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Research Paper

Unintentional opioid overdose deaths in New York City, 2005–2010: A place-based approach to reduce risk

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ABSTRACT

Background: Drug poisoning is the leading cause of death from injuries in the United States. In New York City (NYC), unintentional drug poisoning death is the third leading cause of premature death, and opioids are the most commonly occurring class of drugs. Opioid overdose prevention efforts aim to decrease the number of people at risk for overdose and to decrease fatality rates among those using opioids by improving overdose response. These strategies can be enhanced with a comprehensive understanding of the settings in which overdoses occur.

Methods: A cross-sectional analysis of unintentional opioid poisoning deaths in NYC from 2005 to 2010 ($n = 2649$). Bivariate and multivariate analyses were performed to identify factors associated with settings of fatal opioid overdose.

Results: Three-quarters of the sample overdosed in a home; one-tenth in an institution, and the remaining in a public indoor setting, the outdoors or another non-home setting. Factors associated with overdosing at home include female gender, college degree, residence in the borough of Staten Island, and combined use of opioid analgesics and benzodiazepines. Factors associated with overdosing outside of the home include ages 35–64, residence in Manhattan, and use of heroin.

Conclusion: The sample represents a near census of unintentional opioid overdose deaths in NYC during the study period, and allows for the identification of demographic and drug-using patterns by setting of overdose. Because most opioid overdoses occur inside the home, opioid overdose response programs can most efficiently address the epidemic by both reducing the risk of overdose in the home and targeting those who may be in the home at the time of an overdose for overdose response training. Approaches include minimizing risk of misuse and diversion through safe storage and safe disposal programs, physician education on prescribing of opioid analgesics and benzodiazepines, prescription of take-home naloxone, and Good Samaritan laws.

Introduction

Poisoning is the leading cause of death from injuries in the United States, surpassing motor vehicle crashes (Warner, Chen, Makuc, Anderson & Miniño, 2011). In New York City (NYC), unintentional drug poisoning death is the third leading cause of premature death (Zimmerman et al., 2013). Drug poisoning deaths involving opioid analgesics have more than tripled nationally since 1999 (Warner, Chen, Makuc, Anderson & Miniño, 2011) and doubled in NYC since 2005 (Bradley O'Brien, Paone, Shah & Heller, 2011). Opioids were involved in nearly three-quarters of all NYC unintentional drug poisoning deaths in 2010 (NYC Department of Health and Mental Hygiene, 2013).

Opioid overdose prevention efforts in the United States can be classified into two primary types: efforts that aim to prevent and decrease the number of individuals at risk of opioid overdose, and efforts that decrease the number of fatal opioid overdoses. Primary prevention efforts include preventing individuals from initiating drug misuse. Other primary prevention efforts aim to prevent the transition of drug misuse to drug dependence among at-risk individuals. Effective overdose prevention strategies include engaging populations at risk in opioid replacement therapy and educating users about behaviors that may put them at risk of opioid overdose. Additional prevention strategies include utilizing Prescription Monitoring Programs (PMP) to reduce risky prescribing of opioid analgesics and benzodiazepines, educating physicians on responsible opioid prescribing practices, and patient education on safe storage and disposal of prescription opioids.

Efforts aimed at decreasing the case fatality rate of opioid overdose are achieved by improving overdose response through

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strategies such as naloxone distribution to laypersons and first responders (Centers for Disease Control and Prevention, 2012). In addition, Good Samaritan laws aim to increase calls for emergency response to drug overdose by protecting witnesses from arrest for drug possession when calling emergency services.

The identification of opioid overdose settings can aid in the strategic enhancement of opioid overdose prevention efforts. Previous studies have explored drug overdose settings (Bernstein et al., 2007; Bohnert, Tracy & Galea, 2009; Davidson et al., 2003; Cerdá et al., 2013), and have reported varying findings, ranging from 28% (Davidson et al., 2003) to 83% overdosing in private homes (Cerdá et al., 2013). However, these studies did not evaluate if demographics or drug use characteristics were associated with overdose settings. Drug use is a socially and culturally bound phenomenon, making it plausible that an individual's demographic characteristics and the drugs used may in fact affect the setting and risk level of overdosing. The discovery of common opioid overdose settings, as well as any differences by opioid type and demographic characteristics, can help inform the development and implementation of targeted and effective overdose response programs.

