski, & Friedman, 2007), although primarily among injection heroin users in poor urban areas. Among specific inner-city populations, the following characteristics predict fatal overdoses: a lack of permanent housing (Fischer et al., 2004; Jenkins et al., 2011), housing in poor physical condition (Hembree et al., 2005), residence in a low-income hotel (Davidson et al., 2003), using heroin while alone, (Davidson et al., 2003), and using drugs in public (Dietze, Jolley, Fry, Bammer, & Moore, 2006) or in abandoned buildings (Bohnert, Tracy, & Galea, 2009).

There are differences in the population at highest risk of a prescription OPR overdose compared with those at highest risk of an illicit drug overdose (Mack et al., 2013; Paulozzi, 2012). Further, the location of a fatal overdose varies by the type of drug involved. Illicit drug deaths, such as those involving heroin and cocaine, occurred more often in nonresidential, nonmedical locations. People dying of illicit drug overdoses appeared to be more likely than those dying of prescription OPR overdoses to die in a medical facility (Paulozzi, 2012). A study of overdose deaths in Connecticut found that 8.2% of OPR deaths occurred in public places compared to 19.7% of heroin-related deaths (Green, Grau, Carver, Kinzly, & Heimer, 2011). Describing situations in which drug users survive overdoses is important; understanding why others do not is critical. We know little about whether some determinants of survival (e.g., being alone, being inexperienced, concealing use from

bystanders) differ between prescription OPR and illicit drug users. A closer examination of the location of overdose deaths by type of drug (prescription OPR vs. illicit) for various risk groups may reveal important OPR-specific conditions that can guide overdose prevention activities.

2. Methods

2.1. Data

The Substance Abuse and Mental Health Services Administration's (SAMHSA) public health surveillance system, the Drug Abuse Warning Network (DAWN), collected data on deaths investigated by participating medical examiners/coroners (ME/C) in selected states and metropolitan areas, which CDC received via special request to SAMHSA. The ME/C investigations included information gathered from crime scene reports, police reports, interviews with family and friends, and autopsy reports, including drug toxicology. DAWN cases were identified through a retrospective review of decedent case files in each participating death investigation jurisdiction. The completed investigation records were reviewed by a trained abstractor and data were submitted electronically to SAMHSA (Substance Abuse and Mental Health Services Administration, 2012).

2.2. Measures

Deaths involving prescription OPR[1] or illicit drugs[2] were examined for all 12 states that participated in the DAWN ME/C monitoring effort (2008–2010): Massachusetts, Maryland, Maine, New Hampshire, New Mexico, Oklahoma, Oregon, Rhode Island, Utah, Virginia, Vermont, and West Virginia (N = 14,091 deaths). If reported, marijuana, only legally available at the time in three of the states, was coded among illicit drugs. The ME/C records provided detailed information about all drug-related deaths; however, no drug doses were quantified. Cases were operationally defined as any death determined by the ME/C to be related to recent drug use in which OPRs or illicit drugs were involved. The drug use might have been for legitimate, therapeutic purposes or for the purpose of drug abuse or misuse. We were not able to determine whether decedents had a prescription for the drugs they ingested. Manner of death was coded by ME/C′s as suicide, homicide, natural, unintentional (accidental), or could not be determined, which was assigned by the ME/C when a definitive ruling was not possible. No personal identifying information was available in the database and this study did not require human subjects' review. To ensure anonymity, counts of deaths in a category in each year that were less than four were suppressed. In many subcategories, counts were low in a single year, so data from 3 years were combined for analysis, further protecting decedent identity. Low counts precluded analyses of trends across years by state. When they could be determined, the ME/Cs also submitted race or ethnicity in the case record.

[1]Prescription opioid drugs include buprenorphine, codeine, dihydrocodeine, fentanyl, hydrocodone, hydromorphone, meperidine, methadone, morphine, nalbuphine, oxycodone, oxymorphone, propoxyphene, and narcotic analgesics not otherwise specified. Combination drugs were coded with opioid drug (e.g., acetaminophen/oxycodone was put in the oxycodone category).
[2]Illicit drugs include cocaine, heroin, marijuana, and methamphetamine.

