

Drug Overdose Deaths in Colorado Final data for 1999-2017

Prepared by:

Kirk Bol, MSPH

Registries and Vital Statistics Branch, Center for Health and Environmental Data

Colorado Department of Public Health and Environment

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Introduction

Nationally and in Colorado, drug use disorders and fatal overdoses remain significant public health concerns (Hedegaard et al, 2018). The Colorado Department of Public Health and Environment (CDPHE) is monitoring the severity of the epidemic using a variety of available data, including mortality data from death certificates registered in Colorado. This report will highlight trends in drug overdose deaths among Colorado residents and describe associated health disparities.

Methods

CDPHE's Registries & Vital Statistics Branch manages the analysis of mortality data collected through the registration of death certificates in Colorado. Mortality data analyzed for this report represent drug overdose deaths from 1999-2017 among individuals who resided in Colorado. International Classification of Disease, 10th Revision (ICD-10) codes for underlying cause of death were used to identify fatal drug overdoses, using published definitions from the Centers for Disease Control and Prevention's National Center for Health Statistics, as shown in Appendix 1 (Chen et al, 2014; Hedegaard et al, 2017; World Health Organization, 2016; Hedegaard et al, 2018).

Drug overdose deaths (also referred to as drug overdoses in this report) were further classified according to the involvement of specific substances, including prescription opioid analgesics (prescription opioids), illicit opioids (including heroin), methamphetamine and cocaine, and manner (intent) of the overdose, including unintentional (accidental), intentional self-harm (suicide), and those of undetermined intent.

All death rates are presented as deaths per 100,000 population. Unless otherwise marked, all rates are age-adjusted to ensure comparability between occurrence of deaths over time, across geographic areas and between demographic groups. All age-adjusted rates were computed using the direct method and applying the 2000 US Standard Population (Klein & Schoenborn, 2001). A single overdose death may involve more than one type of drug; in these cases, the death will be included in the counts and rates of each applicable drug type (unless otherwise noted). The frequency and nature of drug overdose deaths involving multiple drug types are also explored in this report.

Drug overdoses were also examined for geographic and demographic variability. Demographic characteristics explored include gender, age, race/ethnicity of the decedent, and area-based poverty. Area-based poverty is measured by calculating the percent of the population in each decedent's census tract of residence that is living at or below the federal poverty level (CDPHE, 2017). These population data come from the 2012-2016 five-year American Community Survey estimates made available by the U.S. Census Bureau. The poverty level categories used in this report include 0-9.9 percent of the population in a decedent's community living at or below the federal poverty level, 10-19.9 percent, 20- 29.9 percent and 30 percent or greater. Counties in Colorado were categorized into Health Statistics Region (HSR), a method often used to examine regional differences for various health indicators within Colorado and ensure that rates can be presented for rural and frontier regions with smaller populations.

The source of all death data is the Vital Statistics Program, Colorado Department of Public Health and Environment. Population estimates utilized for all rates, except those for area-based poverty level, were based on the 2017-vintage estimates provided by the State Demography Office, Colorado Department of Local Affairs.

Results

Overall drug overdose trends

From 1999-2017, there have been 12,821 drug overdose deaths among Colorado residents, and during this time period, rates increased nearly every year. In 2000, the number of overdose deaths was 351, and the age-adjusted rate was 7.8 deaths per 100,000 population; while in 2017, there were 1,012 overdose deaths and the rate increased to 17.6. Until 2015, Colorado's rate of overdose death was higher than the national rate; however, the national rate exceeded Colorado's rate since 2015. Both Colorado's overdose death rate and the nation's have continued to increase in the most recent years of data available (Figure 1).

Opioids continue to propel the overdose epidemic in Colorado; overdoses involving opioids, including opioid analgesics (prescription opioid painkillers) and illicit opioids like heroin nearly quadrupled from 2.5 deaths per 100,000 population in 1999 to 9.8 in 2017. However, overdose deaths involving stimulants have become more common, including those involving methamphetamine (and other psychostimulants with abuse potential), which has been increasing from a relatively stable rate of less than one death per 100,000 population prior to 2011 to 5.2 in 2017. Additionally, overdose deaths involving cocaine, while declining in the years leading up to 2013, have increased from a rate of 1 death per 100,000 population that year to 1.7 in 2017.

Improved drug reporting on Colorado death certificates has led to a decline in unspecified drug overdose deaths and may account for some of the increases in rates for overdoses involving specified drug types. Drug overdoses involving 'only unspecified drugs', which have declined from a high in 2011 of 4.9 per 100,000 population (more than 30 percent of drug overdose deaths) to 2.6 (or 15% of drug overdose deaths). This represents a marked improvement in the quality and completeness of drug specificity provided on Colorado death certificates in the past six years.

Among drug overdose deaths involving opioids (prescription or illicit), the larger contributor over time has been overdoses involving prescription opioids, the rate of which has increased from 1.7 per 100,000 in 1999 to 6.5 in 2017. Rates of overdose deaths involving heroin have increased from 0.9 in 1999 to 3.9 in 2017. These both represent a near quadrupling of overdose death rates in both categories; however, while the rate of prescription opioid overdoses increased steadily in the past 20 years, the increase in heroin death rates is more recent, having begun increasing only in 2011 (Figure 2).

Figure 1. Age-adjusted drug overdose death rates, by involvement of specific drug types: Colorado residents, 1999-2017.

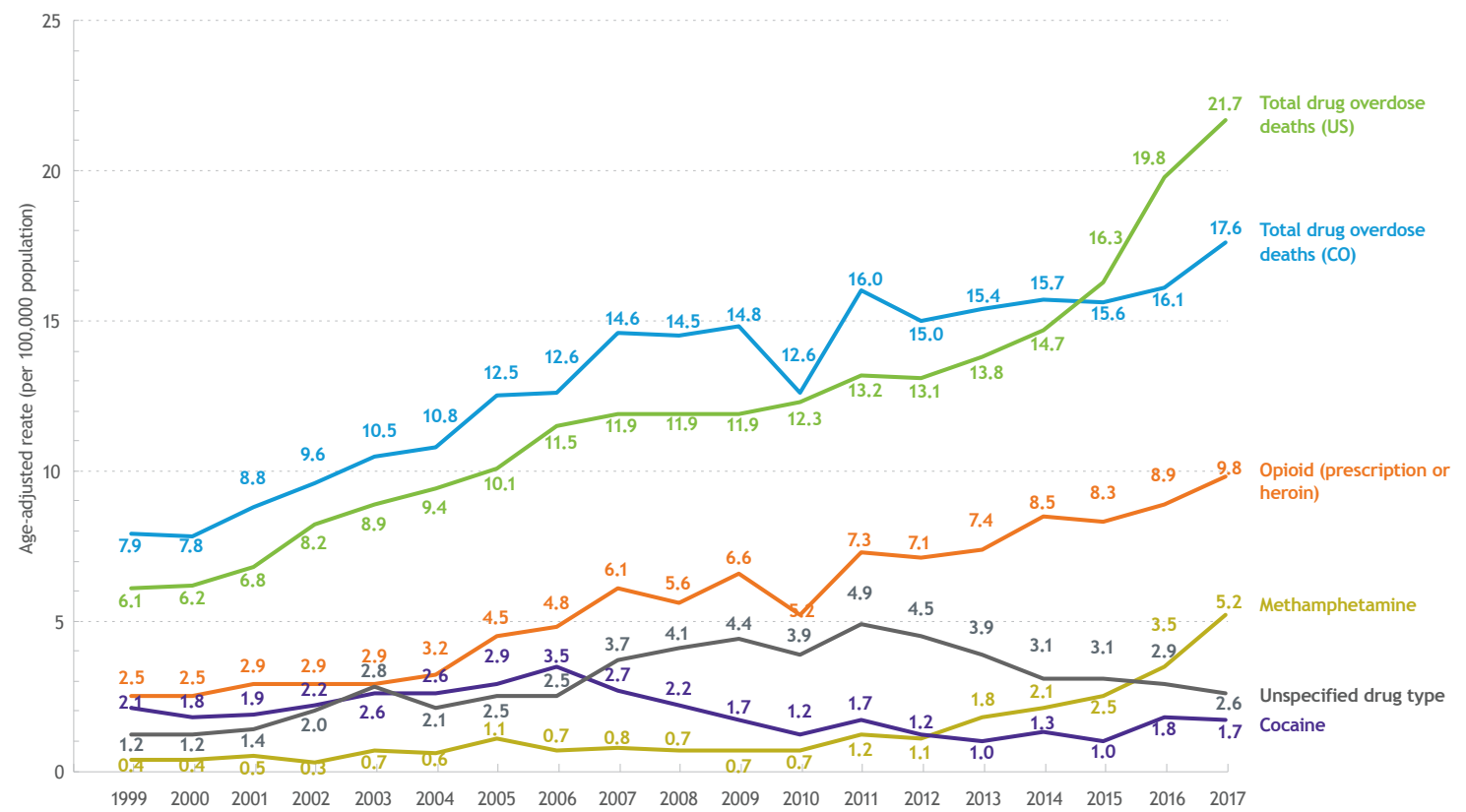
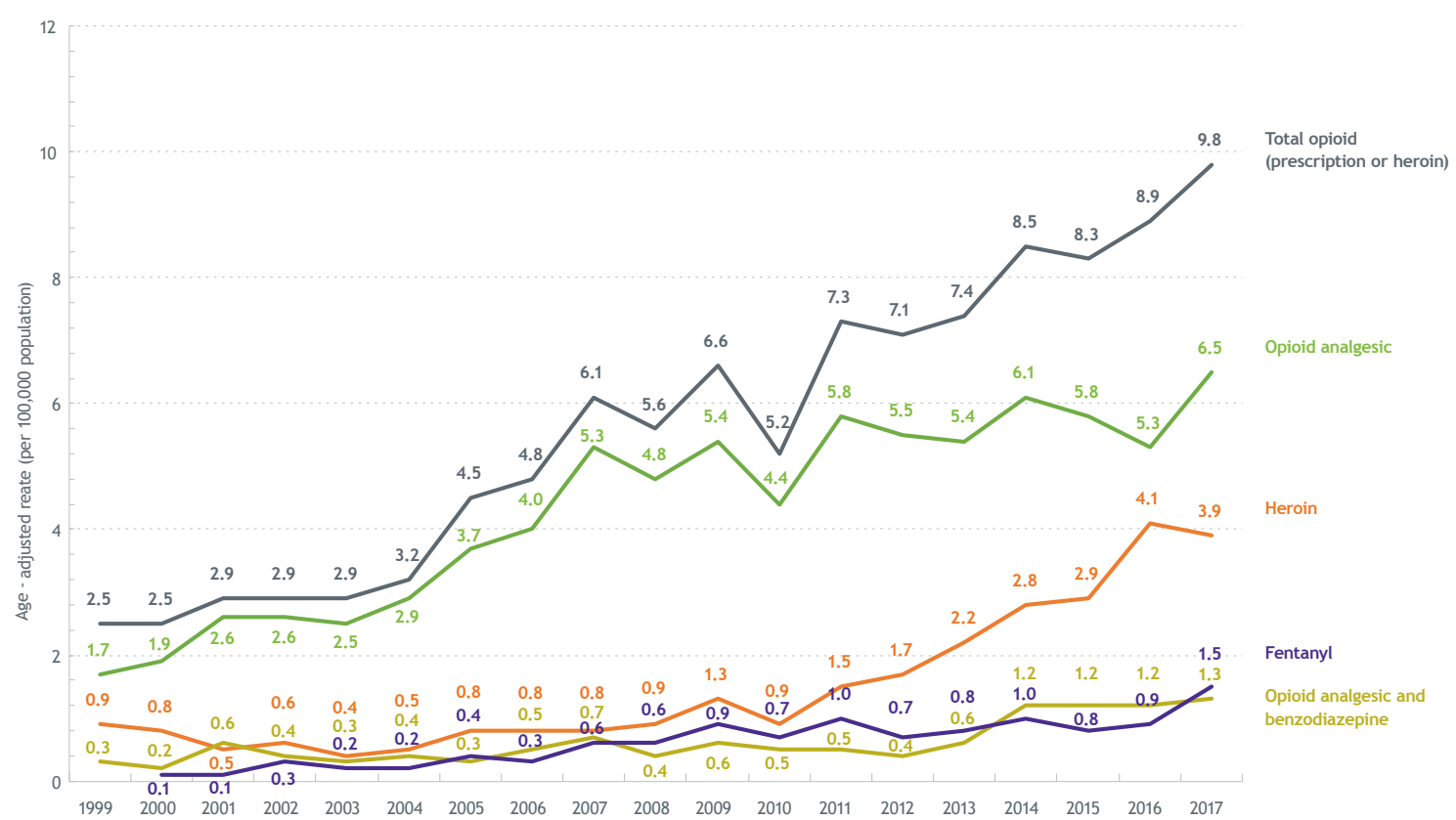


