



RATES AND TRENDS OF OPIOID
OVERDOSE DEATHS, ARIZONA, 1999-2019:
IMPLICATIONS FOR PUBLIC HEALTH POLICY



Arizona Public Health Association, February 21, 2021

Rates and Trends of Opioid Overdose Deaths, Arizona, 1999-2019:

Implications for Public Health Policy

Purpose:

Increasing deaths from opioid drug overdoses have been and remain a serious [public health problem](#) in Arizona and [throughout the U.S.](#) The purpose of this analysis is to provide an overview of rates and trends of opioid overdose deaths in Arizona for the period 1999-2019.

Our report serves as a tool with which to evaluate the effectiveness of the January 2018 Arizona Opioid Epidemic Act and provide information to policymakers as they consider additional interventions to address this continuing public health crisis.

Major Findings:

Overall opioid overdose deaths in Arizona have been increasing for at least the past two decades with the largest increases since 2013 among all categories of race, ethnicity, and gender.

To address the crisis, Arizona State Legislature, the Arizona Department of Health Services, the Arizona Health Care Cost Containment System, and the Governor's Office collaborated to pass and implement the Arizona Opioid Epidemic Act in January 2018. The Act made wide-ranging policy changes throughout the healthcare system including big changes to prescribing practices. Our report explores the nature of the epidemic in Arizona at the 3-year mark since the Act was passed using data from 1999 through the end of 2019.

Despite the implementation of the evidence-based policies within the Arizona Opioid Epidemic Act, our report found no evidence to suggest that the epidemic is slowing. Indeed, the rates of opioid and other drug related deaths have further accelerated, particularly in the synthetic opioid category that includes fentanyl.

The data presented in this report indicate that existing intervention efforts (Arizona Opioid Epidemic Act) have not measurably slowed the overall opioid overdose epidemic in Arizona. Further [public health intervention efforts](#) and additional resources are needed if the death toll from opioid overdoses is to be reduced.

Implications for Public Health Policy:

The 2018 Arizona Opioid Epidemic Act made profound regulatory changes to how opioid medications are prescribed and regulated. Our report examines the opioid mortality trends for the periods before and after implementation of the Act and is a valuable tool for policymakers to evaluate the successes and shortcomings of the interventions within the Act.

Our report found a slight decline in mortality rates from *prescribed* opioids after implementation of the Act. However, profound increases in mortality from fentanyl have continued and even accelerated since implementation of the Act.

We urge Arizona's Executive Branch and the Arizona State Legislature to use these report findings to explore whether changes made to prescribing practices and other portions of the Act have been effective and to implement necessary evidence-based public health policy interventions to mitigate this continuing public health crisis.

Methods:

Mortality data were obtained from the [CDC Wonder Online Database](#). Death certificate data indicate a single *underlying* cause and up to 20 multiple (*contributing*) causes. These causes are coded using the *International Classification of Diseases, Tenth Revision* (ICD-10) which went into effect in 1999.

Identifying opioid-related overdose deaths requires multiple criteria. ICD-10 codes widely utilized by researchers to select opioid overdose deaths include 13 underlying cause of death (UCD) codes that indicate the intent (unintentional, suicide, homicide, undetermined) along with five multiple (contributing) cause of death (MCD) codes that identify the type of drug involved (heroin, methadone, natural and semi-synthetic opioids such as morphine and hydrocodone, and synthetic opioids other than methadone such as fentanyl and tramadol). The full listing and descriptions are presented in the Appendix.

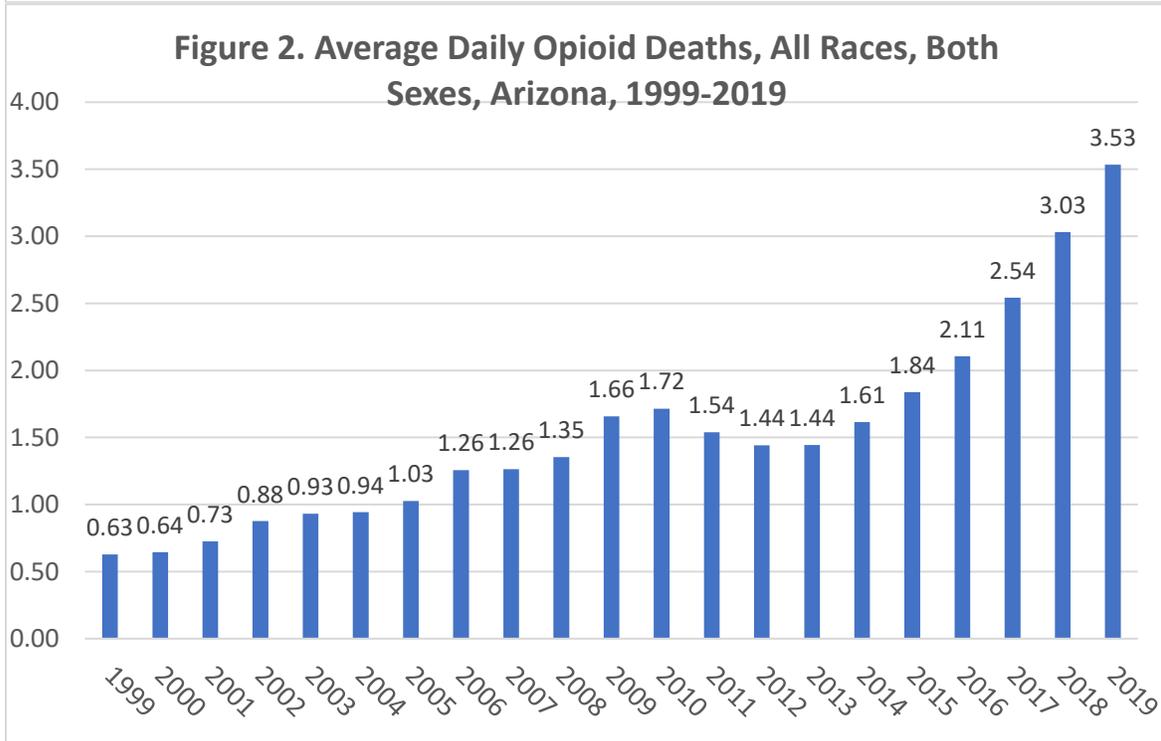
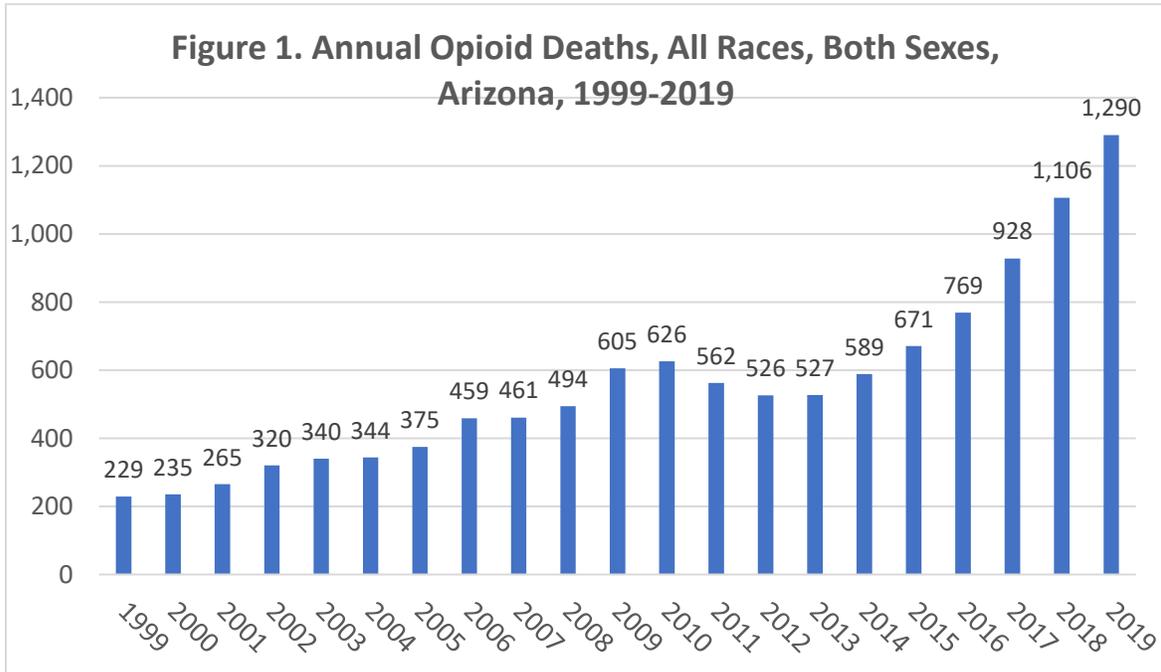
Annual rates and numbers of deaths by race, ethnicity, gender, and type of opioid were obtained for the period 1999-2019. Mortality data in CDC Wonder are [suppressed](#) when there are <10 deaths and rates are not tabulated when there are ≤ 20 deaths as these rates are considered unreliable. Rates and counts for several racial and age categories were either suppressed or flagged as unreliable for multiple years as noted in the text or footnotes to graphs.

