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Research paper

Heroin and fentanyl overdoses in Kentucky: Epidemiology and surveillance

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ABSTRACT

Background: The study aims to describe recent changes in Kentucky's drug overdose trends related to increased heroin and fentanyl involvement, and to discuss future directions for improved drug overdose surveillance.
Methods: The study used multiple data sources (death certificates, postmortem toxicology results, emergency department [ED] records, law enforcement drug submissions, and prescription drug monitoring records) to describe temporal, geographic, and demographic changes in drug overdoses in Kentucky.
Results: Fentanyl- and heroin-related overdose death rates increased across all age groups from years 2011 to 2015 with the highest rates consistently among 25–34-year-olds. The majority of the heroin and fentanyl overdose decedents had histories of substantial exposures to legally acquired prescription opioids. Law enforcement drug submission data were strongly correlated with drug overdose ED and mortality data. The 2016 crude rate of heroin-related overdose ED visits was 104/100,000, a 68% increase from 2015 (62/100,000). More fentanyl-related overdose deaths were reported between October, 2015, and September, 2016, than ED visits, in striking contrast with the observed ratio of >10 to 1 heroin-related overdose ED visits to deaths. Many fatal fentanyl overdoses were associated with heroin adulterated with fentanyl; <40% of the heroin overdose ED discharge records listed procedure codes for drug screening.
Conclusions: The lack of routine ED drug testing likely resulted in underreporting of non-fatal overdoses involving fentanyl and other synthetic drugs. In order to inform coordinated public health and safety responses, drug overdose surveillance must move from a reactive to a proactive mode, utilizing the infrastructure for electronic health records.

Background

From 2010 to 2014, U.S. heroin-related overdose deaths more than tripled, and heroin became the drug involved in the largest proportion (23%) of overdose deaths in the U.S. in 2014 (Warner, Trinidad, Bastian, Minino, & Hedegaard, 2016). The increase in heroin use over the last decade has occurred in the context of broader poly-substance use (Jones, Logan, Gladden, & Bohm, 2015; Rigg & Monnat, 2015) with prior non-medical use of prescription opioids being a strong predictor for transition to heroin use (Carlson, Nahhas, Martins, & Daniulaityte, 2016; Cerda, Santaella, Marshall, Kim, & Martins, 2015; Lankenau et al., 2012; Muhuri, Gfroerer, & Davies, 2013). The transition from non-medical use of prescription opioids to heroin and the associated rise in heroin-related overdose mortality and morbidity were fueled by the increased availability and accessibility of heroin, and decreased price of pure heroin (Caulkins, 2001; CEWG, 2009; Cicero, Ellis, & Harney, 2015; Fries, Anthony, Cseko, Gaither, & Schulman, 2008; Mars, Bourgois, Karandinos, Montero, & Ciccarone, 2014; NDIC, 2009, 2011; Rosenblum, Unick, & Ciccarone, 2014; Siegal, Carlson, Kenne, & Swora, 2003; Unick, Rosenblum, Mars, & Ciccarone, 2014). State and national policies that focused on reducing the misuse and diversion of prescribed controlled substances (e.g., abuse-deterrent formulation of OxyContin and other opioids,

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implementation of prescription drug monitoring programs) have been identified as facilitators for the transition from non-medical use of prescription opioids to heroin although, as Compton, Jones, and Baldwin (2016) have pointed out, the transition to heroin was part of a larger epidemic of opioid-related disorders and deaths (Alpert, Powell, & Pacula, 2017; Compton et al., 2016; Unick, Rosenblum, Mars, & Ciccarone, 2013). The recent escalation of fentanyl-related overdose deaths in the U.S. (DEA, 2015; Frank & Pollack, 2017; Gladden, Martinez, & Seth, 2016; Peterson et al., 2016) further demonstrates that unless the demand for opioid use is addressed (e.g., via adequate opioid use disorder treatment capacity, support for individuals in recovery, and prevention of medically unnecessary opioid use initiation), people with opioid addiction will use any opioids they can obtain and afford, disregarding associated overdose risks.

The risk factors associated with increased opioid misuse, addiction, and overdose are magnified in the state of Kentucky. Kentucky had the third highest age-adjusted drug overdose mortality rate in the U.S. in 2015 (29.9/100,000) (Rudd, Seth, David, & Scholl, 2016), a 21% increase from 24.7/100,000 in 2014 (Rudd, Aleshire, Zibbell, & Gladden, 2016). Kentucky was one of eight states with high burdens of synthetic opioid-involved deaths primarily attributable to fentanyl (Gladden et al., 2016) and had the sixth-highest number of fentanyl seizures in the U.S. in 2014 (CDCHAN). The number of Kentucky resident fentanyl-related deaths tripled from 2013 to 2014, and almost doubled from 2014 to 2015 (Slavova, Akers, & Rock, 2016).