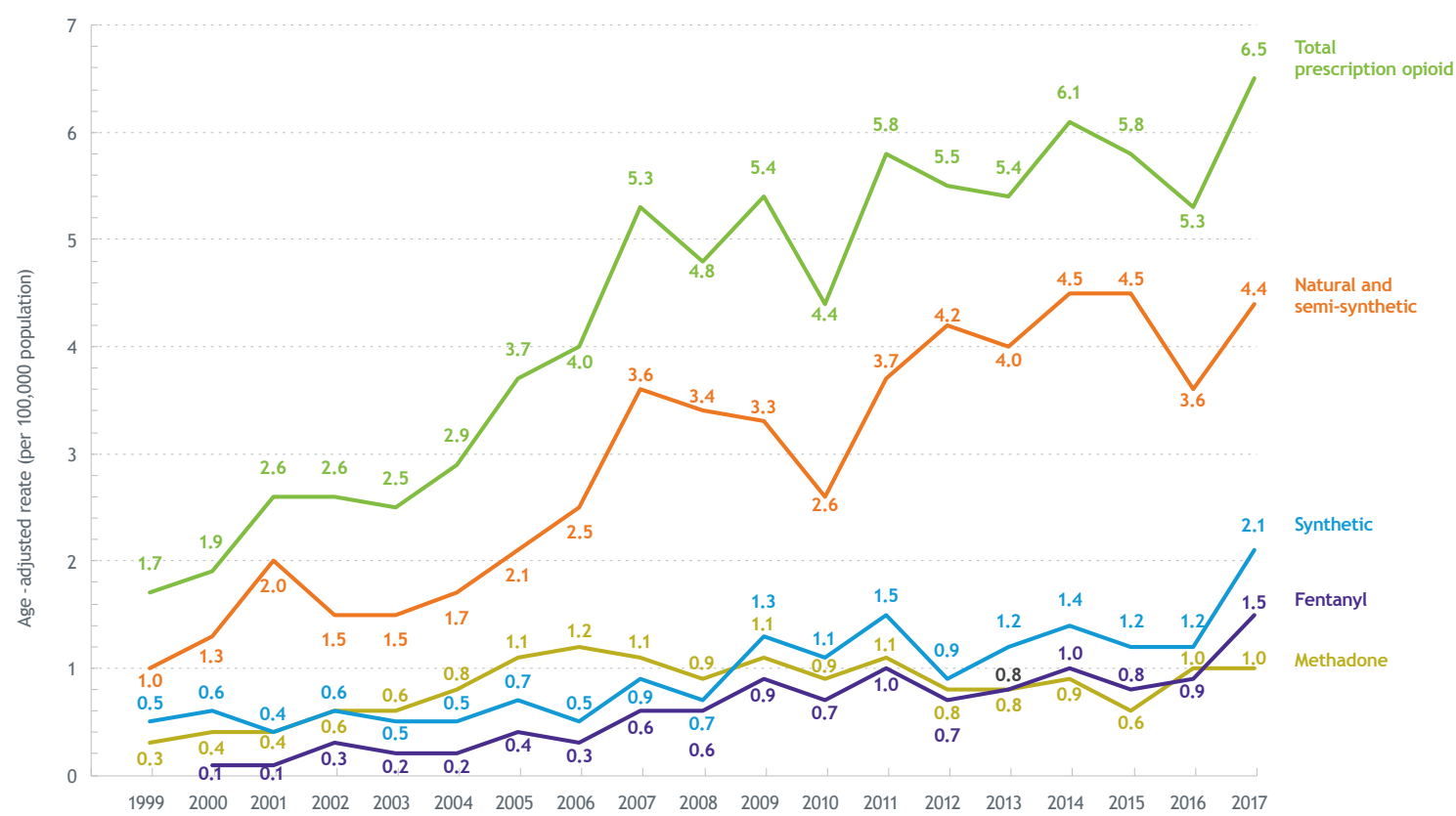
Figure 2. Age-adjusted drug overdose death rates, by involvement of opioids (prescription and illicit): Colorado residents, 1999-2017.



Overdose deaths involving the toxic combination of prescription opioids and benzodiazepines (a class of drugs used principally as a sedative and for treating anxiety) remain a significant concern given the added sedative and respiratory suppression effect the combination may yield (White & Irvine, 1999). Rates of overdose death involving these combinations remained relatively steady at around 0.4 per 100,000 through 2012, but have tripled since to a rate of 1.3 per 100,000 in 2017. Also of significant concern are overdose deaths involving fentanyl, a type of fully-synthetic prescription opioid. Rates of fentanyl-involved overdoses have been slowly but steadily increasing, from a low of 0.1 per 100,000 population in 2000 to 1.5 in 2017. Again, while some of these deaths are attributable to more complete drug-related information being recorded on death certificates, these persistent upward trends remain notable.

The family of prescription opioids, for purposes of categorizing cause of death, fall into three major categories: Natural and semi-synthetic (includes such drugs as morphine, codeine, hydrocodone and oxycodone), methadone (used both for treatment of pain and addiction treatment), and synthetic opioids (other than methadone, and which includes fentanyl, fentanyl analogs, and tramadol). Since 1999, rates of overdose deaths involving natural and semi-synthetic opioids has been the principal driver of the overall increase in overdose deaths involving prescription opioids, for which the rate increased from 1.0 per 100,000 in 1999 to 4.4 in 2017. During this time the rate of overdoses involving synthetic opioids (other than methadone) also increased from 0.5 in 1999 to 2.1 in 2017, driven largely by increases in overdoses involving fentanyl. Overdose deaths involving methadone have remained stable over this time period averaging about 0.8 per 100,000, with little variation after slight increases in the early 2000's (Figure 3).