An initial review of annual opioid death rates clearly revealed that changes in rates varied over different periods of time. Therefore, trends and annual percent changes in rates were analyzed with regression [software](#) that utilizes statistical methodology to determine significant changes in trends for different periods of time. While this software was originally developed by the National Cancer Institute to examine trends in cancer rates, it has been widely applied to trend analysis for many different diseases and injuries.

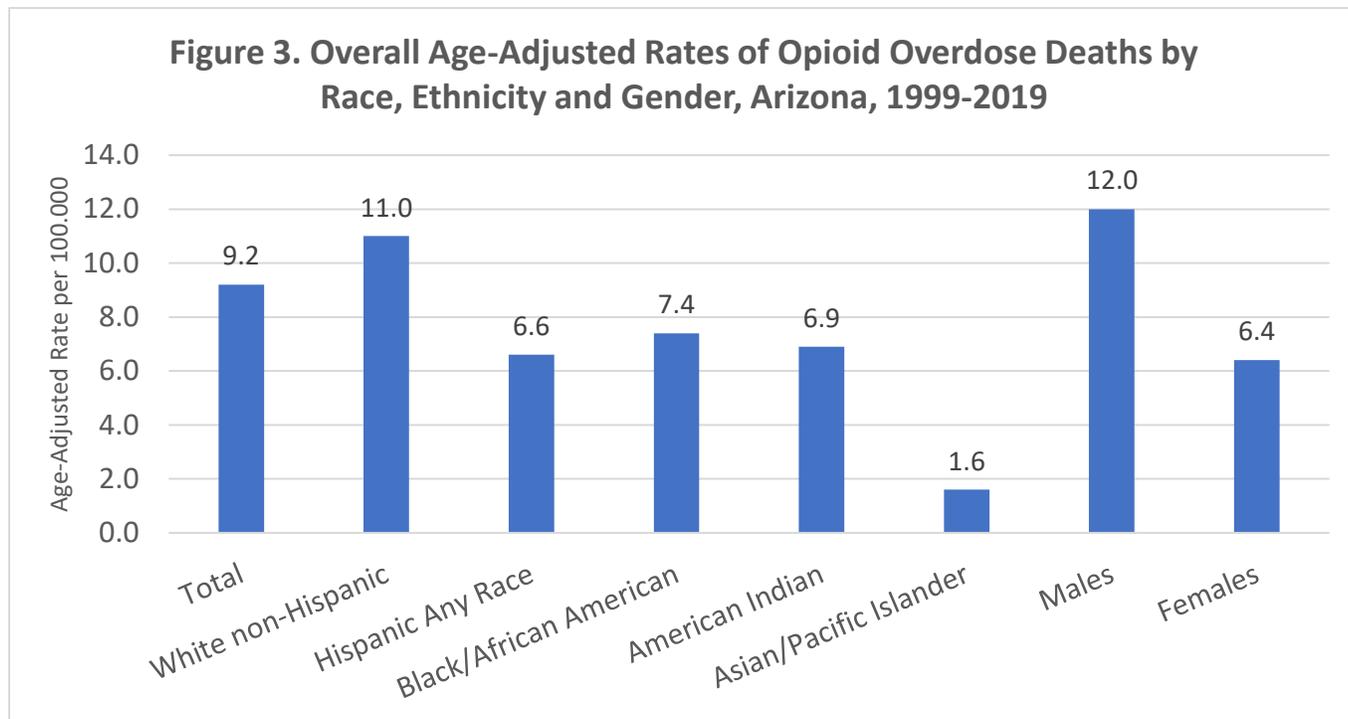
Final data for 2020 were not yet available at the time of this analysis, although some provisional data are provided regarding the widely reported spikes in opioid and other drug overdose deaths during the COVID-19 pandemic as reported by the [CDC](#), [American Medical Association](#), and [ADHS](#).

Findings:

Over the entire 21-year period 1999-2019, a total of 11,720 opioid overdose deaths were recorded. The annual number of deaths ranged from 229 deaths in 1999 to 1,290 deaths in 2019, almost a six-fold increase (Figure 1). Figure 2 shows the average number of daily deaths for each year. Less than one death/day was reported prior to 2005, while three or more daily deaths were recorded in 2018 and 2019.



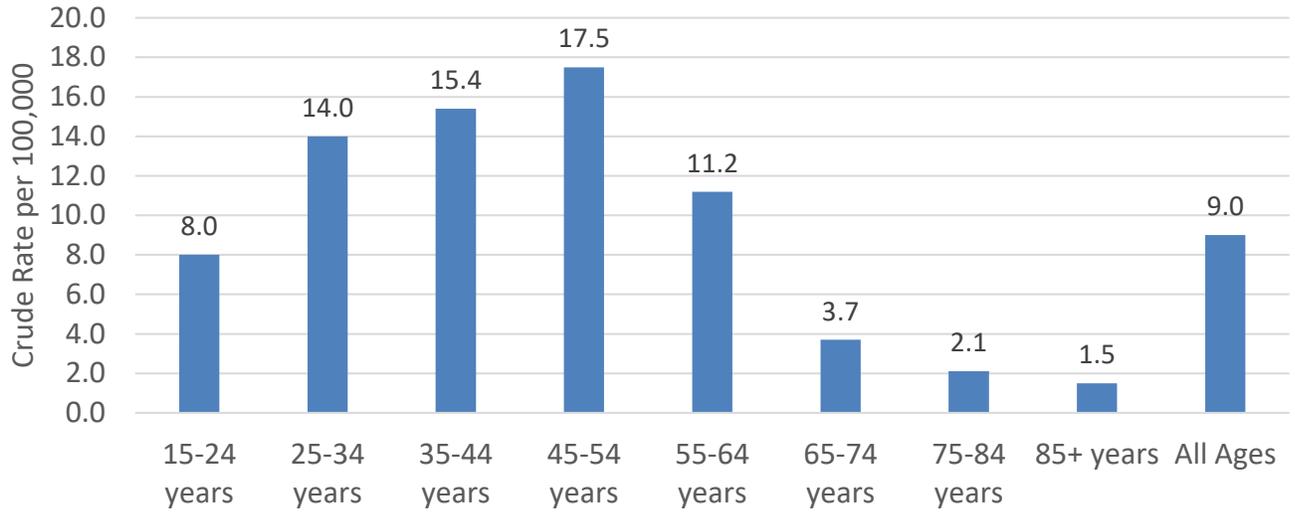
Overall opioid age-adjusted mortality rates for the period 1999-2019 varied by race, ethnicity, and gender (Figure 3). The highest overall rates were among Males (12.0) and non-Hispanic Whites (11.0) and the lowest rate was among Asians/Pacific Islanders (1.6).



