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Recognition and response to opioid overdose deaths—New Mexico, 2012

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Abstract

Purpose—Drug overdose deaths are epidemic in the U.S. Prescription opioid pain relievers (OPR) and heroin account for the majority of drug overdoses. Preventing death after an opioid overdose by naloxone administration requires the rapid identification of the overdose by witnesses. This study used a state medical examiner database to characterize fatal overdoses, evaluate witness-reported signs of overdose, and identify opportunities for intervention.

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Conflict of interest

No conflict declared by any author.

Contributors

All authors have materially participated in the research and/or article preparation and have approved the final submitted article.
L.P., K.N., S.L., M.L. provided project concepts.
B.L., L.P. designed the study.
B.L., B.S. performed data collection and analysis.
B.L. wrote this report.
B.S., L.P., J.B., K.N., S.L., D.S., M.L. reviewed and assisted in the writing of this report.

Methods—We reviewed all unintentional drug overdose deaths that occurred in New Mexico during 2012. Data were abstracted from medical examiner records at the New Mexico Office of the Medical Investigator. We compared mutually exclusive groups of OPR and heroin-related deaths.

Results—Of the 489 overdose deaths reviewed, 49.3% involved OPR, 21.7% involved heroin, 4.7% involved a mixture of OPR and heroin, and 24.3% involved only non-opioid substances. The majority of OPR-related deaths occurred in non-Hispanic whites (57.3%), men (58.5%), persons aged 40–59 years (55.2%), and those with chronic medical conditions (89.2%). Most overdose deaths occurred in the home (68.7%) and in the presence of bystanders (67.7%). OPR and heroin deaths did not differ with respect to paramedic dispatch and CPR delivery, however, heroin overdoses received naloxone twice as often (20.8% heroin vs. 10.0% OPR; $p < 0.01$).

Conclusion—OPR overdose deaths differed by age, health status, and the presence of bystanders, yet received naloxone less often when compared to heroin overdose deaths. These findings suggest that naloxone education and distribution should be targeted in future prevention efforts.

Keywords

Overdose deaths; Drug abuse; Opioid pain relievers; Heroin; Naloxone; Respiratory depression

1. Introduction

In the United States drug overdoses have become a national epidemic, and overdose deaths have more than doubled since 1999 (Paulozzi, 2012). In 2014, there were over 47,000 overdose deaths in the US at a rate of 14.7 per 100,000 population (Rudd et al., 2016). Opioids are the cause of the majority of overdose deaths (Jones et al., 2010). Prescription opioid pain relievers (OPR) and heroin account for most of the opioid related overdose deaths (Rudd et al., 2016). The burden of overdose deaths vary across the US, and the state of New Mexico has historically had a high drug overdose death rate compared with other states (Shah et al., 2008); its rate was 27.3/100,000 population in 2014 (Rudd et al., 2016).

In response to the increasing burden of overdose deaths, the New Mexico State Department of Health has adopted a public health agenda that stresses safe opioid prescribing guidelines and addiction services. This includes secondary prevention measures such as co-prescribing OPRs with the opioid antagonist, naloxone (Bachyrycz et al., 2016; NM DOH, 2011; NM DOH, 2014). Studies of overdose education and community-based naloxone distribution programs, OEND, suggest that these programs are a cost-effective mechanism to promote community naloxone-use (Bagley et al., 2015; Clark et al., 2014; Coffin and Sullivan, 2013; Haegerich et al., 2014). However, prevention of overdose death by naloxone is time-sensitive and relies on bystanders witnessing the overdose event, recognizing the signs of overdose, and taking appropriate actions to prevent the impending death. Previous literature suggests that as many as 85% of heroin overdoses may be directly witnessed (Bohnert et al., 2012; Coffin and Sullivan, 2013), however the rate of witnessing in OPR overdoses has not been described.

Some OEND programs have been successful in training witnesses to identify the signs of acute heroin overdose, including pinpoint pupils, deep unconsciousness, and respiratory depression (Clark et al., 2014). However, chronic OPR users have a less predictable and potentially less easily identifiable opioid overdose syndrome (Dahan et al., 2013). Rather than simple respiratory depression, chronic OPR-use increases the incidence of ataxic breathing patterns and central sleep apnea in a dose-dependent relationship (Guilleminault et al., 2010; Jungquist et al., 2012). It has been suggested that unusual snoring and disordered sleep respirations may provide a recognizable sign of impending OPR overdose (Oliver et al., 2001). The prevalence and recognition of these signs of OPR overdose in non-medical settings has not been well studied.