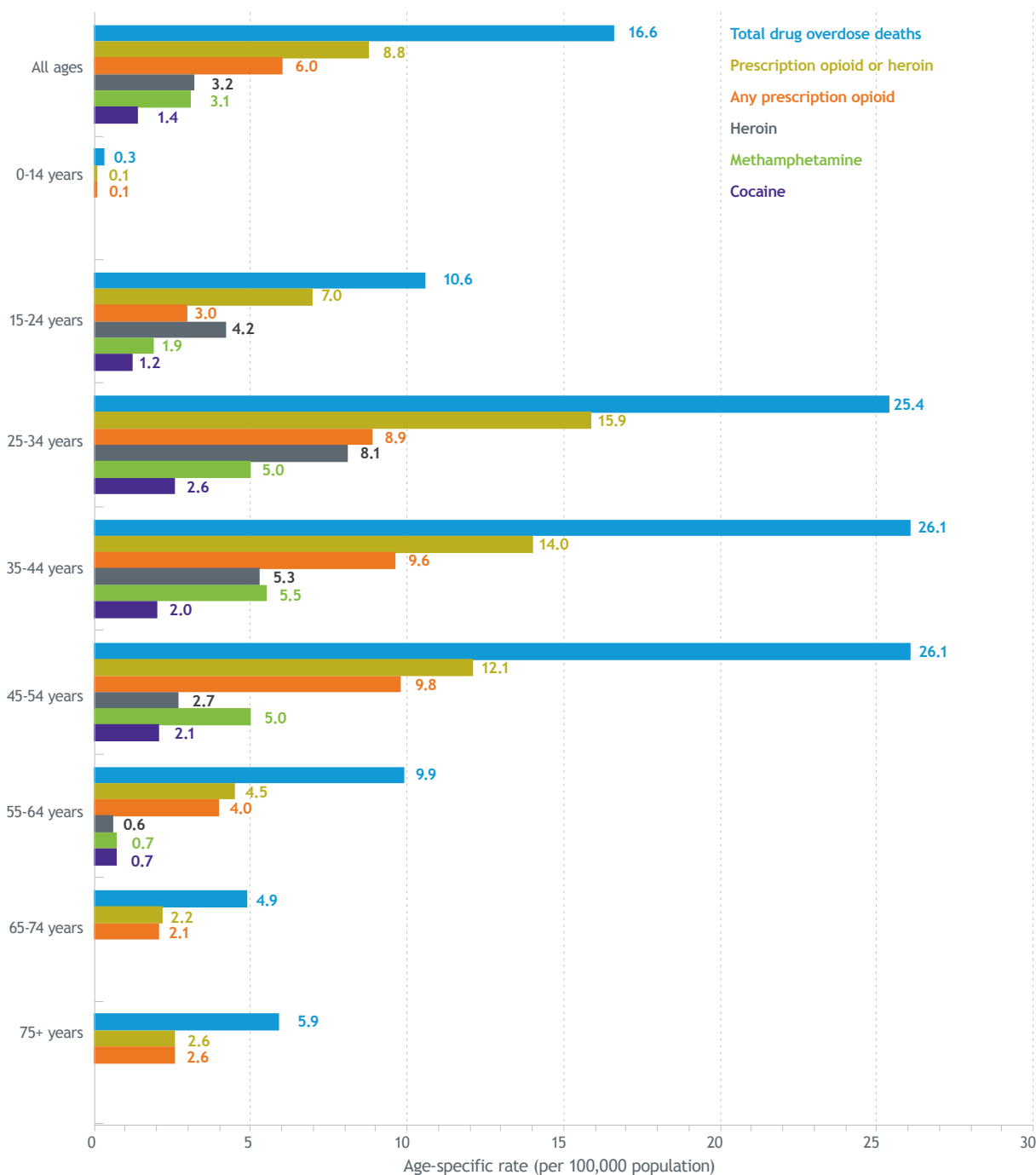
Figure 3. Age-adjusted drug overdose death rates, by involvement of prescription opioids: Colorado residents, 1999-2017.



Drug overdose trends by age, race/ethnicity and poverty

During the time period 2013-2017, Coloradans ages 25-54 had the highest rates of total drug overdose mortality (25-34 yrs: 25.4 per 100,000; 35-44 yrs: 26.1; 45-54 yrs: 26.1); overdose deaths involving either prescription opioids or heroin (25-34 yrs: 15.9; 35-44 yrs: 14.0; 45-54 yrs: 12.1); overdoses involving methamphetamine (25-34 yrs: 5.0 per 100,000; 35-44 yrs: 5.5; 45-54 yrs: 5.0); and overdoses involving cocaine (25-34 yrs: 2.6 per 100,000; 35-44 yrs: 2.0; 45-54 yrs: 2.1). However, while overdose deaths involving prescription opioids is relatively constant over these age groups, heroin overdoses occur more frequently in the younger populations (15-24 yrs: 4.2, 25-34 yrs: 8.1; 35-44 yrs: 5.3) while occurring less frequently in those age 45-54 years (2.7). Additionally, among those 35-54, methamphetamine-involved overdoses occur at higher rates than those involving heroin. Drug overdose deaths among the population age 55 and over are dominated by those involving prescription opioids (Figure 4).

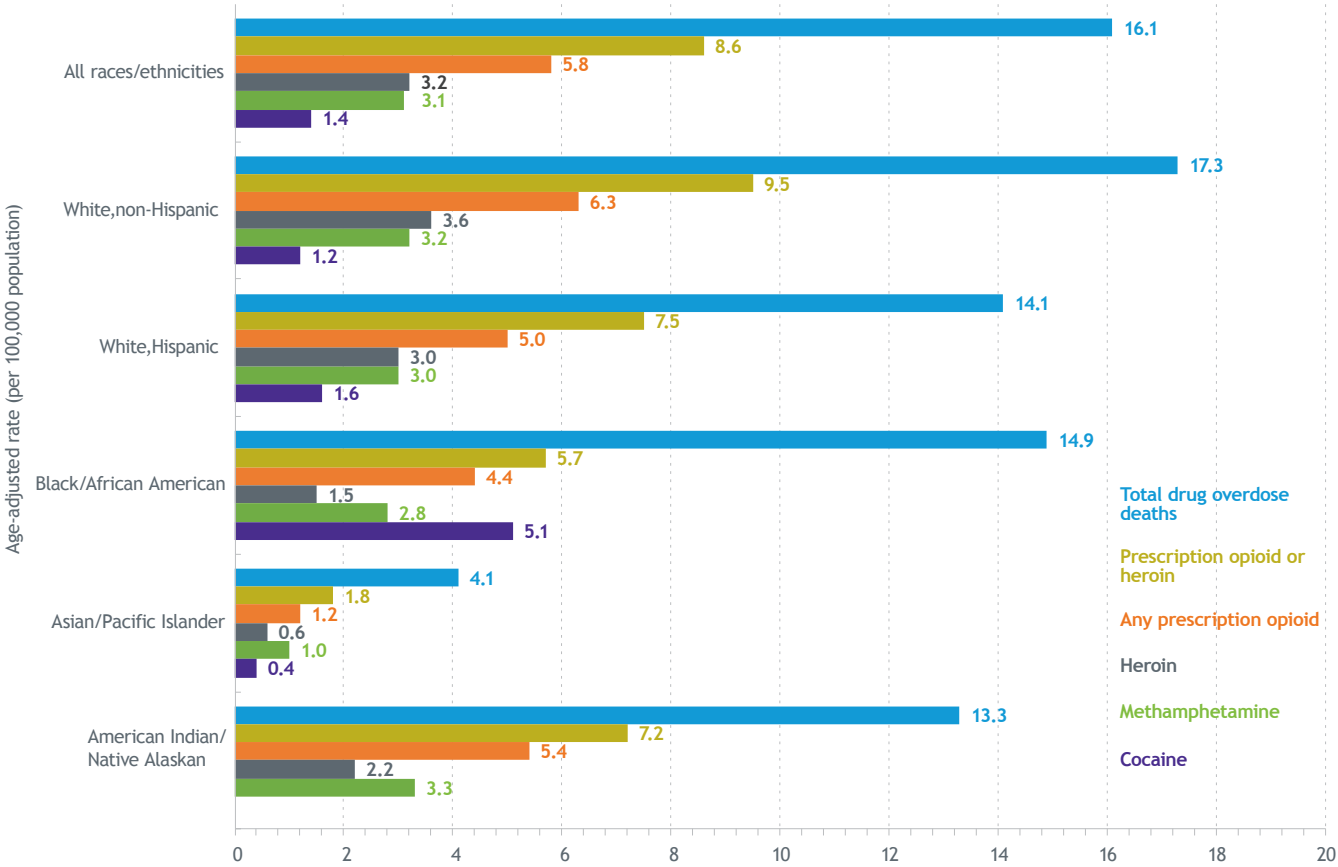
Figure 4. Age-specific drug overdose death rates, by involvement of specific drug types: Colorado residents, 2013-2017.



Also during 2013-2017, total drug overdose death rates were the highest among Colorado’s White, non-Hispanic population (17.3 per 100,000); however, similar rates occurred across the White, Hispanic population (14.1), Black/African American population (14.9) and American Indian/Native Alaskan population (13.3). The rate of total drug overdose death deaths (4.1 per 100,000), and overdose deaths involving all drug types examined for this report, were lowest among the Asian/Pacific Islander population (Figure 5).

Across these populations, rates of overdose death involving opioids of any type were higher than the other drug types examined in this report. However, when considering prescription opioids and heroin separately, while prescription opioid were consistently the most common specific drug type among overdose deaths in most populations, overdose deaths involving cocaine in the Black/African American population (5.1) were slightly higher than prescription opioid-involved overdose deaths (4.4). Alternatively, compared to other populations (except for Asian/Pacific Islander), the rate of heroin-related overdose was lowest in the Black/African American population. Again, with the exception of the Asian/Pacific Islander population, overdose deaths involving methamphetamine occurred at very similar rates across all other populations (averaging approximately 3.1 deaths per 100,000).