The historical reasons for the continuous escalation of overdose mortality in Kentucky include aggressive marketing of OxyContin, “pill mills”, and overprescribing of opioids, as well as cultural and environmental stressors associated with declining employment opportunities, high prevalence of disease and injury, persistent poverty, long-standing problems meeting population needs for general health care, non-pharmaceutical pain management options, and substance use treatment (Case & Deaton, 2015; Durning, 2004; HAC, 2012; HRSA; KDPH, 2013; Paulozzi, Mack, & Hockenberry, 2014; RUPRI, 2006; TFAH, 2017; Tunnell, 2005; Winninger, 2005).

As stakeholders and legislators seek more effective responses to an overdose epidemic of historic proportions, the need for timely and accurate drug overdose surveillance data has become increasingly urgent.

The aims of this study were to describe the changes in temporal, geographic, and demographic trends in heroin and fentanyl overdoses in Kentucky, to illustrate the critical importance of using data from multiple public health and public safety sources to inform state and national drug overdose prevention programs and policies, and to discuss future directions for improved drug overdose surveillance.

Methods

Data sources

Sources included: (1) death certificate (DC) records, Kentucky Office of Vital Statistics, 1999–2016; data for recent years are still provisional; records for October–December 2016 were incomplete and not included in the analysis; (2) overdose death postmortem toxicology, Kentucky State Medical Examiners’ Office, 2013–2016; (3) emergency department (ED) discharge billing records, Kentucky Office of Health Policy, 2008–2016; (4) prescription drug monitoring program (PDMP) data from the Kentucky All-Schedule Prescription Electronic Reporting (KASPER), Office of Inspector General, 2008–2016; and (5) heroin and fentanyl submissions to the Kentucky State Police (KSP) crime labs, 2013–2016. Multiple-cause-of-death (MCOD) data were used to compare Kentucky and U.S. drug overdose mortality rates (CDC/NCHS, 2016). A multi-source drug overdose surveillance system that includes the listed data sources was established at the Kentucky Injury Prevention and Research Center (KIPRC), acting on behalf of the Kentucky Department for Public Health, Cabinet for Health and Family Services.

Definitions and analysis

Drug overdose deaths were identified as deaths with underlying cause of death ICD-10 (International Classification of Diseases, Tenth Revision) codes in the range X40–X44, X60–X64, X85, or Y10–Y14 (Rudd et al., 2016b). Drugs contributing to drug overdoses were identified by multiple-cause-of-death codes T36-T50 (ISW7, 2012). In addition, DC text describing the cause of death and how the injury occurred was searched for contributing drugs (Davis, Sabel, Wright, & Slavova, 2015).

For ED data, heroin-related overdoses were identified by ICD-9-CM codes 965.01 or E850.0 (before October 1, 2015), or ICD-10-CM codes T40.1X1-T40.1X4 with a 7th character of ‘A’ or ‘D’ (on or after October 1, 2015) in any diagnosis field. Overdoses related to opioids other than heroin were identified similarly with ICD-9-CM codes 965.00, 965.02, 965.09, E850.1, or E850.2 (before October 1, 2015), or ICD-10-CM codes T40.0X, T40.2X, T40.3X, T40.4X, or T40.6X, an intent (6th) character 1–4, and an encounter (7th) character ‘A’ or ‘D’ (ISW7, 2012; ISW9, 2016). ED visit numbers reflect treatment episodes and could be higher than the number of distinct overdose patients.

ICD-10 and ICD-10-CM allow tracking overdoses related to methadone (T40.3), “synthetic opioids other than methadone” [e.g., fentanyl, tramadol, buprenorphine] (T40.4), and natural or semi-synthetic opioids other than heroin (T40.2).

Reported frequencies and rates by specific drug are not mutually exclusive unless specifically noted. If an overdose included two or more drugs, the overdose was counted with each relevant drug category. Described drug counts and rates should be interpreted as measures of involvement of these drugs in Kentucky overdose mortality and morbidity.

Continuous opioid use (COU) was defined as having records for opioid analgesics with at least 90 days’ supply in a six-month period, and with gaps between prescriptions of no more than 30 days (Edlund et al., 2010). Daily dose morphine milligram equivalents (MME) were calculated for each patient [all opioid analgesics except buprenorphine] (CDC, 2016; PDMPTTAC, 2013).

Based on 2013 rural-urban continuum codes, counties with Beale codes from 4 to 9 were considered rural; counties with Beale codes of 1–3 were categorized as urban (Fernander, Rayens, Adkins, & Hahn, 2014; USDA, 2013).

Pearson's Chi-square test was used in tests for association between categorical variables. Pearson correlation coefficients were used as a measure for linear correlation between overdose counts and KSP crime lab submissions. SAS® v.9.4 and ArcGIS software were utilized for statistical analysis and visualizations.

Results

Changes over time in drug overdose mortality and morbidity

Mortality

Between 2000 and 2015, increases in overdose deaths in Kentucky and across the U.S. were attributable primarily to natural or semi-synthetic opioid use (e.g., oxycodone, oxymorphone, hydrocodone, morphine) (Fig. 1). By 2015, involvement of heroin and synthetic opioids in overdose deaths had approached that of natural or semi-synthetic opioids, in Kentucky and nationwide. Heroin-related overdose mortality rates in Kentucky more than doubled from 2011 (1.3/100,000) to 2012 (3.4/100,000). The state's