This study explored pre-terminal signs and circumstances of opioid overdose deaths in New Mexico to help inform recommendations for secondary prevention efforts like OEND programs. Additional information about the characteristics of persons at-risk, circumstances at the time of overdose, and the potential signs of overdose can be used to strengthen OEND programs and identify other opportunities for intervention. Specific objectives of this investigation were to characterize the population of fatal overdoses in New Mexico, identify pre-terminal signs of opioid overdose as reported by witnesses, and document resuscitation attempts made for different types of opioid overdoses.

2. Methods

In 2014, we abstracted data on unintentional drug overdose deaths from records maintained at the New Mexico Office of the Medical Investigator (OMI). The OMI is a centralized statewide agency responsible for investigating all unnatural deaths occurring in New Mexico with the exception of some deaths occurring on American Indian reservations and military installations. OMI records include death certificates, autopsy reports, toxicology reports, medical records, and death scene investigations. The medical examiner's determined manner of death and the proximate causes of death are also included in the database.

An unintentional drug overdose was defined as a death registered in New Mexico that occurred during 2012 and met the following criteria: (1) the OMI had assigned the manner of death as "accident" and the cause as "narcotic abuse" or "substance intoxication"; and (2) the decedent was more than 10-years-old. We examined only unintentional deaths as suicidal or homicidal overdoses represent the minority of overdose deaths and require alternative prevention strategies. We excluded decedents under 10 years of age as we were seeking to examine a population of opioid users and overdoses in young childhood are more likely incidental or accidental ingestions. Characterization of drug exposures was based on postmortem toxicology tests. We defined OPR as any natural, semi-synthetic, or fully synthetic opioid compound typically obtained by prescription, whether or not there was evidence of active prescription. In the body, heroin is rapidly metabolized to 6-monoacetylmorphine, morphine, and codeine, and is rarely found in post-mortem toxicology (Drummer, 2004). Therefore, we used an algorithm to define a heroin death as: (1) the presence of heroin in post-mortem blood; (2) the presence of 6-monoacetylmorphine plus either morphine or codeine; or (3) the presence of both morphine and codeine without active

prescriptions and direct evidence of intravenous drug use such as injection paraphernalia found at the scene.

We used OMI records to determine decedent demographic information and medical history. Drug-use history, both by prescription and illicit, was obtained from witness or family statements and, where available, medical records. We obtained height and weight measurements from autopsy reports and calculated a body mass index (BMI). We also reviewed autopsy reports for evidence of occult disease processes. For example, decedents with autopsy findings of hypertensive heart disease were considered to have chronic hypertension in addition to the documented medical history. The death scene report was used to abstract the circumstances of death including the place of death, the presence of witnesses, and any noted pre-terminal signs at overdose. We distinguished recorded reports from bystanders who were in the same location during or after the overdose, from those who directly witnessed the death (e.g. noted the decedent struggling to breathe, heard a thump and found the decedent down, or otherwise saw the decedent alive within minutes of the death). We recorded reports of abnormal behavior (i.e., slurred speech, agitation, confusion, vomiting) or pre-terminal sleep signs (i.e., abnormal respirations, snoring, choking, gurgling). Finally, we assessed opportunities for intervention by recording witness or Emergency Medical Service (EMS) response (i.e., 9-1-1 calls, CPR attempts, and naloxone administration).

We grouped decedent medical history into broad categories by body system, such as cardiac disease (e.g., hypertension, coronary artery disease, other heart disease), pulmonary disease (e.g., emphysema, asthma, pulmonary fibrosis), and liver disease (e.g., cirrhosis, hepatitis). A final category for “chronic disease” included other endocrine, rheumatologic, musculoskeletal, and neurologic conditions. Mental illness was defined as any major depression; psychosis, anxiety, or affective disorders; or previous suicidal ideation or attempts. We included only diseases that were chronic and excluded pathologic findings of acute processes related to the death itself, such as bronchopneumonia, pulmonary edema, acute strokes, or aspiration.