Location of death in the DAWN ME/C data set was initially coded by abstractors into one of six categories: (1) decedent's home (i.e., owned or leased, or long-term care facility); (2) emergency room (ER); (3) other health care facility (i.e., drug treatment); (4) public place; (5) other private location (i.e., hotel or motel) or car; or (6) unknown. The abstractors were given instructions to select *other private location* if the death occurred in a neighbor's house or in a car. Examples of *public place* included “in a store, on the street, or in a park.” Because they are conceptually similar, emergency room (ER) and other medical department or treatment facility cases were combined into one *ER or health care facility* category. Because of the small numbers in each set, three categories (i.e., public place, other private home or car, or unknown) were combined into one *other or missing* category. Manner of death and racial or ethnic categories of decedents were coded by the abstractors based on the records.

3. Results

During a 3-year period (2008–2010), 14,091 prescription OPR or illicit drug-related deaths occurred in 12 states at home (55.7%), at emergency room or health care facilities (27.8%), or in other or missing (16.5%) locations. The majority of the deaths (78.9%) were prescription OPR drug-related, either without illicit drugs (63.4%), or in combination with illicit drugs (15.4%).

There were similar patterns for location of death among white and Hispanic decedents in all three drug categories (Table 1). The majority of white OPR-related deaths occurred at home (62.0%); compared to 64.0% of Hispanic decedents; among white illicit drug drug-related decedents, the largest percentage was at home (45.2%); similar to Hispanic decedents (43.6%). Black OPR related deaths were equally distributed between a home location (44.0%) and an ER (44.3%); the largest percentage for illicit drug-related death was an ER location (46.3%). Among those aged 20 years or older, more than half of the prescription OPR related deaths occurred at home, and although the percentages are lower, the highest category for illicit and combination drug-related deaths was also at home. Among those younger than 20 years, the highest percentage category for OPR-related deaths was home (48.9%); and ER for illicit (36.1%) and combination drug-related deaths (44.2%). The highest percentage category was at home for each manner of death and drug type.

Overall, 61.3% of the prescription OPR-related deaths occurred at home, 25.3% in an ER or health care facility, and 13.4% in another location (Table 2). More than half of OPR-related deaths occurred at home in every state, except MD (49.0%). Although in most states, the highest percentage of illicit drug-related deaths occurred at home, the percentages were lower in each state for illicit drug-related deaths compared with prescription OPR-related deaths. Maryland and Massachusetts had a higher percentage of illicit drug-related deaths occurring at an ER (41.5%) than at home (MD = 35.3%; MA = 41.3%), and Oregon's highest category was other or missing (42.3%; 4.4% of which was a public place and 37.8% was other). For deaths where both prescription OPR and illicit drugs were involved, the highest category for location of death was at home, except in Maryland (ER was highest, 44.4%) and Vermont (ER; 40.0%; other 40%).

4. Discussion and conclusions

This study characterized drug-related deaths by state, age, race or ethnicity, manner of death, and location of death to help guide overdose prevention efforts. Among whites and Hispanics, for all three drug categories, the largest percentage of decedents died at home. The overall percent-age of deaths occurring in public or unknown places was low. In every state except Utah, a higher percentage of illicit drug-related deaths than prescription OPR-related deaths occurred in an ER or health care facility. In all but one state (Maryland), the majority (>50%) of prescription OPR-related deaths happened at home. Black decedents (for prescription OPR and illicit drug categories) and those aged younger than 20 years (illicit and combination drugs) were also more likely to die within an ER or other health care facility.

The pharmacokinetics of opioids vary by drug and can vary even within a drug depending on route of administration (e.g., injection vs. oral administration). Death may occur rapidly depending upon potency and route of administration. Because users of illicit drugs often inject where they buy drugs, and signs of distress may appear rapidly, other users or strangers may notice that a victim is in distress. These other users, however, often do not call 911 for help, perhaps fearing police intervention (Dietze et al., 2006; Tobin, Davey, & Latkin, 2005; Wagner et al., 2015), but instead they may slap or pinch the victim, give them coffee, try to make them walk, inject them with a different substance (e.g., cocaine, salt, water), administer naloxone, or attempt CPR (Baca & Grant, 2005; Bohnert, Tracy, & Galea, 2012; Wagner et al., 2015). Researchers studying inner city illicit drug use have suggested that efforts to prevent overdose (i.e., good Samaritan laws or increased access to naloxone) could focus on those persons using drugs in public or in abandoned buildings (Bohnert et al., 2009). Prescription OPRs, however, are most often taken orally, absorbed slowly and variably, and with toxicity escalating gradually, perhaps after potential bystanders depart (Baca & Grant, 2005). In private homes, overdose prevention may fall to different groups of bystanders, friends, relatives, or caregivers, or their responses may differ. For instance, in private locations, which would include homes, bystanders may not call for emergency services after giving naloxone (Lankenau et al., 2013). Given the short duration of action of naloxone, a return of opioid intoxication from an OPR with a longer duration of action, might then lead to fatal rebound respiratory distress.