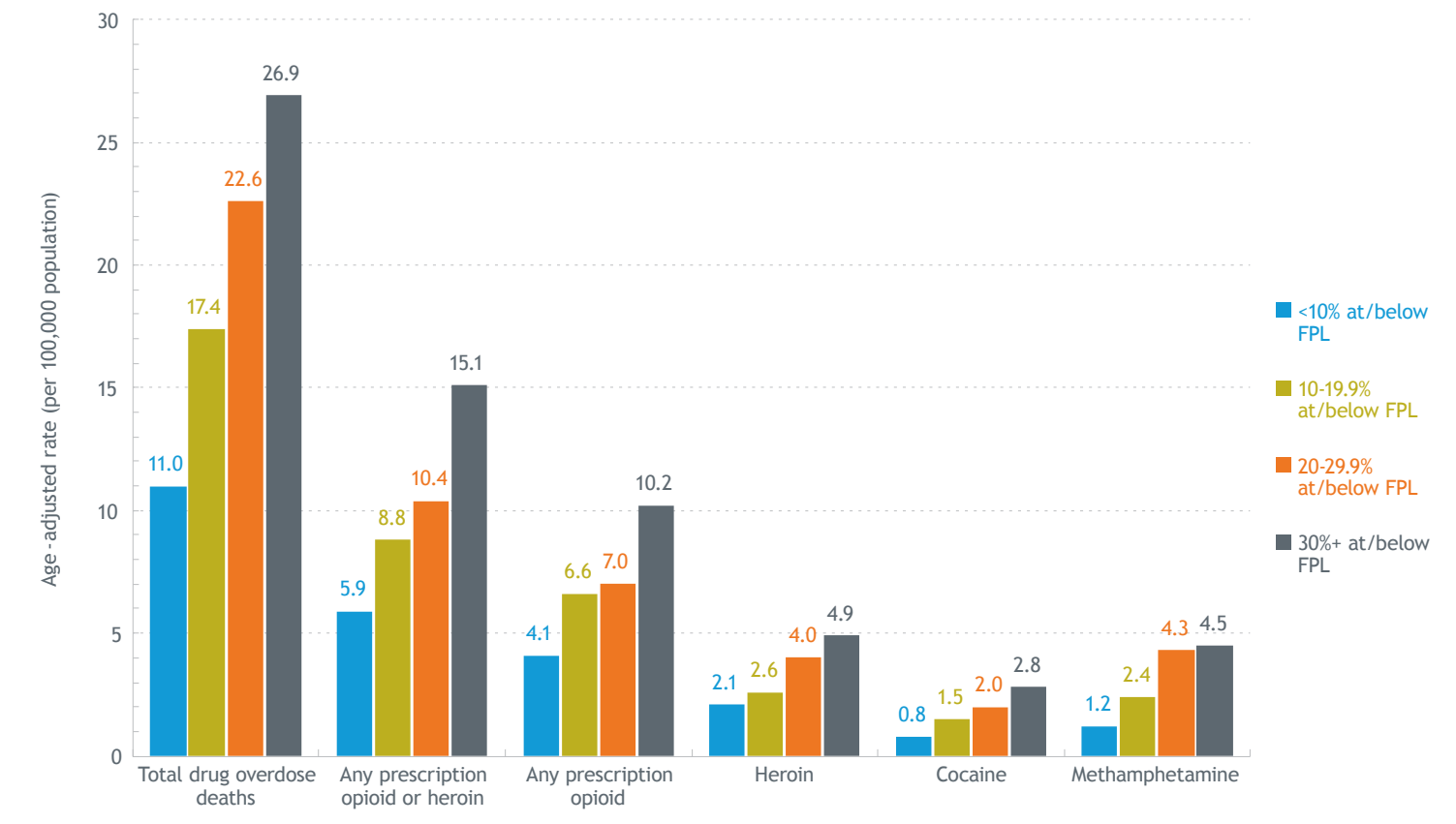
Figure 5. Age-adjusted drug overdose death rates, by race/ethnicity and involvement of specific drug types: Colorado residents, 2013-2017.



From 2012-2016, communities in which larger proportions of the population lived at or below the Federal Poverty Level consistently experienced higher rates of drug overdose deaths. Compared to communities in which less than 10 percent of the population live at or below the Federal Poverty Level (11.0 overdose deaths per 100,000 population), communities where 10-19 percent live at or below the Federal Poverty Level had a rate that was 58 percent higher

(17.4); communities where 20-29 percent live at or below the Federal Poverty Level had a rate that was twice as high (22.6); and communities where 30 percent or more of the population live at or below Federal Poverty Level had a rate that was 250 percent higher (26.9). Similar associations are evident across all drug types examined, including opioids (prescription opioids and/or heroin), methamphetamine and cocaine; while the absolute rates may be lower for the individual drug types compared to total drug overdoses, the relative magnitude of the disparity persists (Figure 6).

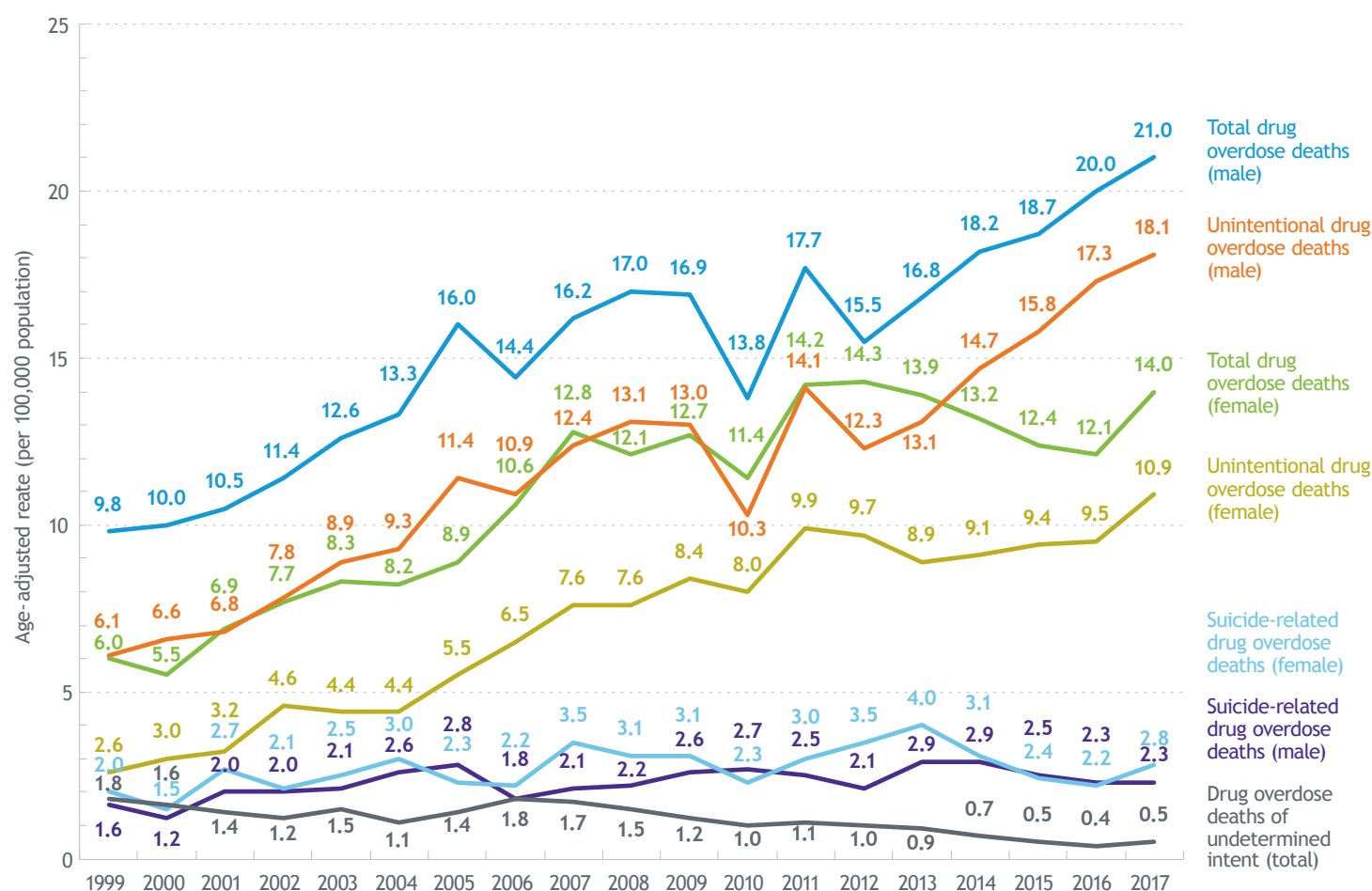
Figure 6. Age-adjusted drug overdose death rates, by area-based poverty status and involvement of specific drug types: Colorado residents, 2012-2016.



Drug overdose trends by manner of death and presence of multiple drug types

Since 1999, rates of unintentional (or accidental) drug overdose deaths have increased consistently in both men and women. Among men, rates of unintentional drug overdose increased from 6.1 per 100,000 population in 1999 to 18.1 in 2017. While rates of unintentional drug overdose death among women were consistently lower than those among men, a similar rate of increase was seen (2.6 in 1999 to 10.9 in 2017). However rates of suicide-related drug overdose death among both men and women have remained fairly constant during the period 1999-2017; while the differences between men and women for rates in suicide-related overdose death are small, rates are consistently slightly higher in women (Figure 7). Drug overdose deaths of undetermined intent, that is, when intent cannot be established at the legally defined level by the investigating coroner, medical examiner or physician, have decreased consistently between 1999-2017 (1.0 to 0.5), reaching new lows in recent years, which again represents an improvement in the completeness of deaths of known manner.