Opioid mortality rates were consistently higher among males than females (all races). As shown in Figure 3, the overall age-adjusted rate for the period 1999-2019 was 6.4 for females and 12.0 for males. Annual rates had similar trends from 1999 to 2013, after which rates rose much more sharply among males (see Trend Analysis below).

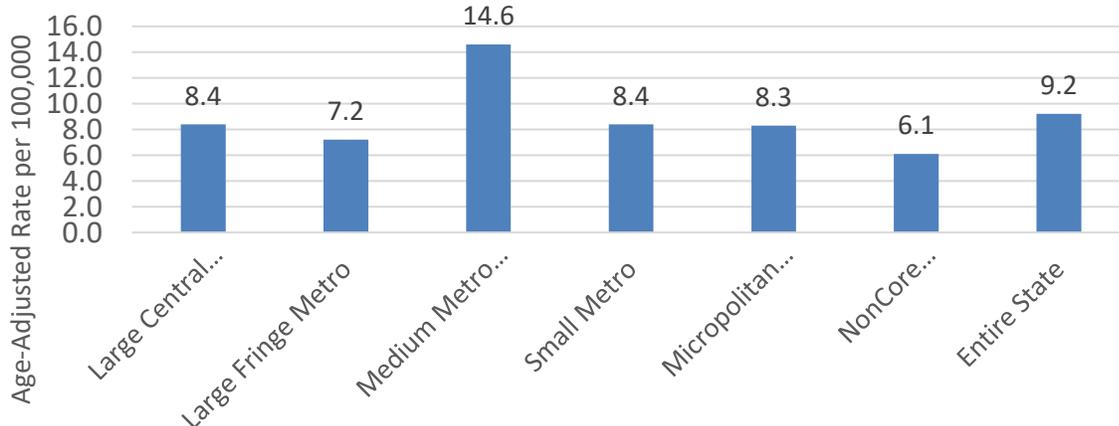
Overall opioid overdose mortality rates by ten-year age categories are shown in Figure 4. Rates increased with age, peaking at the 45-54 years category. Rates sharply declined in each subsequent age bracket.

Figure 4. Overall Crude Rates of Opioid Overdose Deaths by Age Category, All Races, Both Sexes, Arizona, 1999-2019



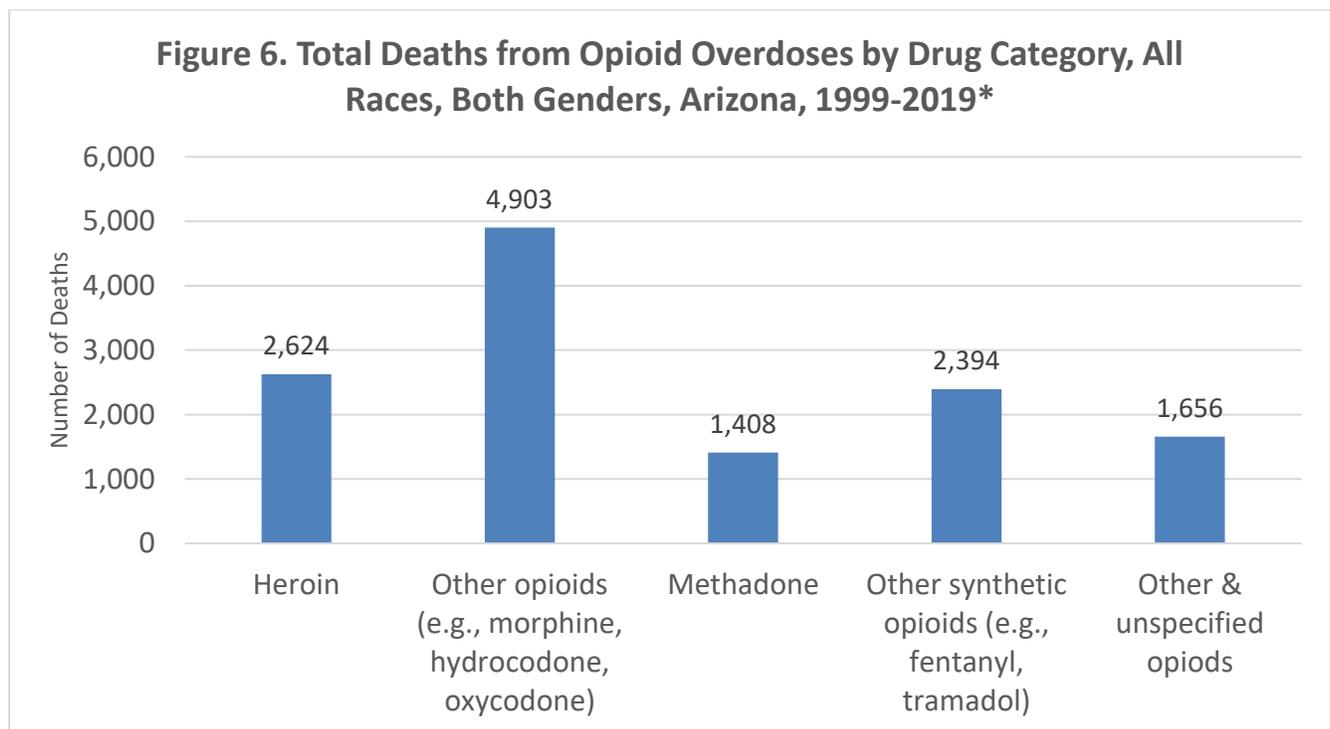
Opioid mortality rates varied by degree of urbanization based on the Urban-Rural Classification Schemes by the [National Center for Health Statistics](#) (Figure 5). The categories are arranged from left to right in order of decreasing urbanization. The Large Central Metro category at the left (Maricopa County) would be the most “urban” location while the NonCore category on the right (Apache, Greenlee, La Paz counties) would be the most “rural” locations. While all locations clearly experienced opioid overdose deaths, the highest rate (14.6) was in Pima County (Medium Metro), and lowest rate (6.1) was in the three most rural counties (as listed above).

Figure 5. Age-Adjusted Rates of Opioid Overdose Deaths by Urbanization Status, All Races, Both Sexes, Arizona, 1999-2019



Figures 6 and 7 show the numbers of deaths and corresponding rates by the type of opioid drug involved. The highest rate of death (3.8/100,000) occurred with the “Other Opioids” category that includes naturally-derived and semi-synthetic prescription drugs such as morphine, codeine, oxycodone, and hydrocodone.