Post-mortem toxicology and autopsy reports were used to define the causative drug agents. For statistical analysis, we identified two mutually exclusive subsets of deaths caused by either OPR or heroin. Deaths caused by other drugs or by a combination of heroin and OPR were included in the study population but omitted from bivariate analysis. This allowed direct comparisons of OPR and heroin overdoses, deaths with similar pharmacologic mechanisms but potentially different populations and pre-terminal events. We performed chi-square tests on categorical variables and T-tests upon continuous variables to test differences between OPR and heroin deaths.

Finally, we performed a multivariable logistic regression to examine factors associated with naloxone administration. Our model included demographic and scene variables which were significantly different between OPR and heroin ($p < 0.05$) and also included the drug categories, OPR, heroin, or other. We tested for collinearity using a tolerance cutoff of <0.4. We performed backwards selection ($p < 0.1$) to select variables for inclusion in our final model. Statistical analysis was conducted using Epi-Info 7.1 and SAS 9.3.

The project protocol was reviewed and determined to be a non-research public health activity and exempt from IRB human subject research review.

3. Results

We identified 489 overdose deaths that met the case definition and abstracted data from all available records. Autopsy records were available in 481 deaths (98%), toxicology reports in 485 deaths (99%), death scene investigator reports in 485 deaths (99%), and health records in 174 deaths (36%).

The mean age of the study population was 43 years (Table 1). More than half of the decedents were 40–59 years of age (51.7%), while only four decedents were under the age of 18. Men represented 65.8% of decedents. White non- Hispanics constituted 46.8% of the decedents, and white Hispanics constituted 42.9%. The mean BMI was 29.4, and 40.1% of decedents had BMI's greater or equal to 30, defined as obese. The most common pre-existing medical conditions included cardiac diseases (58.1%), pulmonary disease (24.5%), chronic pain (29.4%), and other chronic diseases (28.4%). Mental illness was noted in 43.3% deaths. A large majority of decedents had a history of substance abuse (85.4%), and nearly a quarter of decedents (22.5%) had at least one previously documented overdose event.

Of the 489 overdose deaths identified, a total of 241 (49.3%) deaths occurred due to OPR without heroin, 106 (21.7%) died due to heroin without OPR, and 23 (4.7%) deaths were due to a combination of OPR and heroin. One hundred nineteen (24.3%) deaths were due to non-opioid substances including methamphetamines, cocaine, other illicit drugs, alcohol, or other pharmaceuticals either by prescription or over-the-counter. Heroin deaths were significantly younger (mean 38.4 years; $p < 0.01$), more often male (80.2%; $p < 0.01$), and more frequently white, Hispanic (60.4%; $p < 0.01$). OPR deaths occurred in individuals with a higher mean BMI (30.8 OPR vs. 27.9 heroin; $p < 0.01$). Furthermore, OPR deaths had higher rates of pre-existing cardiac disease, diabetes, chronic pain, or other chronic diseases ($p < 0.01$ for each). OPR deaths also more frequently had a documented history of mental illness (56.4% OPR vs. 25.5% heroin; $p < 0.01$). More heroin deaths had a history of substance abuse compared to OPR deaths (84.2% OPR vs. 91.5% heroin; $p = 0.04$), however, there was no difference in the history of previous overdoses between the two groups ($p = 0.2$). Post-mortem toxicology identified other co-ingested substances, in addition to OPR or heroin, in 371 (75.8%) decedents. There was no differences in overall substance co-ingestion between OPR and heroin. However, OPR deaths were more likely to have co-ingested other prescription medications (sedatives, antidepressants/antipsychotics, other) ($p < 0.01$ for all), while heroin deaths were more likely to have co-ingested cocaine, methamphetamines, and alcohol ($p = 0.09$, 0.04, and <0.01 respectively).