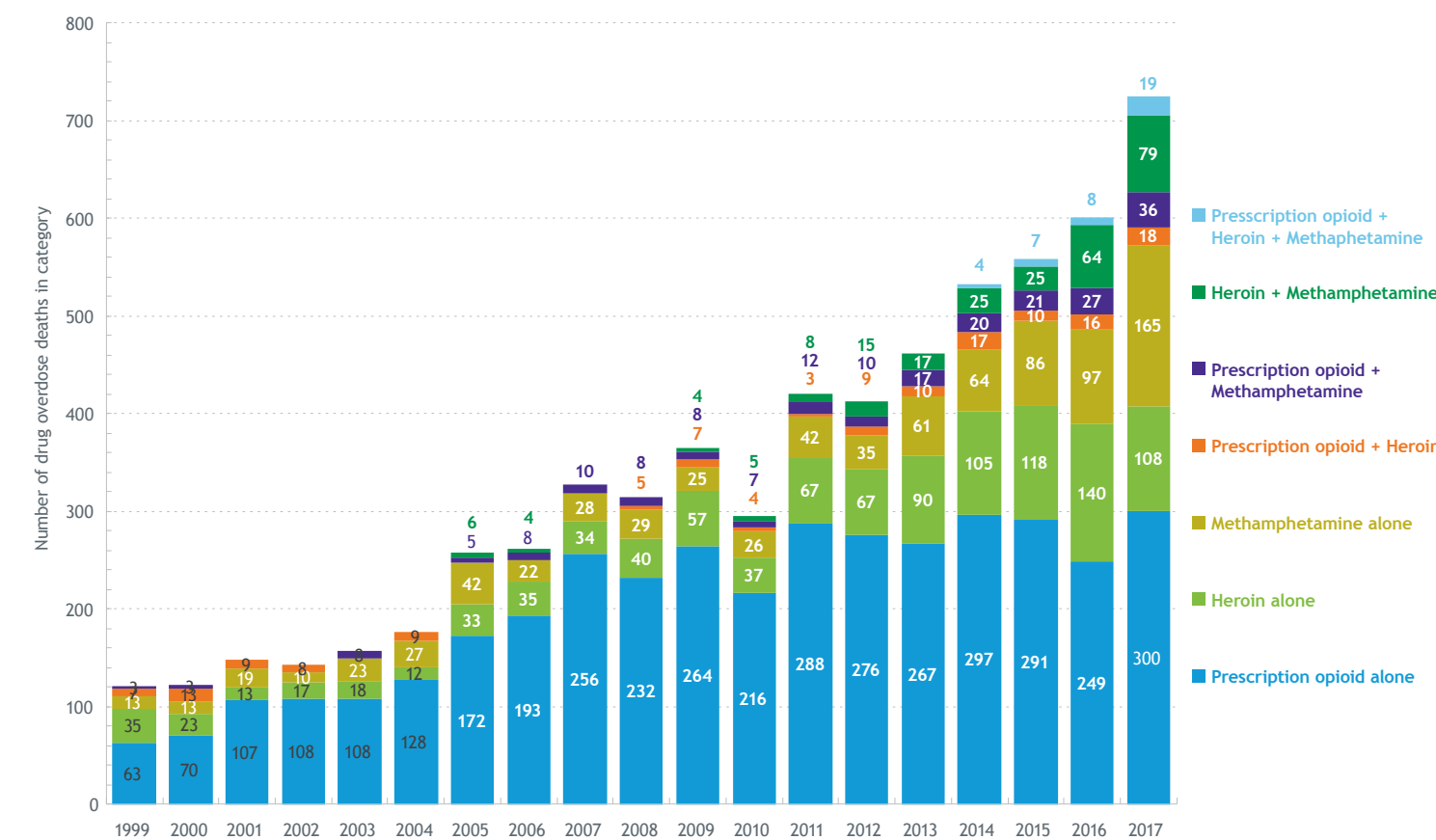
Figure 7. Age-adjusted drug overdose death rates, by sex and manner of death: Colorado residents, 1999-2017.



When completing the cause of death portion of a death certificate, in addition to indicating the fact that a death was due to a drug overdose, the certifier is also asked to include all drugs that are deemed physiologically significant in causing death; consequently, as noted in the methods description, a death may be counted in more than one drug-specific category should more than one type of drug be noted on the death certificate. As such, it is of growing interest to explore the frequency at which deaths involve multiple drug types, and for those that do, characterize what drugs were noted as having contributed to death.

Considering the three main categories of drug types explored in this report—prescription opioids, heroin and methamphetamine—nearly 90 percent of drug overdose deaths between 1999-2017 involving one of these drug types indicated the presence of only one drug type (Figure 8). Thus it is a relatively small proportion of drug overdose deaths involving two or all three of these types of drugs. Among those overdose deaths involving any or all of these three drug types, the combination of heroin and methamphetamine (heroin+methamphetamine) was the most prevalent (4%), followed by prescription opioid+methamphetamine (3.2%) and prescription opioid+heroin (2.4%), with less than 1 percent noting all three drug types. Overall the proportions of drug overdose deaths with multiple drugs noted remains relatively small, but has increased over time: The total number of overdose deaths involving two or all three of these three drug types has increased from 10 overdose deaths in 1999 to 152 overdose deaths in 2017, as has the proportion among drug overdose deaths involving opioids or methamphetamine (8% in 1999 to 21% in 2017) (Figure 8).

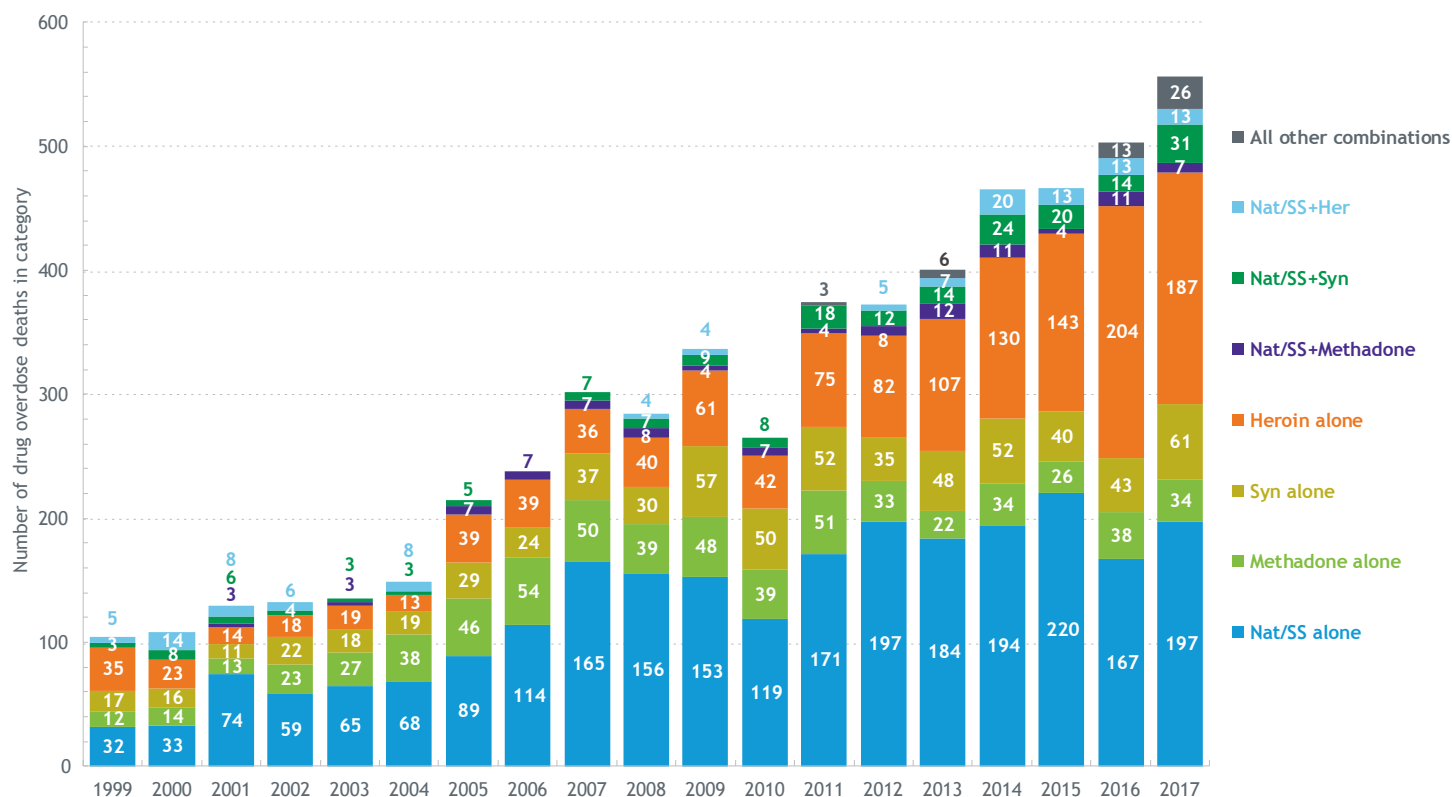
Figure 8. Numbers of drug overdose death rates, involvement of one or more types of drugs*: Colorado residents, 1999-2017.



* Categories displayed limited to those with three or more deaths

Similar to concerns about the presence of multiple drug types among overall drug overdose deaths, the presence of multiple types of opioids (including prescription opioids, methadone and heroin) is of significant interest. Considering the four primary categories of opioids—natural/semisynthetic prescription opioids (Nat/SS), methadone, fully synthetic prescription opioid (excluding methadone; Syn) and heroin (Her)—among overall drug overdose death, the presence of multiple opioid types is relatively uncommon. Between 1999-2017, approximately 10 percent of opioid-related overdose deaths were noted to have involved more than one type of opioid (a proportion fairly consistent over this time period). Among these, the combination occurring most frequently were natural/semi-synthetic and fully synthetic (Nat/SS+Syn, 3.5%), followed by natural/semi-synthetic and heroin (Nat/SS+Her, 2.3%) and natural/semi-synthetic and methadone (Nat/SS+Methadone, 2%). Remaining combinations of two, three or all four drug types comprised less than 2 percent of opioid-related overdoses with more than one opioid noted (Figure 9).

Figure 9. Numbers of drug overdose death rates, involvement of one or more types of opioid: Colorado residents, 1999-2017.



* Categories displayed limited to those with three or more deaths

Drug overdose deaths by geographic region of residence

The following section presents summaries and maps of drug overdose deaths by geographic region of decedents' residence for the time period 2013-2017. The maps present both the rates of drug overdose deaths in a given category among Colorado's Health Statistics Regions in the form of quartiles (roughly four equal groups, as a color gradient), as well as whether the death rate in a given Health Statistics Region was statistically higher or lower than the overall statewide rate (grid or diagonal hash marks, respectively).