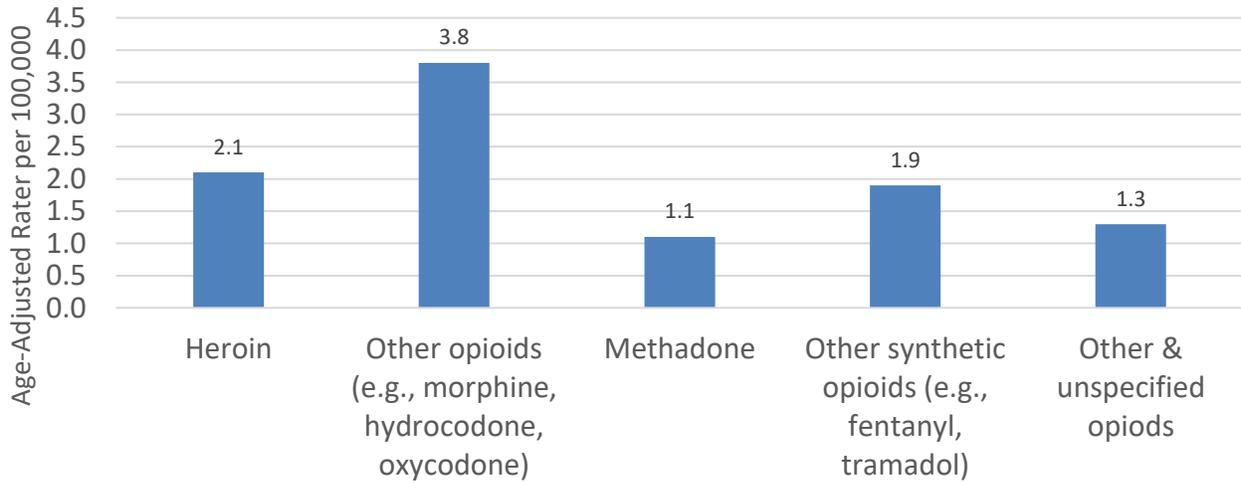
The next two highest rates involved heroin (2.1/100,000) and “Other synthetic narcotics” excluding methadone (1.9/100,000), a category that includes drugs such as fentanyl, tramadol, and several drugs that have now been banned (Darvon) or largely discontinued (Demerol).



*Categories are not all mutually exclusive since multiple drugs can be involved with a death.

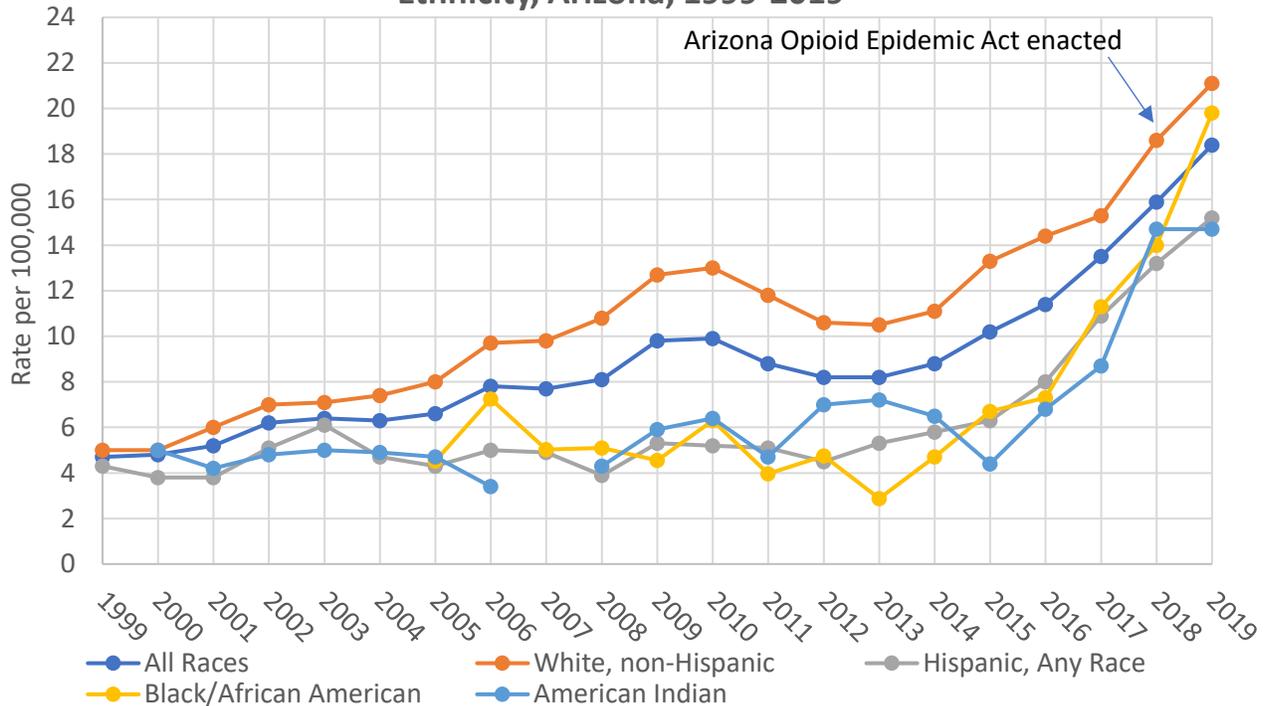
Annual rates of opioid deaths varied widely by year (Figure 8). In general, rates showed moderate increases until around 2010, then a slight decline until 2013, and finally greatly increasing rates from 2013 to 2019. Regression trend analysis, shown in a separate section below, confirmed this pattern.

Figure 7. Age-Adjusted Rates of Opioid Overdose Deaths by Drug Category, All Races, Both Genders, Arizona, 1999-2019*



*Categories are not all mutually exclusive since multiple drugs can be involved with a death.

Figure 8. Annual Rates* of Opioid Overdose Deaths by Race and Ethnicity, Arizona, 1999-2019



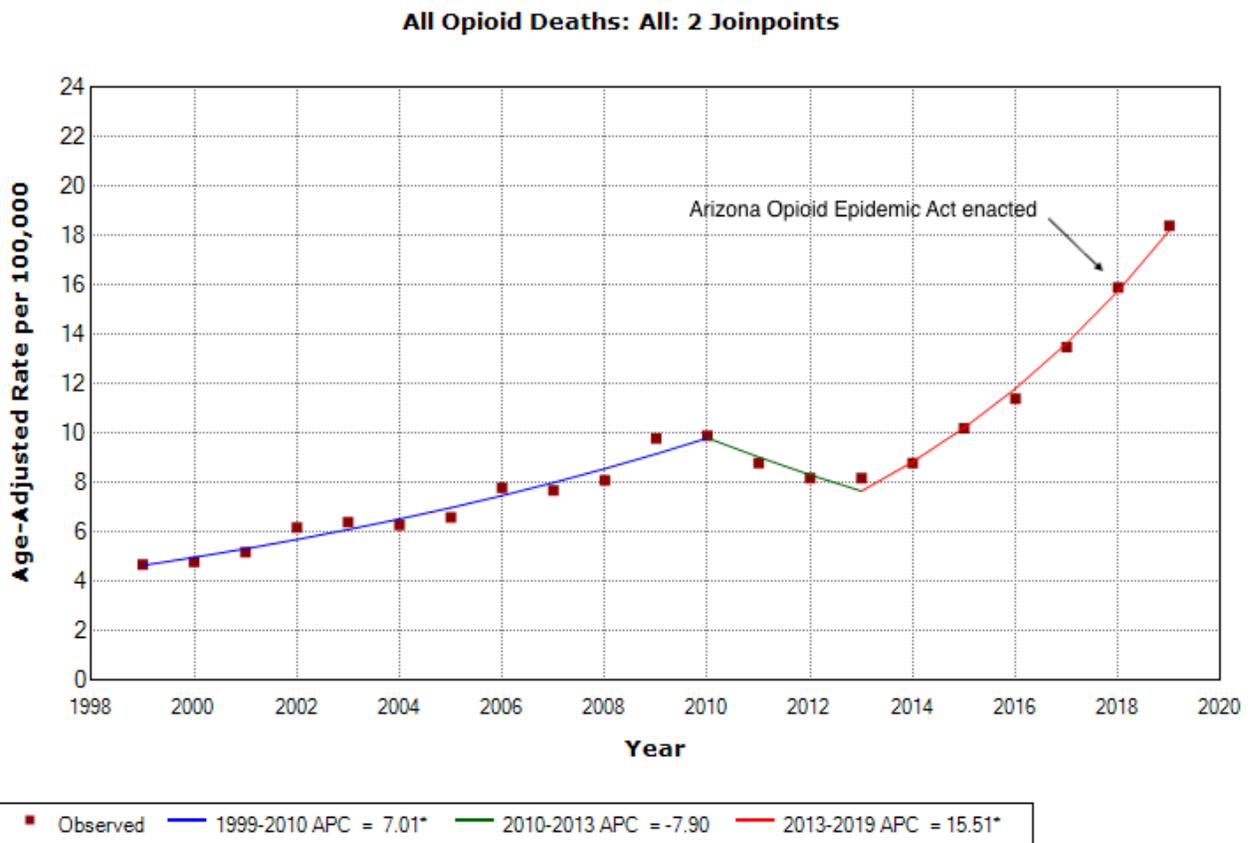
* Age-adjusted Rates shown for All Races, non-Hispanic Whites, and Hispanics - Any Race; crude rates are shown for Blacks/African Americans, and American Indians. Rates for Blacks/African Americans are suppressed or unreliable prior to 2015; rates for American Indians are unreliable prior to 2009; rates for Asians/Pacific Islanders are suppressed or unreliable for all years and are not shown.