Drug overdose deaths occurred at a home (not necessarily that of the decedent) in 68.7% of deaths (Table 2). OPR deaths were more often in a home, (80.1% OPR vs. 66.0% heroin), while heroin deaths were more often in hotels/motels or outdoors (5.8% OPR vs. 20.7% heroin) ($p < 0.01$). Bystanders were present during the drug use or at the time of death in 67.7% of deaths without a significant difference between heroin and OPR. Deaths were

directly witnessed (e.g., bystanders found the decedent unresponsive but still exhibiting some signs of life, still breathing, foaming at the mouth, gurgling or choking, etc.) in 30.9% of deaths. OPR overdose deaths were more often witnessed by family (21.6% OPR vs. 11.3% heroin) while heroin overdose deaths were more often witnessed by friends or acquaintances (6.2% OPR vs 9.4% heroin) ($p = 0.02$). Witnesses reported signs of overdose including abnormal drowsiness, confusion or agitation, nausea or vomiting, snoring, gurgling, choking, or any other respiratory abnormalities in 94 deaths (19.2%) without difference between OPR and heroin deaths. However, abnormal drowsiness and abnormal snoring respirations were noted more commonly in OPR overdoses than in heroin overdoses ($p < 0.01$, $p = 0.02$ respectively).

While overdose deaths were directly witnessed in only 30.9% of deaths, EMS responded to 72.0% of the deaths without a difference between heroin and OPR overdoses ($p = 0.89$). CPR was performed on 46.4% of decedents (30.3% by bystanders, 38.7% by EMS), also without significant difference between heroin and OPR overdoses ($p = 0.51$). Home naloxone was administered by bystanders in 6 deaths (1.2%), and EMS administered naloxone in 59 deaths (12.1%). Naloxone was administered twice as often in heroin overdoses as in OPR overdoses (10.0% OPR vs. 20.8% heroin; $p < 0.01$). The death scene investigations and health care records indicated that drug paraphernalia was found on the scene in 55% of deaths, while autopsy found the stigmata of intravenous drug use (injection sites, skin ulcerations, skin infections, etc.) in 18.6% of deaths. Both the presence of drug paraphernalia and the stigmata of intravenous drug use were more associated with deaths by heroin ($p < 0.01$ for each).

Our multivariate analysis found that the following characteristics were associated with naloxone administration: directly witnessed deaths, deaths outside the home, and in decedents with visible signs of injection ($p < 0.01$). Age, sex, race, drug type, a past history of substance abuse, and the presence of drug paraphernalia were not associated with naloxone delivery (Table 3).

4. Discussion

This study represents all unintentional overdose deaths for individuals older than 10 years of age recorded by the New Mexico OMI in 2012. We found that OPR was the most common agent responsible for overdose deaths and occurred most often in middle-aged, white, non-Hispanic men. OPR overdose deaths, as compared to heroin deaths, had a larger burden of chronic medical illnesses including chronic pain. Most overdoses occurred in a home, where witnesses were present, most often family members. Witness observation of snoring and abnormal drowsiness was associated with OPR deaths. However, despite no differences between OPR and heroin for deaths directly witnessed, CPR performance, or paramedic calls, heroin deaths were more likely to receive naloxone than OPR deaths. As such, this study provides evidence that significant opportunities exist, especially within the OPR-using community, to secondarily prevent overdose deaths by promoting family education, increasing availability of home naloxone, and improving the rate of EMS naloxone administration during resuscitations of potential OPR overdose victims.

This study is methodologically similar to other studies involving the review of medical investigator databases (Cerdá et al., 2013; Visconti et al., 2015). Similar to these and other demographic studies, our findings indicate that OPR overdoses are more common in persons older than 40 years, while heroin overdoses are more common in a younger population (Cerdá et al., 2013; Paulozzi, 2011). In this study women had fatal OPR overdoses at a rate nearly equal to males, which is consistent with a recent report from the Centers for Disease Control and Prevention that identified increased OPR-use among women (CDC, 2013). Also, the racial/ethnic diversity of the study population reflects the social landscape of New Mexico, and the high rate of heroin use in the Hispanic population in New Mexico has been previously described (Shah et al., 2008). Our study did report a high rate of substance co-ingestion, similar to that reported by Visconti et al., however our study had fewer heroin and OPR co-ingestions (4.7%) as compared to the study from San Francisco (31.3%) during the same time period (Visconti et al., 2015). This discrepancy may be related to the relatively small numbers of heroin overdose deaths in Visconti et al.'s study and the challenges of identifying heroin in post-mortem toxicology.