The percentage of prescription OPR-related deaths occurring at home generally increased with age, rising to more than two-thirds among those aged 50 years or older. Age and residential status are closely related, perhaps decreasing the chance of overdose witnesses as age increases. In the United States in 2013, 15% of those younger than 20 years and 21.5% of those aged 45–54 years or older lived alone (U.S. Census Bureau, 2013). As people age, they are more likely to live alone and spend more time alone, which may increase their chances of having an unwitnessed drug overdose.

This study has several limitations. We were unable to distinguish between decedents who had a prescription for an OPR and those who acquired them in other ways. Further, the data do not indicate the location where the drug was taken, the amount consumed, whether bystanders were present in the home, or whether bystanders (e.g., family or housemates)

knew the drug(s) were taken. These five pieces of information would greatly enhance the ability to understand the circumstances of the fatal event. Given increasing public awareness about naloxone and increased access to it in the United States, it would also be useful to know whether anyone in a household had access to it.

In addition, assigning responsibility to one drug in multidrug deaths is a challenge. Non-opioid prescription drugs were also reported by ME/Cs (e.g., alprazolam, diazepam, benzodiazepines), and they were sometimes taken in combination with prescription opioids, but not in sufficient quantity to present as a separate analytic category. Thus, any of the cases coded into the three drug categories used in this analysis (prescription opioids, illicit drugs, prescription opioids, and illicit drugs) could have involved other prescription, illicit, or over the counter drugs. The drugs involved in deaths might not all have been identified and documented. DAWN ME/C does not rely on a statistical sampling of MEs, and findings cannot be considered representative of ME/Cs who did not participate, and results cannot be extrapolated to the entire United States (Substance Abuse and Mental Health Services Administration, 2012). State laws dictate which deaths are subject to ME review, and these laws vary by state. Finally, toxicology testing practices can vary depending on local concerns, funding, and testing technology, which affects the number of deaths determined to be DAWN ME/C cases and the number of deaths attributed to particular drugs. It is likely that our results undercount the number of drug-related deaths.

Consideration of home-based interventions for prescription OPR pain reliever overdoses is a prudent public health strategy. On-site interventions, such as naloxone administration, rescue breathing, or calling 911, are clearly most useful when someone is there to administer them (Clark, Wilder, & Winstanley, 2014; Enteen et al., 2010). Naloxone given by first responders can reverse the effects of the opioid taken with high efficacy (Vilke, Sloane, Smith, & Chan, 2003), but even the administration of CPR by a bystander before an ambulance arrives can decrease hospitalizations among nonfatal cases (Dietze, Cantwell, & Burgess, 2002). SAMHSA's Opioid Overdose Toolkit (http://store.samhsa.gov/shin/content//SMA14-4742/Overdose_Toolkit.pdf) provides individuals and communities with information about preventing opioid-related overdose deaths and the U.S. Department of Health & Human Services offers a federal resource (www.hhs.gov/opioids) of tools and information for families, health care providers, law enforcement, and other stakeholders about prescription drug abuse and heroin use prevention, treatment, and response.

Patients and physicians can also take steps to reduce prescription OPR overdose deaths. Patients need to discuss all medications they are taking with their health care provider, use prescription drugs only as directed, store them in a secure place, and get help for substance abuse problems (National Treatment Referral Helpline 1-800-662-HELP [4357]). Physicians can discuss all pain treatment options, including ones that do not involve prescription drugs, as well as the risks and benefits of taking prescription painkillers. Physicians can follow guidelines for prescribing painkillers responsibly (http://www.cdc.gov/drugoverdose/prescribing/guideline.html), including the following: screening and monitoring for substance abuse and mental health problems; prescribing only the quantity needed on the basis of appropriate pain diagnosis; using patient–provider agreements combined with urine drug

tests for people who use prescription painkillers long-term; and avoiding combinations of prescription painkillers and benzodiazepines unless there is a specific medical indication.