Regression Trend Analysis:

As previously noted, [regression analysis](#) was used to statistically examine opioid mortality trends. This analysis can identify statistically significant differences in trends (rates of increase or decrease) over different periods of time. The year in which there is a turning point in trends is referred to as a “joinpoint” in these analyses since it joins two different trend lines for that category; some analyses show one joinpoint (meaning two different trend lines), while others show two joinpoints (meaning three different trend lines).

For all opioid overdose deaths (all races, both sexes), such rate differences were readily observed (Figure 9). There was a statistically significant 7.0% annual increase in the mortality rate between 1999 and 2010, a non-significant 7.9% annual decrease for the period 2010-2013, and a larger significant 15.5% annual increase between 2013 and 2019. That later increase was largely driven by dramatic increases in the drug category that includes fentanyl and tramadol (see Figure 14).

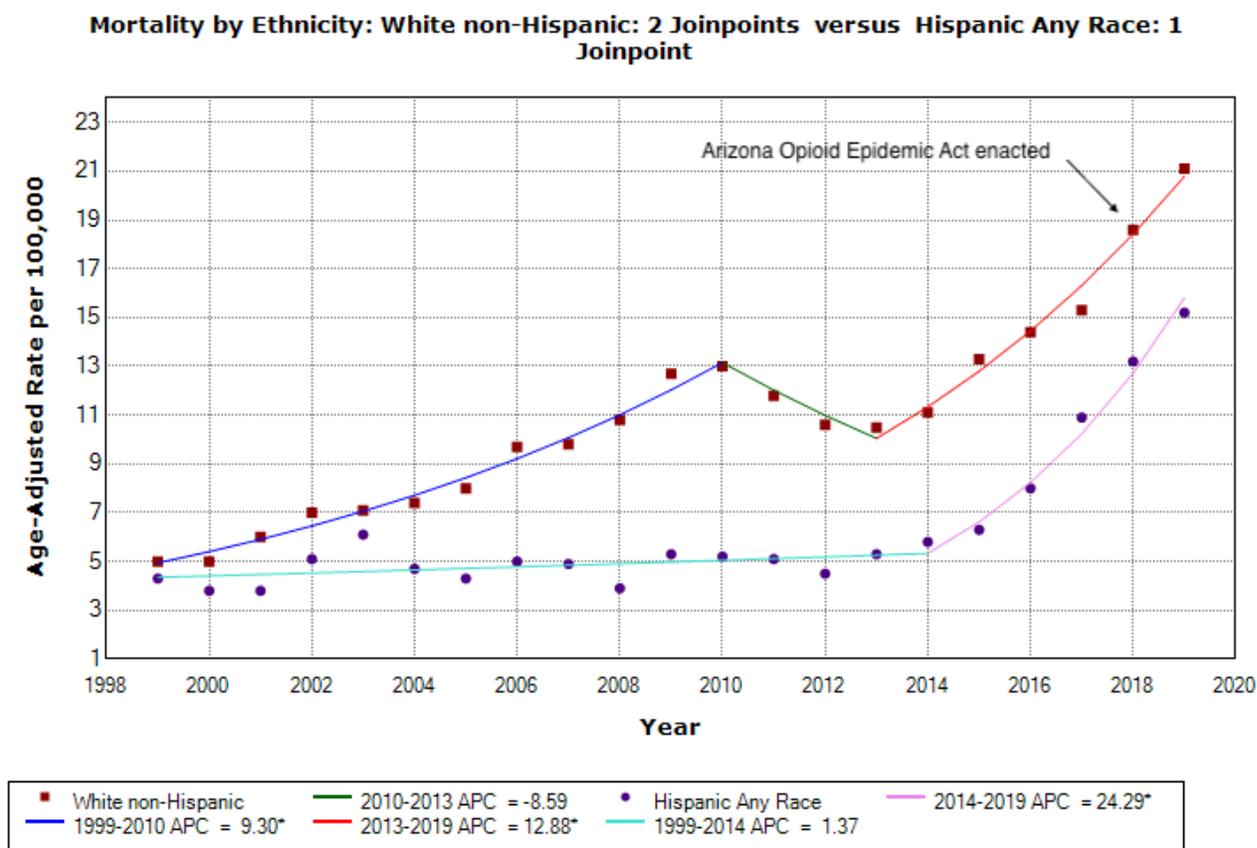
Figure 9. Statistical Trends for All Opioid Age-Adjusted Mortality Rates, Arizona, 1999-2019.



* Indicates that the Annual Percent Change (APC) is significantly different from zero at the alpha = 0.05 level.
Final Selected Model: 2 Joinpoints.

Figure 10 shows differing trends among non-Hispanic Whites and Hispanics of any race during 1999-2010. Among non-Hispanic Whites, there was a significant 9.3% annual increase during 1999-2010, a non-significant 8.6% decrease during 2010-2013, and a significant 12.9% annual increase during 2013-2019. Among Hispanics of any race, there was a non-significant 1.4% annual increase during 1999-2014, then shifting to a significant and large 24.3% annual increase during 2014-2019.