The frequency of co-morbid medical conditions among the OPR overdose deaths has also been described in similar studies. Morasco et al. (2010) reviewed the medical history of Veterans Administration patients and found that patients prescribed opioids for non-cancer pain were more likely to have cardiac disease, pulmonary disease, mental illness, and substance abuse than veterans without opioid prescriptions. The rate of obstructive sleep apnea (OSA) in this study also seems consistent with previously published data describing its association with middle age, male gender, obesity, and chronic conditions such as hypertension and diabetes (Young et al., 2008). However, the medical literature is conflicting regarding the role of opioids in the development or exacerbation of OSA (Guilleminault et al., 2010; Wang et al., 2013). Therefore, while we did find an association of snoring to OPR deaths, it is difficult to determine whether OSA played any causal role in the deaths. Regardless, if abnormal snoring was identified as a sign of impending overdose, these deaths might have been secondarily prevented by witnesses with immediate access to naloxone delivery devices.

Similar to previous literature, the majority of overdoses in this study occurred in a private home and in the presence of others (Bohnert et al., 2012; Cerdá et al., 2013; Coffin and Sullivan, 2013). Despite there being no significant difference in most indicators of scene response (i.e., witnessing, performance of CPR, paramedic response), victims of fatal heroin overdose received naloxone at twice the rate of OPR overdoses (20.8% vs. 10.0%). This difference appeared to be attributable to heroin deaths being more commonly witnessed, occurring outside the home, and showing the signs of injection drug use, likely all factors that helped EMS rapidly identify the overdose. A possible alternative is that OPR overdoses might be rescued more often and are, therefore, underrepresented in death records. OPRs are typically orally ingested, and are, therefore, absorbed into the body more slowly than injected opioids such as heroin. There may be a longer rescue window and OPR overdoses may potentially receive life-saving treatment more often. Our study did not include successful resuscitations and cannot evaluate this possibility, nor examine other factors that may influence naloxone utilization. Nevertheless, there is growing evidence in the literature that disparities do exist in naloxone delivery, and this study reaffirms that EMS protocols

should call for the use of naloxone when clinically indicated irrespective of the patient characteristics or the presence of drug paraphernalia (Davis et al., 2014; Faul et al., 2015; Sumner et al., 2016).

This study is not without limitations. This was a retrospective review of OMI records from a single year, and susceptible to errors in laboratory results, death investigations, and medical examiner determinations. Furthermore, OMI records were inconsistently complete, and missing data in EMS reports and medical records may have introduced information bias, as older patients and persons with chronic illness may have had more complete records. The population examined only included deceased overdose victims, and did not capture drug overdose survivors. Inclusion of these persons would have provided an opportunity to assess risk. The study relied upon post-mortem accounts from families, friends, or bystanders, who are subject to recall bias. Finally, death scene investigations were highly variable in format and detail. Therefore, it is possible that “open and shut” death investigations of heroin overdoses may have contained less information than overdose deaths of uncertain circumstance (e.g. an individual found dead in bed at home without direct evidence of drug use).

Further study of this subject would ideally be based on information systematically collected prospectively. A standard questionnaire could be designed to obtain more complete and consistent information on events preceding the overdose, the medical and social history, and the scene response. Such a questionnaire could be formatted to be used by EMS, police, and death investigators. Finally, further studies would benefit from routine linkage to state-wide prescription drug monitoring program databases and electronic medical records to help distinguish legally prescribed medications from diverted pharmaceuticals and illicit drugs.

In New Mexico, overdose deaths that occur in a home and in the presence of witnesses present an opportunity for secondary prevention. This study provides evidence of potential utility for naloxone in homes where there is known OPR-use. Furthermore, efforts to educate families on the signs of overdose and the use of naloxone may promote earlier interventions when overdoses are witnessed and potentially reversible. Finally, EMS protocols should promote the early administration of naloxone and medical care providers should consider the possibility of opioid overdose even in the absence of the signs of injection drug-use. Such efforts may have a payoff for OPR deaths comparable to than that seen in harm reduction programs directed primarily at the heroin-using populations (Walley et al., 2013).

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Table 1

Decedent Characteristics by Drug Category, New Mexico, 2012.

