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Heroin and pharmaceutical opioid overdose events: Emergency medical response characteristics

Caleb J. Banta-Green[a,f,*], Phillip O. Coffin[b,d], Jennie A. Schoeppe[a,c], Joseph O. Merrill[d], Lauren K. Whiteside[e,f], Abigail K. Ebersol[d]

[a] Alcohol and Drug Abuse Institute, University of Washington, Seattle, WA, USA
[b] San Francisco Department of Public Health, San Francisco, CA, USA
[c] Group Health Research Institute, Seattle, WA, USA
[d] Department of Medicine, University of Washington School of Medicine, Seattle, WA, USA
[e] Division of Emergency Medicine, University of Washington Seattle WA, USA
[f] Harborview Injury Prevention and Research Center, Seattle WA, USA

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ABSTRACT

Background: Emergency Medical Services (EMS) data may provide insight into opioid overdose incidence, clinical characteristics, and medical response. This analysis describes patient characteristics, clinical features, and EMS response to opioid overdoses, comparing heroin and pharmaceutical opioid (PO) overdoses, using a structured opioid overdose case criteria definition.

Methods: A case series study was conducted. EMS medical staff screened cases for possible overdoses and study staff categorized the likelihood of opioid overdose. Medical form data were abstracted. Patient characteristics, clinical presentation, and medical response to heroin and PO-involved overdoses were compared with bi-variate test statistics.

Results: We identified 229 definite or probable opioid overdose cases over six months: heroin in 98 (43%) cases (10 also involved PO), PO without heroin in 85 (37%) cases, and 46 (20%) that could not be categorized and were excluded from analyses. Heroin overdose patients were younger than PO (median age 33 v 41 ($p < 0.05$)), more often male (80% v 61% ($p = < 0.01$)), intubated less (8% v 22%, $p < 0.01$) and more likely to be administered naloxone (72% v 51%, $p < 0.01$). No significant differences were found between heroin and PO overdoses for initial respiratory rate, Glasgow Coma Scale score, or co-ingestants, but heroin users were more likely to have miotic pupils ($p < 0.01$).

Conclusions: While heroin and PO events presented similarly, heroin-involved cases were more likely to receive naloxone and less likely to be intubated. Standardized case definitions and data documentation could aid opioid overdose surveillance as well as provide data for measuring the impact of professional and lay interventions.

1. Introduction

1.1. Opioid morbidity and mortality

Opioid overdoses, heroin and pharmaceutical, are a major public health problem. The use, abuse and morbidity and mortality related to these substances is inter-related and shifting over time (Jenkins et al., 2011; Jones, 2013; Pollini et al., 2011). Prescribing, use, and misuse of pharmaceutical opioids have begun to level off in some regions, (Cicero and Ellis, 2015; Degenhardt et al., 2015; Jones et al., 2014, 2013; Paulozzi et al., 2014, 2006) but there are indications that heroin use and fatal overdoses are increasing (Cicero et al., 2014; Jones, 2013; Jones et al., 2015). Opioid addiction is a chronic and relapsing condition, thus elevated rates of overdose are likely to persist well into the future. Moreover, opioids remain a commonly prescribed medication for many conditions including acute pain, some chronic pain conditions, and cancer related pain, so the potential for overdoses is likely to also persist (Volkow et al., 2011).

1.2. Documenting non-fatal pharmaceutical opioid and heroin overdoses

Non-fatal opioid overdoses are much more common than fatal

* Corresponding author at: Alcohol and Drug Abuse Institute, University of Washington, Seattle, WA, USA..
E-mail addresses: calebbg@uw.edu (C.J. Banta-Green), pcoffin@gmail.com (P.O. Coffin), jennie.schoeppe@gmail.com (J.A. Schoeppe), joem@uw.edu (J.O. Merrill), laurenkw@uw.edu (L.K. Whiteside), aebersol@uw.edu (A.K. Ebersol).

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overdoses. While approximately one of every 100 heroin users will die each year of an overdose, another 15–25 will have a non-fatal overdose (Darke et al., 2003) (Jenkins et al., 2011). Annual overdose incidence rates are much less well understood for pharmaceutical opioid users. In one study of chronic pain patients prescribed at least 100 milligrams morphine equivalent per day, approximately 2% had a non-fatal or fatal overdose each year (Dunn et al., 2010). Timely and accurate estimates of overdose incidence and the resulting burden of medical care can be difficult to obtain whether from general population surveys, medical records reviews, or reports from programs dispensing take-home naloxone kits for overdose treatment.