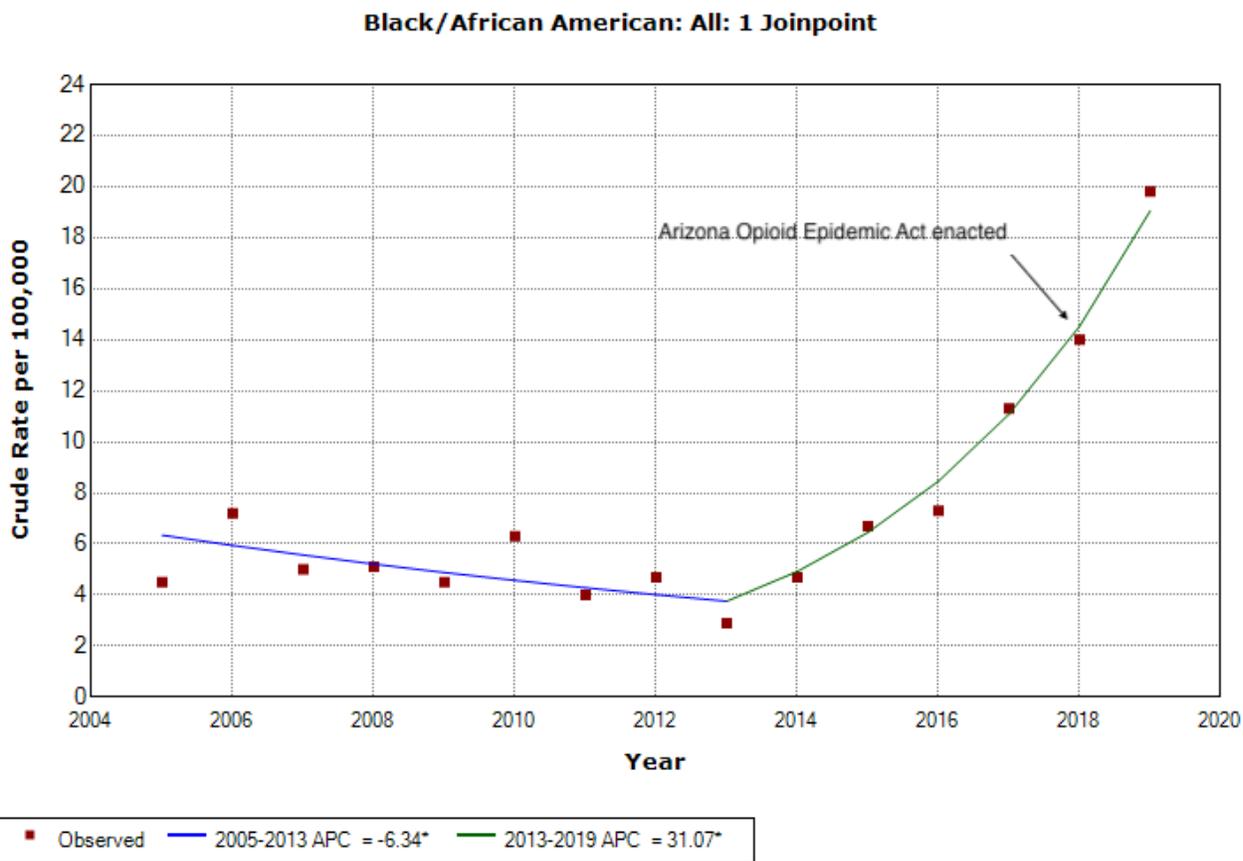
Figure 10. Statistical Trends for Age-Adjusted Mortality Rates for non-Hispanic Whites and Hispanics – All Races, Arizona, 1999-2019.



* Indicates that the Annual Percent Change (APC) is significantly different from zero at the alpha = 0.05 level.
Final Selected Model: White non-Hispanic - 2 Joinpoints, Hispanic Any Race - 1 Joinpoint. Rejected Parallelism.

Due to too few deaths and suppressed data, trend analysis for Blacks/African Americans was limited to crude rates for the limited period 2005-2019. There was a significant 6.3% annual *decrease* in rates during 2005-2013 followed by a significant five-fold higher (31.1%) annual increase during 2013-2019 (Figure 11). While trend analysis among Blacks/African Americans was limited by the small numbers of annual deaths and many statistically unreliable annual mortality rates, the increase beginning in 2013 is based mostly on statistically reliable annual rates.

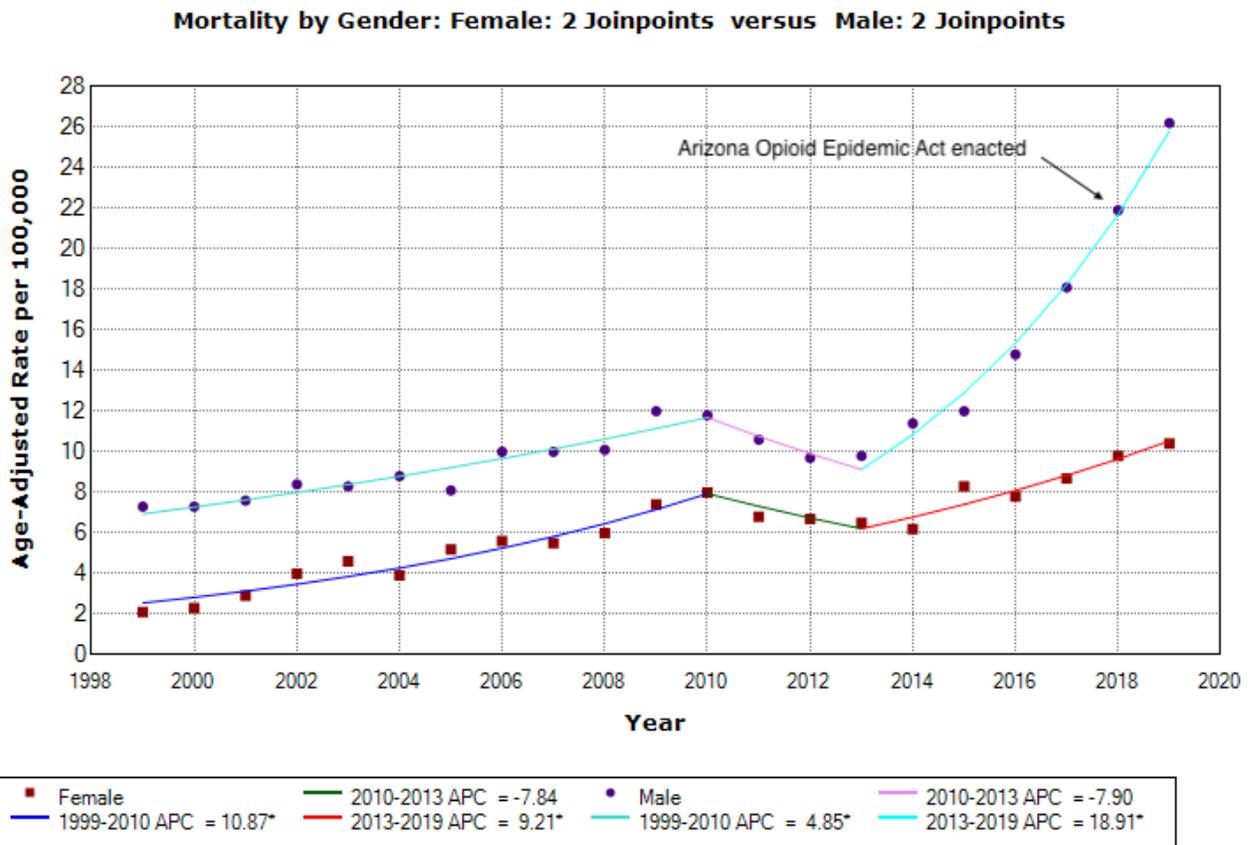
Figure 11. Statistical Trends for Crude Opioid Mortality Rates, Blacks/ African Americans, Arizona, 2013-2019.



* Indicates that the Annual Percent Change (APC) is significantly different from zero at the alpha = 0.05 level.
 Final Selected Model: 1 Joinpoint.

Although appearing similar, mortality trends for males and females were not statistically parallel (Figure 12). Among males, there was a significant 4.9% annual increase during 1999-2010 followed by a significant and much larger 18.9% annual increase during 2013-2019. Among females, there was a significant 10.9% annual increase during 1999-2010 followed by a more modest 9.2% annual increase during 2013-2019.

Figure 12. Statistical Trends for Opioid Age-Adjusted Mortality Rates by Gender, Arizona, 1999-2019.