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Biographies

Keith W. Easterling, PhD, MPH, currently has joint appointments as a Senior Lecturer in the Department of Pharmacology of the Emory University School of Medicine and in the inter-departmental Neuroscience and Behavioral Biology program at Emory University. Dr. Easterling studies opioids, stimulants, and club drugs, particularly their involvement in addiction and disease. His behavioral studies in the laboratory characterize the regulation of receptors, the effects of early-life stress on later drug use, and the identification of novel pharmacological therapies. His fellowship at CDC studying behavioral determinants of drug abuse and overdose was completed as part of an MPH degree program.

Karin A. Mack Ph.D. is the Associate Director for Science in the Division of Analysis, Research and Practice Integration at CDC's Injury Center. Her current projects include research on prescription drug overdoses and population level change to reduce injuries. Dr. Mack earned her Ph.D. at the University of Maryland and a Bachelor's degree from James Madison College of Michigan State University.

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opportunities for intervention. Drug and Alcohol Dependence. 2015; 153:215–220. [PubMed: 26091751]

Table 1

Location of drug-related deaths by demographics and manner of death, Drug Abuse Warning Network Medical Examiner, 2008–2010 (n = 14,091).

	Prescription opioids[a]			Illicit drugs[b]			Both prescription opioid and illicit drugs		
	Location								
	Home Row% (*n*)	ER/health care facility Row% (*n*)	Other or missing Row% (*n*)	Home Row% (*n*)	ER/ health care facility Row% (*n*)	Other or missing Row% (*n*)	Home Row% (*n*)	ER/ health care facility Row% (*n*)	Other or missing Row% (*n*)
Race/ethnicity									
White	62.0 (4979)	24.6 (1979)	13.4 (1073)	45.2 (993)	30.1 (661)	24.7 (543)	50.5 (894)	30.6 (541)	18.9 (334)
Black	44.0 (169)	44.3 (170)	11.7 (45)	33.8 (158)	46.3 (216)	19.9 (93)	41.4 (84)	38.4 (78)	20.2 (41)
Hispanic	64.0 (231)	21.1 (76)	15.0 (54)	43.6 (105)	32.0 (77)	24.5 (59)	55.1 (97)	27.3 (48)	17.6 (31)
Other/missing	62.0 (101)	21.5 (35)	16.6 (27)	25.0 (17)	38.2 (26)	36.8 (25)	51.6 (16)	29.0 (9)	19.4 (6)
Age group (years)									
0–19	48.9 (115)	37.4 (88)	13.6 (32)	34.0 (33)	36.1 (35)	29.9 (29)	30.2 (13)	44.2 (19)	25.6 (11)
20–29	52.0 (792)	31.0 (472)	17.0 (259)	40.1 (250)	32.6 (203)	27.3 (170)	43.8 (227)	35.3 (183)	20.8 (108)
30–39	57.2 (1108)	29.0 (562)	13.7 (266)	39.7 (265)	33.1 (221)	27.1 (181)	45.8 (240)	34.5 (181)	19.7 (103)
40–49	64.3 (1669)	22.4 (580)	13.3 (346)	42.5 (375)	35.5 (313)	22.0 (194)	54.4 (370)	27.2 (185)	18.4 (125)
50–59	68.2 (1383)	20.3 (411)	11.6 (235)	49.4 (291)	29.5 (174)	21.1 (124)	57.1 (216)	26.5 (100)	16.4 (62)
60+	66.5 (413)	23.7 (147)	9.8 (61)	51.3 (59)	29.6 (34)	19.1 (22)	69.4 (25)	22.2 (8)	_ [c]
Manner									
Suicide/homicide	65.8 (612)	19.1 (178)	15.1 (140)	53.8 (78)	20.0 (29)	26.2 (38)	68.5 (50)	13.7 (10)	17.8 (13)
Unintentional	61.6 (3931)	24.4 (1558)	13.9 (889)	43.1 (944)	32.2 (704)	24.7 (540)	50.6 (817)	30.1 (486)	19.3 (312)
Undetermined	57.4 (937)	32.1 (524)	10.4 (170)	39.2 (251)	38.6 (247)	22.2 (142)	45.6 (224)	36.7 (180)	17.7 (87)

[a] Opioid drugs = buprenorphine, codeine, dihydrocodeine, fentanyl, hydrocodone, hydromorphone, meperidine, methadone, morphine, nalbuphine, oxycodone, oxymorphone, propoxyphene, and narcotic analgesics not otherwise specified.