Methods

Sample

The sample included all unintentional opioid poisoning deaths among NYC residents aged 15–84 from January 1, 2005 to December 31, 2010, using linked death certificates and medical examiner files. Unintentional drug poisoning death was defined as a death for which the death certificate recorded (i) the manner of death as "accidental," and (ii) the codes for underlying causes of death as "poisoning by a psychoactive substance (excluding alcohol or tobacco)" (ICD-10 codes X40-X44) or a "mental or behavioral disorder due to a psychoactive substance" (ICD-10 codes F11-16, F18-19). The sample was limited to decedents with toxicology results positive for one or more opioids. Methadone was recorded for toxicologies including methadone or methadone metabolite. Heroin was recorded if any of the following were present in toxicology: morphine, 6-monoacetylmorphine (6-MAM), diacetylmorphine, acetylcodeine, morphine and codeine, 6-MAM and codeine, and diacetylmorphine and codeine. Opioid analgesics were recorded if any of the following were present in toxicology: codeine (without heroin), alfentanyl, fentanyl, carfentanyl, sufentanil, hydrocodone, hydromorphone, meperidine, oxycodone, oxymorphone, papavirine, pentazocine, propoxyphene, thebaine, tramadol, or phenacetin.

All manners of death other than unintentional, i.e. intentional, undetermined, or homicide were not included. The sample excluded non-NYC residents and decedents whose borough of residence was unknown or missing. The final analytic sample excluded decedents with missing overdose setting.

Variables and definitions

Demographic variables included gender, race/ethnicity, age, education, borough of residence, and neighborhood poverty. Race/ethnicity included non-Hispanic white, non-Hispanic black, Hispanic, and Non-Hispanic other, which collapsed other race/ethnicities and missing. Age was categorized as 15–24, 25–34, 35–44, 45–54, 55–64, and 65–84 years. Education level was determined from the death certificate and defined as less than high school, completed high school or General Education Development exam, some college, and college or more. Neighborhood poverty was defined from United Hospital Fund area (UHF, an aggregation of zip codes averaging nearly 200,000 population) of residence, as the percent of residents with incomes below 100% of the Federal Poverty Level per American Community Survey and Census 2000. Neighborhood poverty was categorized into four groups: low (<10% of residents below poverty), medium (10% to <20% below poverty), high (20% to <30% below poverty), and very high (≥30% below poverty).

Settings of overdose were abstracted from medical examiner files as a text field and categorized into five groups. The decedent's home or others' homes were collapsed into the category home. Home was defined as a non-staffed residential address, including independent apartments, houses, and public housing. Staffed residences such as homeless shelters and supportive housing facilities were not included in the 'home' category. Other locations were classified as non-home, and stratified into four sub-groups: institutional residences, public indoors, outdoors, and other. Institutional residences included homeless shelters, single room occupancies, supportive housing, nursing homes, and assisted living facilities. Public indoor settings included bars, restaurants, hotels, public bathrooms, offices, building lobbies, elevators, and stairways. Outdoors included parks, streets, roofs, cars, buses, and subways. The setting category other included prison, drug treatment programs, and hospitals.

Drugs and drug metabolites were abstracted from toxicology reports of medical examiner files, and included alcohol, benzodiazepines, cocaine, methadone, heroin, and opioid analgesics. Given the large number of patients in methadone maintenance in NYC, methadone is reported separately from other opioid analgesics. Drugs were not mutually exclusive; a decedent's toxicology could be positive for more than one drug. In addition to single drug classifications, four drug combinations were analyzed: heroin and opioid analgesics, heroin and methadone, methadone and opioid analgesics, and opioid analgesics and benzodiazepines.

Data analysis

A descriptive analysis of demographics and drug types was conducted for the total sample and for subsamples by setting. All drugs and drug combinations were analyzed as dummy variables. Age-adjusted rates were calculated for demographics and drug types, while age-standardized rates were calculated for each age group. Rates were age-adjusted to Census 2000. To obtain aggregate rates across six years, age-adjusted rates were averaged.

Logistic regression was used to compare characteristics of those who overdosed at home to those who overdosed elsewhere. Interactions were tested between demographics and between each drug. Multivariate logistic regression using backward selection was conducted to determine predictors of overdose settings. All variables significant at 0.05 were kept in the final model. Adjusted odds ratios and corresponding 95% confidence intervals were computed, and model fit was evaluated. All analyses were conducted using SAS 9.2 (Cary, NC).

Results

From 2005 to 2010, there were 4083 unintentional drug overdose deaths in NYC. The greatest number of unintentional drug poisoning deaths occurred in 2006 ($n = 838$) and decreased each subsequent year to a low of 541 in 2010 (data not presented). A total of 1434 decedents did not meet inclusion criteria (criteria were not mutually exclusive and could overlap): 1126 decedents did not test positive for any opioids, 179 were not NYC residents, 127 were missing borough of residence, and 53 were missing setting of overdose. The final analytic sample was comprised of 2649 decedents. Proportions of overdoses by setting did not change significantly over the study period, so all years were collapsed. There