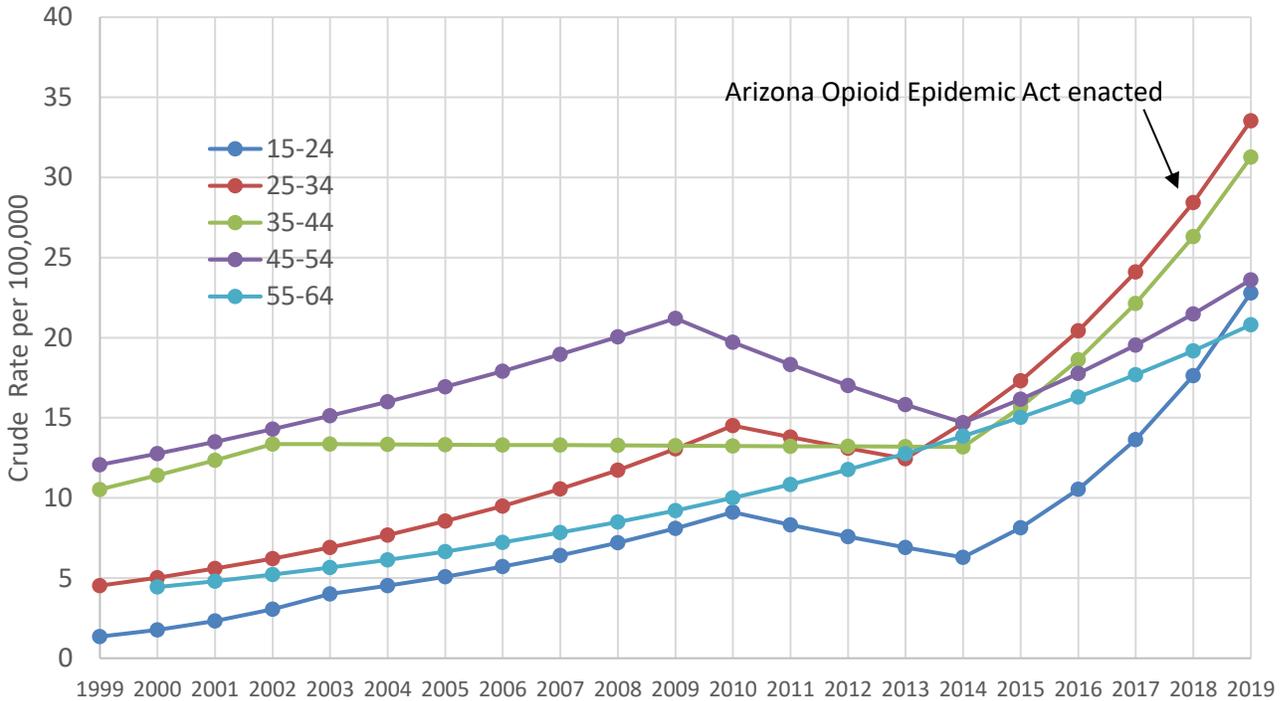


* Indicates that the Annual Percent Change (APC) is significantly different from zero at the alpha = 0.05 level.
Final Selected Model: Female - 2 Joinpoints, Male - 2 Joinpoints. Rejected Parallelism.

Figure 13 shows the trends of opioid overdose deaths by 10-year age categories (rates for the 0-14 and 65+ categories were either suppressed or mostly unreliable and were not analyzed). For all age categories, rates increased significantly over time. For the 55-64 category, the rate of increase was relatively consistent over the whole time-period 1999-2019 with an average annual increase of 8.5%. For all other age categories, trends varied over time, with the largest increases observed beginning in 2013-14.

The smallest annual increases after 2013-14 were seen for the two oldest categories (45-54, 55-64) at 9-10%. The 25-34 and 35-44 categories had annual increases almost double those of the older groups at 18-19%. The sharpest annual increase, however, was among the 15-24 age group at 29.3%, an alarming increase in the youngest age group. That age group also had the highest average annual increase over the whole 1999-2019 period (15.2%), while average annual increases in all other age groups ranged from 3.4% to 9%.

Figure 13. Statistical Trends for Opioid Overdose Death Rates by 10-Year Age Categories, All Races, Both Sexes, Arizona, 1999-2019



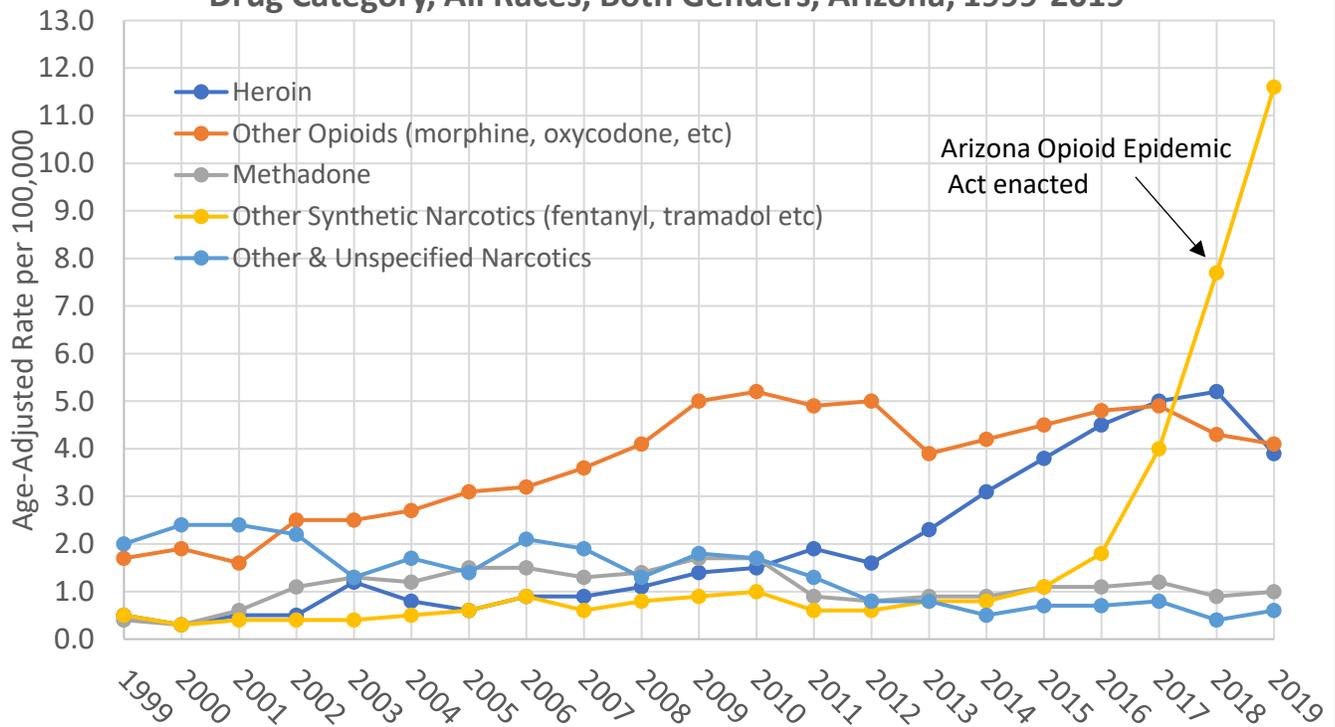
- Age 15-24 Years: Significant annual increases for 1999-2009 (17.6%) and 2014-2019 (29.3%)
- Age 25-34 Years: Significant annual increases for 1999-2010 (11.2%) and 2013-2019 (18.0%)
- Age 35-44 Years: Significant annual increase for 2014-2019 (18.8%)
- Age 45-54 Years: Significant annual increase for 1999-2009; significant annual decrease for 2009-2014 (-7.1%); significant annual increase for 2014-2019 (9.9%)
- Age 55-64 Years: significant annual increase for 1999-2019 (8.5%)

Figure 14 shows the trends of opioid overdose deaths by type of drug involved. Different trends were clearly evident for different categories of drugs. While Methadone and “Other & Unspecified Narcotics” showed long-term annual decreases in rates, all other categories showed rising rates. The “Other Opioids” category that includes drugs such as morphine, codeine, oxycodone, and hydrocodone, showed a significant 10.4% annual increase, before leveling off around 2010.