[b] Illicit drugs = cocaine, heroin, marijuana (if reported), and methamphetamine.

[c] Suppressed due to low count.

Table 2

Location of drug related death by drug class and state, Drug Abuse Warning Network Medical Examiner, 2008–2010 (n = 14,091).

	Location		
	Home Row% (*n*)	**ER or health care facility Row% (*n*)**	**Other or missing Row% (*n*)**
Prescription opioid[a]			
Massachusetts	52.3 (641)	33.4 (409)	14.3 (175)
Maryland	49.0 (478)	38.1 (372)	12.9 (126)
Maine	65.2 (223)	22.8 (78)	12.0 (41)
New Hampshire	65.1 (179)	24.0 (66)	10.9 (30)
New Mexico	72.2 (539)	14.6 (109)	13.3 (99)
Oklahoma	68.1 (906)	21.5 (286)	10.4 (138)
Oregon	65.4 (450)	16.6 (114)	18.0 (124)
Rhode Island	58.9 (168)	28.8 (82)	12.3 (35)
Utah	68.3 (528)	22.1 (171)	9.6 (74)
Virginia	61.9 (723)	25.1 (293)	13.0 (152)
Vermont	66.1 (82)	25.8 (32)	8.1 (10)
West Virginia	56.0 (563)	24.7 (248)	19.4 (195)
All states	61.3 (5480)	25.3 (2260)	13.4 (1199)
Illicit drug[b]			
Massachusetts	41.3 (198)	41.5 (199)	17.3 (83)
Maryland	35.3 (183)	41.5 (215)	23.2 (120)
Maine	33.3 (7)	33.3 (7)	33.3 (7)
New Hampshire	51.4 (37)	30.6 (22)	18.1 (13)
New Mexico	48.0 (147)	29.1 (89)	22.9 (70)
Oklahoma	44.0 (103)	40.2 (94)	15.8 (37)
Oregon	37.6 (187)	20.1 (100)	42.3 (210)
Rhode Island	48.1 (52)	41.7 (45)	10.2 (11)
Utah	62.2 (117)	20.2 (38)	17.6 (33)
Virginia	46.2 (169)	31.4 (115)	22.4 (82)
Vermont	44.4 (8)	27.8 (5)	27.8 (5)
West Virginia	39.4 (65)	30.9 (51)	29.7 (49)
All states	42.8 (1273)	33.0 (980)	24.2 (720)
Both opioid and illicit			
Massachusetts	45.3 (266)	36.1 (212)	18.6 (109)
Maryland	38.7 (117)	44.4 (134)	16.9 (51)
Maine	50.0 (11)	31.8 (7)	18.2 (4)
New Hampshire	50.0 (19)	31.6 (12)	18.4 (7)
New Mexico	59.8 (131)	19.2 (42)	21.0 (46)
Oklahoma	57.4 (62)	25.9 (28)	16.7 (18)
Oregon	56.0 (121)	19.4 (42)	24.5 (53)

	Location		
	Home Row% (*n*)	**ER or health care facility Row% (*n*)**	**Other or missing Row% (*n*)**
Rhode Island	61.2 (52)	24.7 (21)	14.1 (12)
Utah	62.3 (170)	22.3 (61)	15.4 (42)
Virginia	50.0 (73)	34.2 (50)	15.8 (23)
Vermont	_ [c]	40.0 (6)	40.0 (6)
West Virginia	39.3 (66)	36.3 (61)	24.4 (41)
All states	50.0 (1091)	31.0 (676)	18.9 (412)

[a] Opioid drugs = buprenorphine, codeine, dihydrocodeine, fentanyl, hydrocodone, hydromorphone, meperidine, methadone, morphine, nalbuphine, oxycodone, oxymorphone, propoxyphene, and narcotic analgesics not otherwise specified.

[b] Illicit drugs = cocaine, heroin, marijuana (if reported), and methamphetamine.

[c] Suppressed due to low count.