Total drug overdose deaths by Health Statistics Region

During the time period 2013-2017, the highest rates (top quartile) of total drug overdose deaths involving any drug type occurred among residents of Health Statistics Regions (HSR) 4, 6, 7 and 8, representing El Paso County, and those counties comprising the southeast portion of Colorado, Pueblo County and the San Luis Valley. Rates in this area were all statistically higher than the state average during this time. The rate in HSR 19 (Mesa County) was also in the top quartile, but was not statistically higher than the statewide rate; while HSRs 14 and 20 (Adams and Denver Counties, respectively) had statistically higher rates, they were not in the top quartile (Figure 10).

Drug overdose deaths involving prescription opioids or heroin by Health Statistics Region

The highest rates of overdose death where opioids were involved (either prescription opioids or heroin) in 2013-2017 occurred among residents of HSRs 6, 7, 8 and 14 (southeast Colorado, Pueblo County, the San Luis Valley and Adams County), though only those of HSR 7 and 14 were statistically higher than the statewide rate. While

the rate in HSR 20 (Denver County) fell into the third quartile, it was statistically higher than the statewide rate during this time period (Figure 11).

Figure 10. Age-adjusted total drug overdose death rates, by Health Statistics Region of residence: Colorado residents, 2013-2017.

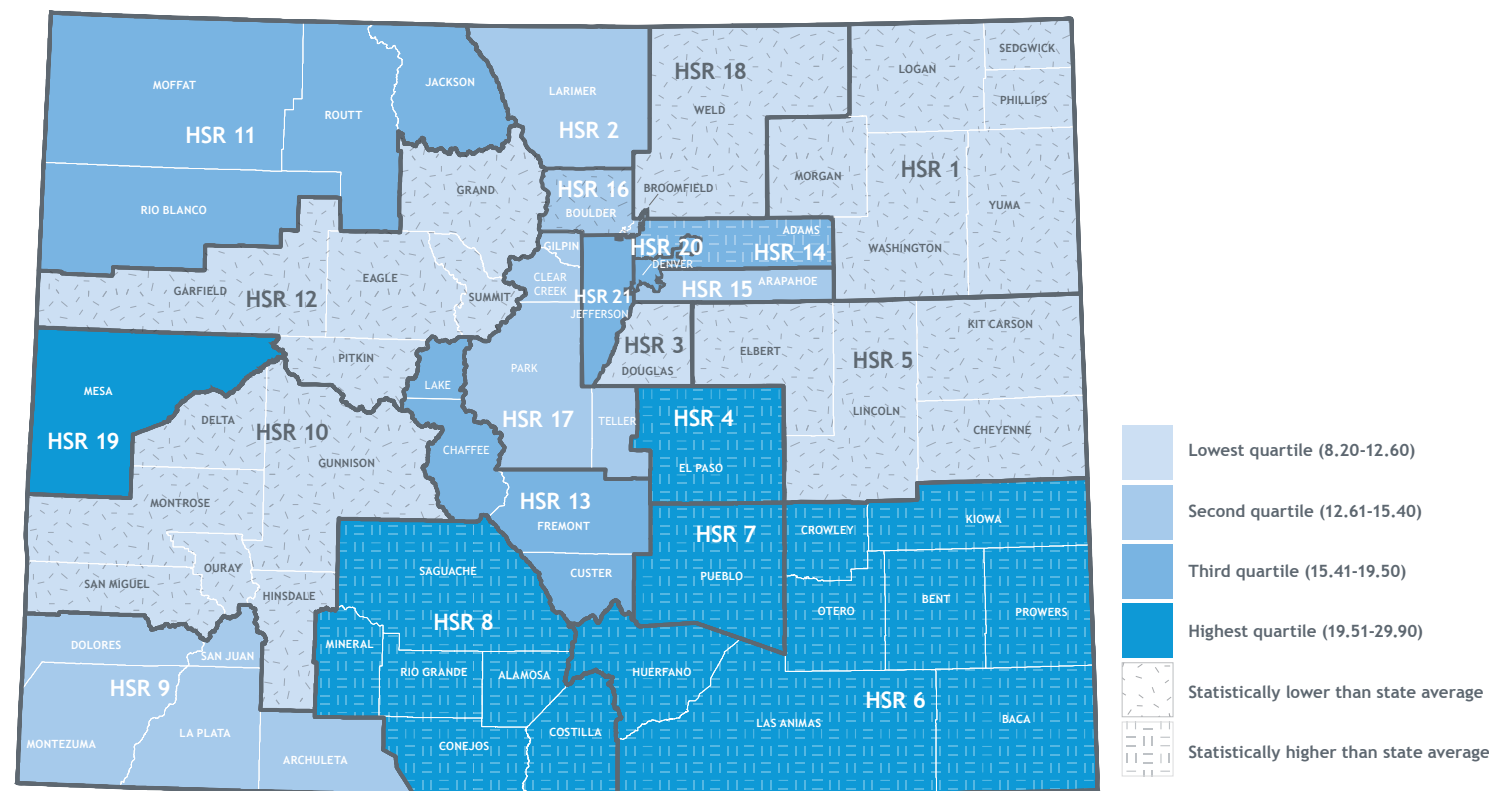
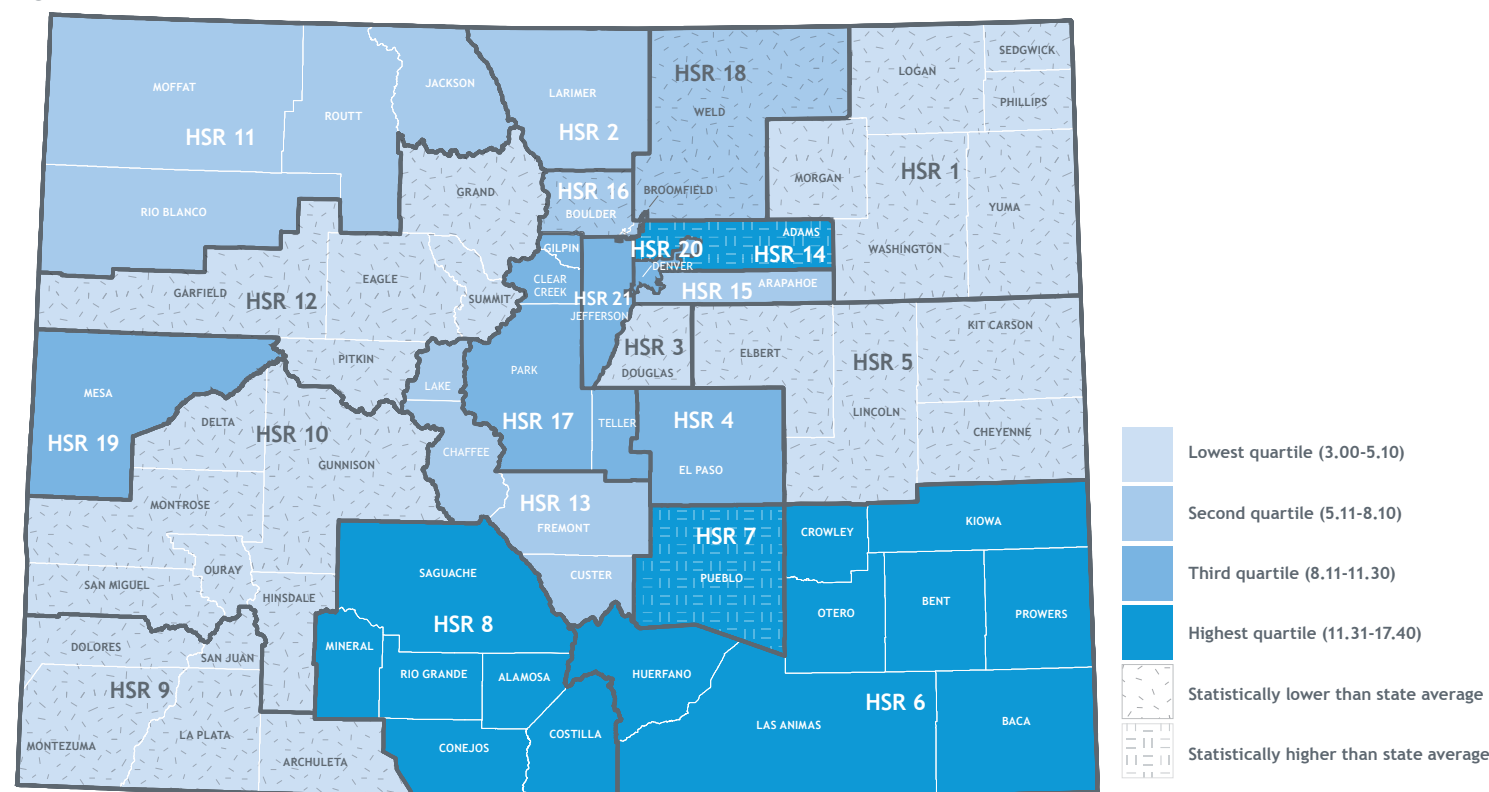