	Total (N = 489) n (%)	OPR without heroin (N = 241) n (%)	Heroin without OPR (N = 106) n (%)	P-value (OPR vs heroin)
Demographics				
Age (mean, median)	43.4, 44.1	44.6, 44.6	38.4, 36.5	<0.01
Age Group (years)				<0.01
10–29	92 (18.8)	37 (15.4)	34 (32.1)	
30–39	100 (20.4)	48 (19.9)	26 (24.5)	
40–49	140 (28.6)	72 (29.9)	26 (24.5)	
50–59	113 (23.1)	61 (25.3)	14 (13.2)	
≥60	44 (9.0)	23 (9.5)	6 (5.7)	
Sex				<0.01
Male	322 (65.8)	141 (58.5)	85 (80.2)	
Race/Ethnicity				<0.01
White, Non- Hispanic	229 (46.8)	138 (57.3)	36 (34.0)	
White, Hispanic	210 (42.9)	88 (36.5)	64 (60.4)	
American Indian	39 (8.0)	12 (5.0)	5 (4.7)	
Other	11 (2.2)	3 (1.2)	1 (0.9)	
Pre-existing Medical Conditions				
BMI (mean, median)	29.4, 27.9	30.8, 29.5	27.9, 26.1	<0.01
Documented Medical History	404 (82.6)	215 (89.2)	70 (66.0)	<0.01
Cardiac Disease	284 (58.1)	156 (64.7)	42 (39.6)	<0.01
Pulmonary Disease	120 (24.5)	67 (27.8)	23 (21.7)	0.23
Liver Disease	105 (21.5)	42 (17.4)	31 (29.2)	0.01
Diabetes	70 (14.3)	45 (18.7)	4 (3.8)	<0.01
Cancer	8 (1.6)	3 (1.2)	0 (0.0)	0.25
Other Chronic Disease	139 (28.4)	91 (37.8)	12 (11.3)	<0.01
Chronic Pain	144 (29.4)	120 (49.8)	8 (7.5)	<0.01
Surgical History	93 (19.0)	63 (26.1)	12 (11.3)	<0.01
Obstructive Sleep Apnea	17 (3.5)	14 (5.8)	2 (1.9)	0.11
Home Oxygen Use	25 (5.1)	21 (8.7)	3 (2.8)	0.05
Tobacco Use History	330 (67.5)	185 (76.8)	63 (59.4)	<0.01
Mental Illness History	212 (43.3)	136 (56.4)	27 (25.5)	<0.01
Substance Abuse History	418 (85.4)	203 (84.2)	97 (91.5)	0.04
Overdose History	110 (22.5)	67 (27.8)	22 (20.8)	0.17
Alcohol Abuse History	190 (38.9)	89 (36.9)	34 (32.1)	0.38
Co-ingested substances				
Multiple substances	371 (75.8)	205 (85.1)	88 (83.0)	0.63
Cocaine	77 (15.7)	27 (11.2)	19 (17.9)	0.09
Methamphetamine	82 (16.8)	19 (7.9)	16 (15.1)	0.04
Marijuana	32 (6.5)	17 (7.1)	4 (3.8)	0.24
Prescription Sedatives	165 (33.7)	123 (51.0)	17 (16.0)	<0.01

	Total (N = 489) n (%)	OPR without heroin (N = 241) n (%)	Heroin without OPR (N = 106) n (%)	P-value (OPR vs heroin)
Antidepressants/Antipsychotics	99 (20.2)	77 (32.0)	7 (6.6)	<0.01
Other Prescription Medications	33 (6.7)	28 (11.6)	3 (2.8)	<0.01
Non-prescription Medications	9 (1.8)	7 (2.9)	1 (0.9)	0.26
Alcohol	146 (29.9)	58 (24.1)	41 (38.7)	<0.01

Table 2

Scene findings of drug overdose deaths by drug category, New Mexico, 2012.

