



## Research Paper

## Using medical examiner case narratives to improve opioid overdose surveillance



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## ABSTRACT

**Background:** Current opioid overdose mortality surveillance methods do not capture the complexity of the overdose epidemic. Most rely on death certificates, which may underestimate both opioid analgesic and heroin deaths. Categorizing deaths using other characteristics from the death record including route of drug administration may provide useful information to design and evaluate overdose prevention interventions.

**Methods:** We reviewed California Electronic Death Reporting System records and San Francisco Office of the Chief Medical Examiner (OCME) toxicology reports and investigative case narratives for all unintentional opioid overdose deaths in San Francisco County from 2006 to 2012. We chose this time period because it encompassed a period of evolution in local opioid use patterns and expansion of overdose prevention efforts. We created a classification system for heroin-related and injection-related opioid overdose deaths and compared demographic, death scene, and toxicology characteristics among these groups.

**Results:** We identified 816 unintentional opioid overdose deaths. One hundred fifty-two (19%) were standard heroin deaths, as designated by the OCME or by the presence of 6–monoacetylmorphine. An “expanded” classification for heroin deaths incorporating information from toxicology reports and case narratives added 20 additional heroin deaths (13% increase), accounting for 21% of all opioid deaths. Two hundred five deaths (25%) were injection-related, 60% of which were attributed to heroin. A combined classification of expanded heroin and injection-related deaths accounted for 31% of opioid overdose deaths during this period.

**Conclusions:** Using additional sources of information to classify opioid overdose cases resulted in a modest increase in the count of heroin overdose deaths but identified a substantial number of non-heroin injection-related opioid analgesic deaths. Including the route of administration in the characterization of opioid overdose deaths can identify meaningful subgroups of opioid users to enhance surveillance efforts and inform targeted public health programming including overdose prevention programs.

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## Introduction

Opioid overdose is a leading cause of death in the United States (Calcaterra, Glanz, & Binswanger, 2013; Warner, Chen, & Makuc, 2009; Warner, Chen, Makuc, Anderson, & Minino, 2011). In recent years, national opioid overdose surveillance data demonstrate that the types of opioids causing overdose are evolving (Rudd, Seth, David, & Scholl, 2016). While opioid analgesics were responsible for the rapid increase in overdose mortality during the 2000s, deaths due to heroin and synthetic opioids have been responsible for more recent increases (Calcaterra et al., 2013; Peterson et al.,

2016; Rudd, et al., 2016). Existing opioid overdose surveillance strategies may not completely capture changing trends in opioid overdose. For example, fentanyl mixed with or sold as heroin or other prescription opioids increases the risk of overdose death, but is often difficult to identify using post-mortem toxicology and is inconsistently specified as a cause of death on death certificates (Gladden, Martinez, & Seth, 2016; Lung & Lemos, 2014; Rudd et al., 2016; Somerville et al., 2017).

When data are available, public health authorities track opioid overdose mortality by the type of opioid involved. Opioid types are extracted from International Classification of Disease (ICD) codes on death certificates (CDC, 2015), which may result in underestimation or misclassification of specific opioid types (Jauncey, Taylor, & Degenhardt, 2005; Mertz, Janssen, & Williams, 2014; Ruhm, 2016). In addition, up to one quarter of death certificates with drug overdose listed as the cause of death do not include the specific drugs implicated (Warner, Paulozzi, Nolte, Davis, & Ls, 2013). In response to these limitations, epidemiologists and researchers have proposed more comprehensive overdose surveillance efforts relying on multiple data sources including cause of death registries, toxicology reports, autopsies, medical examiner reports, and prescription drug monitoring systems (Cone et al., 2003; Hargrove et al., 2017; Hirsch, Proescholdbell, Bronson, & Dasgupta, 2014; Landen et al., 2003).

Death certificates are imperfect data sources for identifying specific causative drugs in overdose. In addition, they do not typically include information about the route of drug administration. Route of administration is notable because injection of opioids is associated with a higher risk of addiction and unintentional overdose (Black, Trudeau, Cassidy, Budman, & Butler, 2013; Darke & Hall, 2003; Liebling, Green, Hadland, & Marshall, 2017), and because people who inject drugs (PWID) may be qualitatively distinct from people who ingest opioids by means other than injection (Brugal et al., 2002; Novak & Kral, 2011). Furthermore, interventions designed to reduce opioid overdose mortality tend to target populations that are not defined exclusively by the type of opioids that they use. For instance, in regions of the United States where laws permit syringe access and lay naloxone distribution, naloxone has historically been delivered through syringe access programs targeting PWID (Wheeler et al., 2015). As a result, we would expect early lay naloxone provision in such regions to reduce opioid overdose mortality for PWID, regardless of the type of opioid ingested.