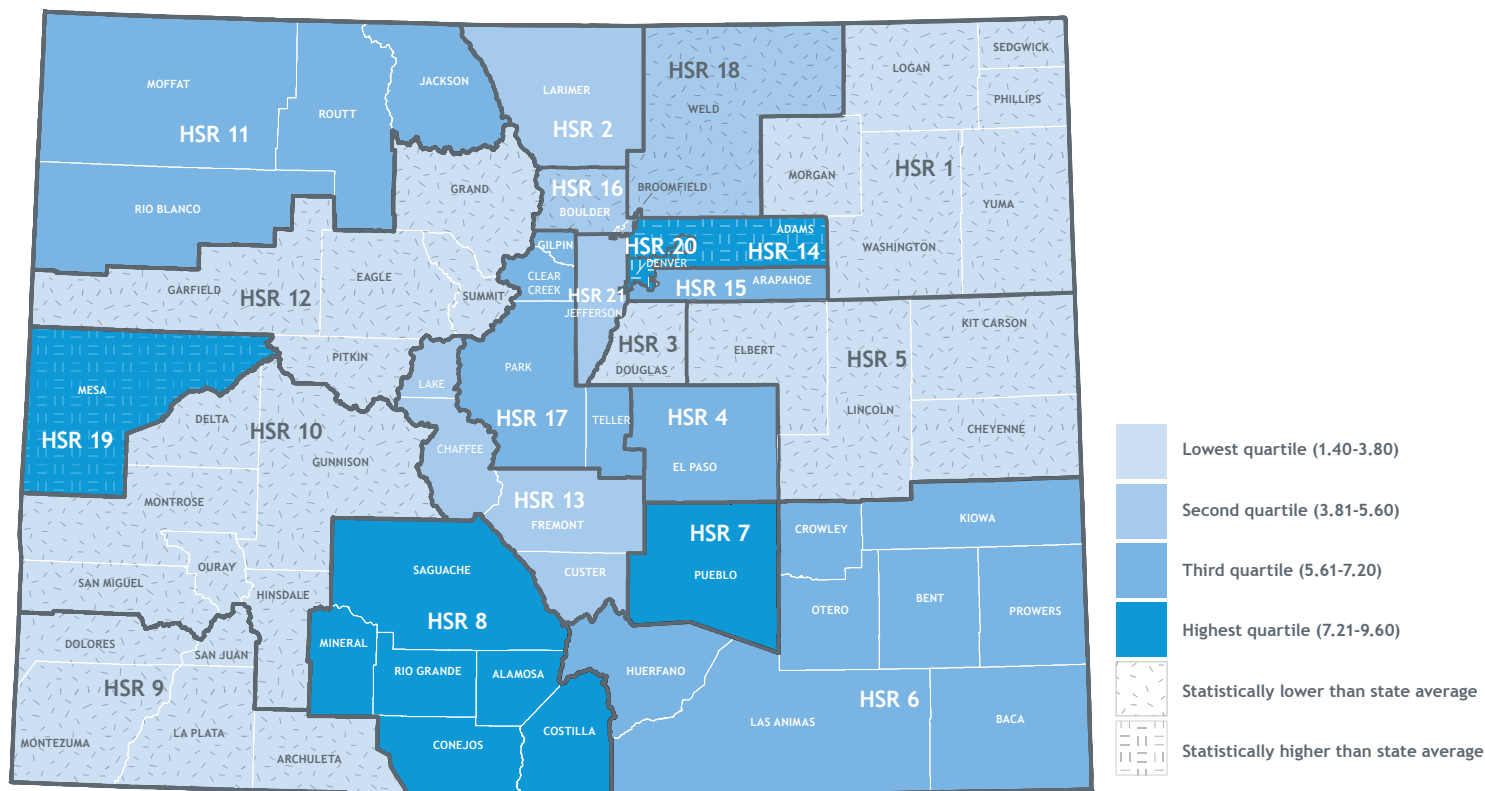
Figure 11. Age-adjusted death rates of drug overdose involving opioids (prescription opioids or heroin), by Health Statistics Region of residence: Colorado residents, 2013-2017.



Drug overdose deaths involving prescription opioids by Health Statistics Region

Drug overdose deaths involving prescription opioids (and excluding heroin) follow similar geographic patterns as those for total opioid-related overdoses. The highest rates in 2013-2017 occurred among residents of HSRs 7, 8, 14, 19 and 20 (Pueblo County, the San Luis Valley, Adams, Mesa and Denver Counties), though among these only the rates in HSR 14, 19 and 20 were statistically higher than the statewide rate during this period (Figure 12).

Figure 12. Age-adjusted death rates of drug overdose involving prescription opioids, by Health Statistics Region of residence: Colorado residents, 2013-2017.



Drug overdose deaths involving heroin by Health Statistics Region

During the time period 2013-2017, rates of drug overdose death involving heroin were highest in HSRs 4, 6, 7, 8 and 20 (Pueblo County, southeast Colorado, Pueblo County, the San Luis Valley and Denver County), wherein those of HSRs 4, 7 and 20 were statistically higher than the statewide rate (Figure 13).

Drug overdose deaths involving methamphetamine (and other psychostimulants) by Health Statistics Region

Regions in which the rates of drug overdose death involving methamphetamine (or other psychostimulants with abuse potential) include HSRs 4, 7, 19 and 20 (El Paso, Pueblo, Mesa and Denver Counties). Among these, rates in HSRs 4, 7 and 20 were statistically higher than the statewide rate during the period 2013-2017 (Figure 14).

Figure 13. Age-adjusted death rates of drug overdose involving heroin, by Health Statistics Region of residence: Colorado residents, 2013-2017.

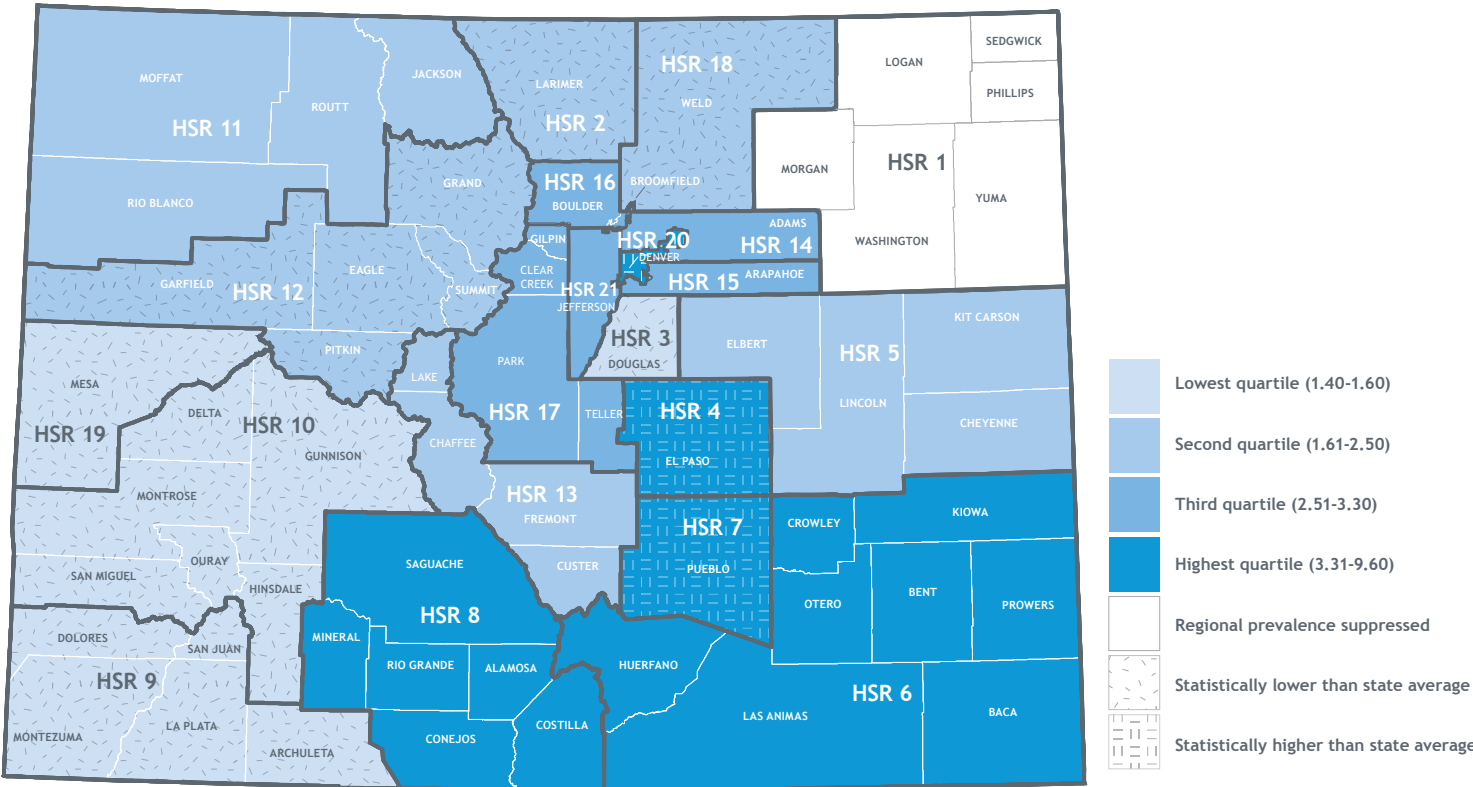
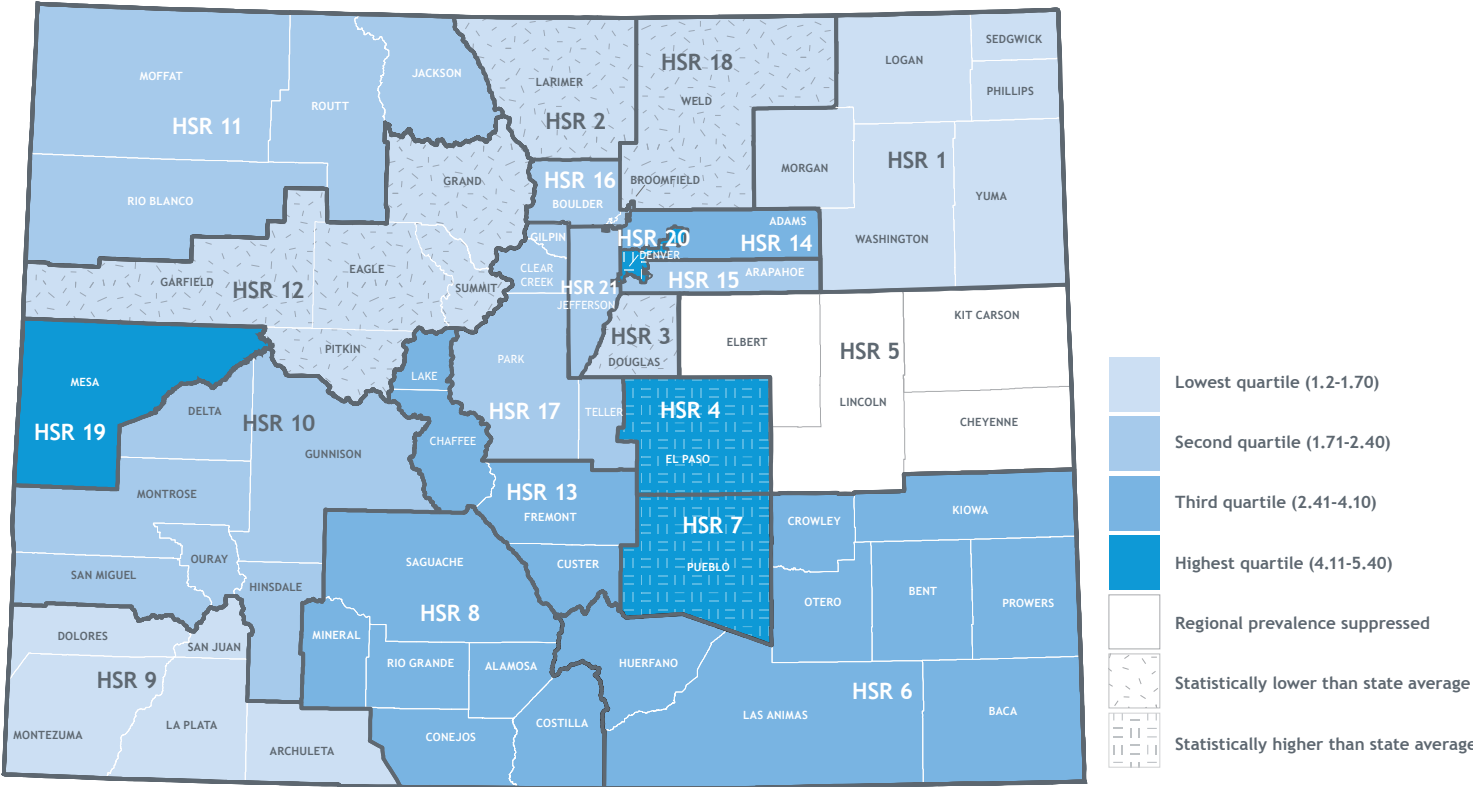