Emergency Medical Services (EMS) data can provide unique insight into both non-fatal and fatal opioid overdoses that is difficult to obtain from other data sources. There are standard physical exam findings that should be documented in all overdose victims that any EMS provider should be able to identify and report in the written record. For example, patients with opioid overdose can have constricted pupils, decreased respiratory rate and a decreased level of consciousness which can be measured using the Glasgow Coma Score (GCS) (Tintinalli et al., 2011). GCS was initially used in trauma patients with head injury, but is a standard way to understand any patient's best motor, verbal and eye response at any given time and is scored from 3 to 15 with a higher score indicating a higher level of consciousness. To date, most research on opioid overdoses using EMS data has relied upon the administration of naloxone for identifying opioid overdose cases, but not all patients having an opioid overdose are treated with naloxone, biasing overdose estimates (Cantwell et al., 2005; Knowlton et al., 2013; Lindstrom et al., 2015; Merchant et al., 2006; Sporer et al., 1996). For patients who are not breathing but have a pulse, the first step in the Basic Life Support (BLS) algorithm is rescue breathing or assisted ventilation. BLS measures such as providing adequate oxygenation and assisting with ventilation can often stimulate spontaneous respirations in opioid overdose victims and they can regain consciousness alleviating the need for naloxone. Conversely, patients with polysubstance overdoses that include opioids, such as those with sedatives or alcohol, may need more support than rescue breathing (e.g., BLS) and naloxone. Patients with polysubstance overdose may require advanced life support (ALS) measures such as tracheal intubation and ventilator support. Tracheal intubation is a procedure that can be performed by trained EMS personal for patients who are not breathing and do not have a normal level of consciousness after attempts at rescue breathing and other BLS interventions have failed. After successful tracheal intubation (e.g., placement of a tube in the trachea) respirations can be provided via a ventilator to keep patients alive who are not able to breathe spontaneously (American Heart Association, 2015).

1.3. The potential value of emergency medical services data

In order to better understand how to prevent fatal overdoses and provide emergency medical care for those who do overdose, as well as to evaluate the possible impact of medical, law enforcement, and public health intervention efforts, it is necessary to understand how often opioid overdoses are occurring, characteristics of those patients experiencing opioid overdoses, and what care they receive from emergency medical responders. Reviewing EMS data is one way to obtain detailed event-level data on serious medical events including opioid overdoses, this type of data has been important for gaining insights into other medical conditions. For instance, improved pre-hospital recognition and treatment of out-of-hospital cardiac arrest with community based interventions that include improved rates of bystander CPR (cardiopulmonary resuscitation) or chest compressions and access to AED's (automated external defibrillator) improved outcomes in many communities (Chan et al., 2014; Malta Hansen et al., 2015; Nichol et al., 2014). Additionally, data collected from EMS providers can improve detection of influenza surveillance (Rosenkötter et al., 2013).

1.4. Intent of analysis

In the current era of frequent opioid overdoses, comparing heroin to pharmaceutical opioid overdoses can provide valuable insight into the event-level characteristics of this disorder. The objectives of this study were to describe and compare characteristics of patients and of paramedic treatment provided for heroin and pharmaceutical opioid overdoses evaluated by paramedics in a large urban EMS system using structured opioid overdose criteria. In addition, we wanted to explore the annual incidence rate of non-fatal opioid overdoses.

2. Materials and methods

2.1. Study design

A case series study of opioid overdose events was conducted.

2.2. Setting and population

The population studied included those who received care from Advanced Life Support (ALS) paramedics in the city of Seattle, Washington (population 621,829 in 2011). Only cases necessitating a paramedic response were included in this analysis. Patients transferred by basic life support (BLS) did not generate a MIRF for review.

2.3. Study protocol

All EMS paper medical incident report forms (MIRFs) from the City of Seattle for cases from 6 alternating months in 2011 (February, April, June, August, October, December) were initially reviewed independently by a physician and a nurse on staff at Seattle Medic 1, the unit within the Seattle Fire Department that oversees ALS services. The MIRFs serve as the paramedics' record for patient information and care delivered. Photocopies of the MIRF's were provided for further review by the study team. The University of Washington Institutional Review Board approved the study procedures including a waiver of consent.

Research staff separated the records into definite, probable and possible opioid overdose categories based on a set of criteria (See Fig. 1). A medical expert (P.O.C.) reviewed the possible cases, including the written narrative provided by the paramedic, and determined whether or not they were a probable overdose. One month's worth of all paramedic MIRFs were re-screened to evaluate the sensitivity and specificity of the initial chart screening process for opioid overdose case detection.

2.4. Measurements

The following data points were extracted from the MIRF: cardiac arrest, overdose type, date of incident, type of location of incident, age of patient, gender of patient, race/ethnicity of patient, incident mechanism code e.g., drug overdose, drug/alcohol withdrawal, incident type code (e.g., decreased level of consciousness, respiratory depression), tracheal intubation, time of day, date, patient transport location, whether the patient died, initial respiratory rate, initial Glasgow Coma Scale score, initial pupil status, EMS administration of naloxone, response to naloxone (level of consciousness and respiratory rate), suicidal intent based on paramedics' opinion, and a text summary of social and environmental context. The following data points were extracted from a computerized summary of ambulance dispatches: a protocol number used to identify the incident, the initial level of rescue officials present (EMTs, paramedics, or paramedics with additional rescue workers), and final response type. A determination of whether heroin and/or pharmaceutical opioids were involved in the case was based upon the narrative written by paramedics and may have been noted in a medication list or otherwise; for instance, the narrative may have read "patient said to have taken heroin". If both heroin and prescription