	Total (N = 489) n (%)	OPR without heroin (N = 241) n (%)	Heroin without OPR (N = 106) n (%)	P-value (OPR vs heroin)
Location of Death				<0.01
Home	336 (68.7)	193 (80.1)	70 (66.0)	
Hospital/Medical Facility	69 (14.1)	32 (13.3)	12 (11.3)	
Hotel/Motel	21 (4.3)	7 (2.9)	8 (7.5)	
Outdoors/Street	56 (11.5)	7 (2.9)	14 (13.2)	
Other	7 (1.4)	2 (0.8)	2 (1.9)	
Bystander present[a]	331 (67.7)	173 (71.8)	79 (74.5)	0.60
Death witnessed[b]	151 (30.9)	77 (32.0)	29 (27.4)	0.02
Family	76 (15.5)	52 (21.6)	12 (11.3)	
Friends	38 (7.8)	15 (6.2)	10 (9.4)	
Strangers	5 (1.0)	0 (0.0)	3 (2.8)	
Medical Personnel	27 (5.5)	10 (4.1)	4 (3.8)	
Reported signs of overdose	94 (19.2)	52 (21.6)	17 (16.0)	0.3
Abnormal drowsiness	29 (5.9)	20 (8.3)	0 (0.0)	<0.01
Abnormal confusion or agitation	8 (1.6)	0 (0.0)	1 (0.9)	0.13
Vomiting or nausea	8 (1.6)	3 (1.2)	2 (1.9)	0.64
Snoring	36 (7.4)	28 (11.6)	4 (3.8)	0.02
Gurgling/Choking	22 (4.5)	11 (4.6)	6 (5.7)	0.66
Other Respiratory Abnormalities	21 (4.3)	11 (4.6)	6 (5.7)	0.66
EMS called to scene	352 (72.0)	188 (78.0)	82 (77.4)	0.89
CPR performed on scene	227 (46.4)	118 (49.0)	56 (52.8)	0.51
Performed by bystander	148 (30.3)	79 (32.8)	36 (34.0)	0.83
Performed by EMS	189 (38.7)	97 (40.2)	47 (44.3)	0.48
Naloxone administered on scene	62 (12.7)	24 (10.0)	22 (20.8)	0.01
Administered by Bystanders	6 (1.2)	2 (0.8)	3 (2.8)	0.15
Administered by EMS	59 (12.1)	24 (10.0)	20 (18.9)	0.02
Drug paraphernalia on scene	269 (55.0)	127 (52.7)	78 (73.6)	<0.01
Signs of intravenous drug use	91 (18.6)	9 (3.7)	62 (58.5)	<0.01

[a] Bystander present either during drug use, during drug intoxication, or immediately preceding death.

[b] Decedent found with signs of life (e.g. breathing, foaming at the mouth, turning blue, etc.).

Table 3

Odds of Naloxone Administration Before Death, New Mexico—2012.

Variable	cOR	p-value	aOR[a]	Confidence Limits
Age				
10–29	5.05	0.17		
30–39				
40–49				
> = 50				
Sex				
Male	0.11	0.74		
Female				
Race/Ethnicity				
White, non- Hispanic	2.21	0.33		
White, Hispanic				
Other				
Location of Death				
Died outside of home	11.56	<0.01	1 (ref)	
Died at home			0.36	0.19–0.66
Witnessed death				
No	16.87	<0.01	1 (ref)	
Yes			2.24	1.16–4.32
Drug paraphernalia present				
No	1.26	0.26		
Yes				
Signs of injection				
No	10.92	<0.01	1 (ref)	
Yes			2.29	1.07–4.92
Drug type				
OPR	8.11	0.02	1 (ref)	
Heroin			1.40	0.62–3.17
Mixed/Other			0.92	0.44–1.93
Substance abuse history				
No	2.83	0.09	1 (ref)	
Yes			5.07	0.65–39.80
Overdose history				
No	1.00	0.99		
Yes				
Chronic pain				
No	1.61	0.20		
Yes				
Mental illness history				
No	0.27	0.61		

Variable	cOR	p-value	aOR[a]	Confidence Limits
Yes				
Abnormal behavior[b]				
No	0.25	0.88		
Yes				
Abnormal sleep signs[c]				
No	8.23	<0.01	1 (ref)	
Yes			1.94	0.84–4.48

[a]Adjusted via backwards selection from a full model for variables with cOR p < 0.1.

[b]Abnormal behavior: drowsiness, confusion, agitation, or vomiting.

[c]Abnormal sleep signs: snoring, choking, gurgling, other respiratory abnormalities