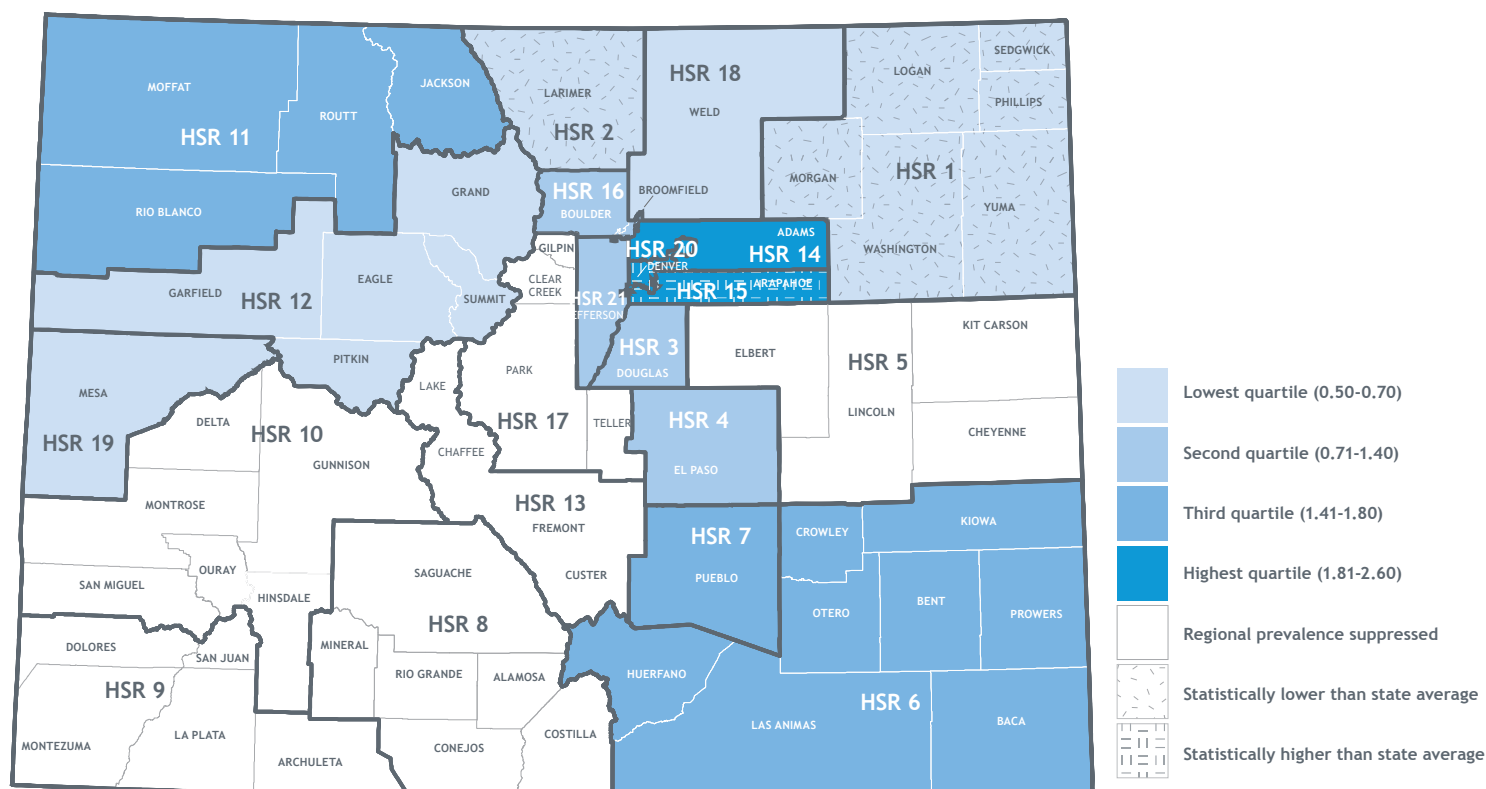
Figure 14. Age-adjusted death rates of drug overdose involving methamphetamine (and other psychostimulants with abuse potential), by Health Statistics Region of residence: Colorado residents, 2013-2017.



Drug overdose deaths involving cocaine by Health Statistics Region

Between 2013-2017, the highest rates of drug overdose death involving cocaine were centered in the states urban core, including HSRs 14, 15 and 20 (Adams, Arapahoe and Denver Counties). Among these the rates in HSRs 15 and 20 were statistically higher than the statewide rate (Figure 15).

Figure 15. Age-adjusted death rates of drug overdose involving cocaine, by Health Statistics Region of residence: Colorado residents, 2013-2017.



Discussion

During the time period 1999-2017 drug overdose deaths nearly tripled and the rate has more than doubled during this time, and include increases in overdose deaths involving prescription opioids, heroin and other drugs. CDPHE will continue also to monitor the trends in synthetic opioid and fentanyl-involved overdose deaths: Rates for synthetic opioids doubled from 2015-2016, coinciding with a precipitous rise concentrated on the East Coast (Seth et al., 2018). CDPHE has concentrated its opioid prevention efforts on educating health care providers about prescribing guidelines, support of collaborative community efforts to reduce the number of opioid overdoses, increasing the capacity of local communities to respond to the crisis, and supporting increased access to naloxone to help prevent fatal overdoses.

Limitations in reporting do limit these analyses of death certificate data: CDPHE does not have access to the toxicology reports on deaths and cannot determine whether the drugs that were not indicated on the certificate represent negative test results or whether the drug was not part of the testing. However, compared to earlier years, the proportion of death certificates without mention of specific drugs present has been cut in half, a strong indicator that the data quality is improving. This mirrors a national trend toward improved data quality as well, and represent

commendable efforts to ensure the availability of accurate and timely data in support of the prevention of drug-related misuse, abuse and overdose.

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Suggested Citation

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Appendix 1: ICD-10 Drug overdose codes used in report

Category	Underlying Cause of Death (ICD-10)	Multiple Cause of Death (ICD-10, any mention)
Total Drug Overdose	X40-X44, X60-X64, X85, Y10-Y14	---
Opioid (prescription opioid analgesic or heroin)	X40-X44, X60-X64, X85, Y10-Y14	T40.1-T40.4
Prescription Opioid Analgesic	X40-X44, X60-X64, X85, Y10-Y14	T40.2-T40.4
Heroin	X40-X44, X60-X64, X85, Y10-Y14	T40.1
Methamphetamine (and other psychostimulants with abuse potential)	X40-X44, X60-X64, X85, Y10-Y14	T43.6
Cocaine	X40-X44, X60-X64, X85, Y10-Y14	T40.5
Only Unspecified Drug(s)	X40-X44, X60-X64, X85, Y10-Y14	T50.9 and excludes records with mention of T36.0-T50.8
Opioid & Benzodiazepine-Related Overdose	X40-X44, X60-X64, X85, Y10-Y14	T40.2-T40.4 and T42.4
Fentanyl	X40-X44, X60-X64, X85, Y10-Y14	T40.4 and mention of 'fentanyl' in text literals on death certificate
Natural and Semi-Synthetic Opioid Analgesic	X40-X44, X60-X64, X85, Y10-Y14	T40.2
Methadone	X40-X44, X60-X64, X85, Y10-Y14	T40.3
Fully Synthetic Opioid Analgesic (excluding methadone)	X40-X44, X60-X64, X85, Y10-Y14	T40.4
Unintentional Drug Overdose	X40-X44	---
Suicide Overdose	X60-X64	---
Overdose with Undetermined Manner/ Intent	Y10-Y14	---