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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.

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.

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

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(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.