Currently, it is unclear how much of the opioid analgesic epidemic is occurring among PWID who transitioned from illicit opioids to opioid analgesics, as opposed to occurring among a new population of individuals who were not previously using illicit opioids. Obtaining accurate estimates of the number of people who inject drugs is challenging due to multiple methodologic limitations (Lansky et al., 2014), yet recent data suggest increases in the rates of injection of opioid analgesics (Jones, Christensen, & Gladden, 2017). Using additional data sources to track the route of drug administration may help to clarify the evolving relationships between injection drug use (IDU), specific opioid types, and overdose mortality.

In order to improve our understanding of opioid overdose mortality in San Francisco, we undertook a detailed review of San Francisco County opioid overdose medical examiner case narratives and toxicology reports from 2006 to 2012. In line with methods used by others (Davidson et al., 2003; Mertz et al., 2014; Visconti, Santos, Lemos, Burke, & Coffin, 2015), we reviewed medical examiner case narratives, toxicology reports, and cause of death designations. We created a classification system for heroin-related and injection-related overdose deaths. We then compared demographic, death scene, and toxicology characteristics among these subgroups. We chose to review overdose cases from 2006 to

2012 because they occurred during a time of evolving opioid use patterns and expansion in overdose prevention programming in San Francisco (Enteen et al., 2010).

## Methods

### *Study setting and data sources*

We identified all opioid overdose deaths occurring in San Francisco County from 2006 to 2012 in the California Electronic Death Reporting System (CA-EDRS), a statewide electronic repository of vital records. San Francisco is located in Northern California with a population of approximately 860,000. We reviewed a list of all potential overdose deaths and manually selected cases that included an opioid or unspecified substance in the cause of death. We excluded cases that occurred outside of San Francisco County or deaths designated as a suicide or homicide by the medical examiner. For cases that identified an unspecified substance in the cause of death, we manually reviewed toxicology reports and included cases that were found to involve opioids.

After generating a complete list of opioid overdose deaths from review of CA-EDRS records, we reviewed investigative case narratives from the San Francisco Office of the Chief Medical Examiner (OCME) for all identified cases. The OCME is required to investigate all deaths that may be related to drug or alcohol use. When a case comes under the jurisdiction of the OCME, an investigator arrives at the death scene typically within an hour of death being declared by first responders. Investigators prepare a report that describes the events preceding death, the discovery of the body by witnesses, the medical history of the decedent, and characteristics of the death scene that may have contributed to the death such as drug paraphernalia, body positioning, and environmental exposures. OCME medical personnel collect postmortem toxicology specimens from all decedents unless other circumstances prevent testing (e.g., decomposition, delay in reporting death). A physician with certification in internal medicine and addiction medicine [E.H.] completed review of OCME toxicology reports and investigative case narratives for all overdose cases during this period, recording qualitative variable abstraction in a database. A second physician [P.C.] reviewed all cases; discrepancies in variable assignment were resolved through team case review. The Institutional Review Board of the University of California San Francisco approved as exempt this analysis of death records (IRB# 15-17539).

### *Measures and definitions*

#### *Decedent and death scene characteristics*

We obtained demographic characteristics, including age, gender, and race/ethnicity of decedents from CA-EDRS. We abstracted additional measures related to the decedent and death scene from OCME case narratives. These measures included history of heroin use and history of IDU as obtained by the OCME investigators through interviews with healthcare providers, witnesses, friends, and family members. We also abstracted the location in which the decedent was found as well as who found the decedent. For location, we identified single room occupancy (SRO) hotels, privately owned institutions known to have lower cost monthly rents and typically located in low-income areas of the city, by referencing the name and address of death to a list of SROs generated by the San Francisco Department of Public Health. For who found the decedent, we defined a cohabitant as an individual staying with the decedent at the time of the overdose event, which included permanent and temporary arrangements. We abstracted whether prescription opioids or injection drug paraphernalia (e.g. syringes, cookers, or tourniquets) were found at the death scene.

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