Heroin showed a significant 16.4% annual increase from 1999 until 2017. The most alarming and abrupt increase was for “Other Synthetic Narcotics,” the category that includes drugs such as fentanyl, tramadol, and several discontinued narcotics. Trend analysis for that category showed a modest but significant 5.7% annual increase during the period 1999-2015; however, between 2015 and 2019, there was a staggering and significant 84.2% annual increase in mortality rates for this category, which has been largely attributed to use of illicitly manufactured fentanyl.

A [2021 CDC report](#) found an overall 1,040% increase in synthetic opioid mortality rates from 2013 to 2019, similar to the 1,350% increase in Arizona during that same time period. Fentanyl is 50x more potent than heroin and 100x more potent than morphine, [according to the CDC](#). When mixed even in small amounts with other drugs like heroin, overdoses are much more likely to occur and be fatal.

Figure 14. Statistical Trends in Rates of Opioid Overdose Deaths by Drug Category, All Races, Both Genders, Arizona, 1999-2019



- Heroin (T40.1): Significant 16.4% annual increase 1999-2017.
- Other Opioids (T40.2): Significant 10.4% annual increase 1999-2010.
- Methadone (T40.3): Significant 42.9% annual increase 1999-2003; significant 2.3% annual decrease 2003-2019.
- Other Synthetic Narcotics (T40.4): Significant 5.7% annual increase 1999-2015; significant 84.2% increase 2015-2019.
- Other and Unspecified Narcotics (T40.6): Significant 6.8% annual decrease 1999-2019

Discussion:

Overall opioid overdose deaths in Arizona have been increasing for at least the past two decades with the largest increases during 2013-2019 among all categories of race, ethnicity, age, and gender. [Similar findings](#) have been published for the U.S. The [ADHS Opioid Epidemic website](#) indicated that 8,559 “suspect opioid deaths” occurred between 06/15/17 (shortly after Gov. Ducey declared a state of emergency) and 02/12/21. The Arizona Opioid Epidemic Act was enacted on 01/26/18 and the Governor declared an end to the emergency on 05/29/18.

Despite those actions, the available data do not support a slowing of the epidemic. Indeed, the rates of opioid and other drug related overdose deaths have further accelerated, particularly in the synthetic opioid category that includes fentanyl. This worrisome pattern is similar to reported [US Trends](#) for the same 1999-2019 period.

Although final 2020 mortality data are not yet available, further spikes in opioid overdose deaths are reported to have occurred during 2020 in Arizona and throughout the US ([CDC](#), [AMA Issue Brief](#)). Provisional data from [CDC/NCHS](#) and a [CDC Health Alert on Dec. 12, 2020](#) for the 12-month periods ending June 2019 and June 2020 indicated an estimated 27% increase in opioid overdose deaths in the US, but a 43% increase in Arizona over those two time periods. It was also noted that the recent acceleration in drug overdose deaths began in 2019 prior to the pandemic and continued into 2020.

In that CDC Alert, it was also noted that the overdose deaths in the 12-month period ending in May 2020, was the largest number ever recorded for a 12-month period. The main driver of that increase was attributed to synthetic opioids.

Synthetic opioid deaths in the U.S. increased 38% in the 12-month period ending in May 2020 compared to the equivalent period ending in June 2019. Even larger increases in synthetic opioid deaths (98%) were seen in 10 western states (including Arizona), consistent with illicitly manufactured fentanyl availability in those states.

A [February 2021 CDC report](#) showed that from 2013 to 2019, mortality rates involving synthetic opioids other than methadone increased 1,040% in the U.S., similar to the 1,350% increase in Arizona over the same period.

Non-fatal opioid overdoses have also increased. A study of nearly 190,000 [Emergency Room \(ER\) visits](#) across 48 states found that opioid overdoses were 29% higher in 2020 compared to the same time period in 2019. A recent *Arizona Republic* article (02/01/21, "Arizona Deaths Rose 25% in 2020") reported that fatal drug overdose deaths had spiked during the COVID-19 pandemic with ADHS estimating that about 2,300 deaths will likely have occurred in 2020. If verified by final data, that number will greatly exceed the number of opioid overdose deaths for 2020 that would have been expected based on trend data for 2013-2019 (pre-COVID pandemic).

Based on the 15% average annual rate of increase in overall opioid deaths seen during 2013-2019, approximately 1,500 opioid deaths would have been expected in 2020. This is in contrast to the ADHS estimated pandemic-related number of 2,300. In other words, instead of the expected 15% increase from 2019 to 2020, the increase would be almost 3.5-fold higher at 53%.

It should also be noted here that opioid overdose deaths in 2018-2019 ($N=2,396$) exceeded [motor vehicle deaths](#) ($N=1,992$) for the first time in Arizona history.

There are [many determinants](#) for the persistent annual increases in opioid overdose deaths and the [latest pandemic-related surge](#) in both deaths and ER visits. The changing trend patterns over time, such as the rise in heroin deaths and the shocking rise (84% per year) in overdose deaths due to synthetic opioids such as fentanyl, indicate that these determinants are also changing over time, creating both challenges and opportunities for prevention.

A [2019 IQVIA Institute study](#) showed that opioid prescriptions declined by 33% between the start of 2014 and the end of 2018, and the total dosage (morphine milligram equivalents) declined by 43% since the peak in 2011. The number of newly initiated opioid prescriptions also declined (by 23%) since 2014. These changes were attributed to “changes in clinical use, regulatory and reimbursement policies and legislation, all of which have increasingly restricted prescription opioid use since 2012.”

After many years of increased use and abuse (and subsequent lawsuits), prescription opioid use has been declining since around 2011, a decline that is now reflected in steady or declining mortality rates from prescription opioids since that time. Unfortunately, at the same time, [heroin](#) and synthetic opioid use—primarily illicitly manufactured fentanyl—have sharply increased and the rate of opioid overdose deaths continues to expand year after year. The data presented in this report indicate that existing intervention efforts (Arizona Opioid Epidemic Act) have not yet mitigated the opioid overdose epidemic in Arizona. Further [public health intervention efforts](#) and additional resources are needed if the death toll from opioid overdoses is to be reduced.

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Appendix: Technical Documentation for ICD10 Codes Used to Identify Opioid Overdose Deaths

MCD - ICD-10 Codes: (Type of Drug)
T40.1 Heroin;
T40.2 Other opioids; (includes drugs such as morphine, codeine, hydrocodone, oxycodone)
T40.3 Methadone;
T40.4 Other synthetic narcotics other than methadone; (includes drugs such as fentanyl, tramadol)
T40.6 (Other and unspecified narcotics)
UCD - ICD-10 Codes: (Nature of Intent)
X40 (Accidental poisoning by and exposure to nonopioid analgesics, antipyretics and antirheumatics);
X41 (Accidental poisoning by and exposure to antiepileptic, sedative-hypnotic, antiparkinsonism and psychotropic drugs, not elsewhere classified);
X42 (Accidental poisoning by and exposure to narcotics and psychodysleptics [hallucinogens], not elsewhere classified);
X43 (Accidental poisoning by and exposure to other drugs acting on the autonomic nervous system);
X44 (Accidental poisoning by and exposure to other and unspecified drugs, medicaments and biological substances);
X60 (Intentional self-poisoning by and exposure to nonopioid analgesics, antipyretics and antirheumatics);
X61 (Intentional self-poisoning by and exposure to antiepileptic, sedative-hypnotic, antiparkinsonism and psychotropic drugs, not elsewhere classified);
X62 (Intentional self-poisoning by and exposure to narcotics and psychodysleptics [hallucinogens], not elsewhere classified);
X63 (Intentional self-poisoning by and exposure to other drugs acting on the autonomic nervous system);
X64 (Intentional self-poisoning by and exposure to other and unspecified drugs, medicaments and biological substances);
X85 (Assault by drugs, medicaments and biological substances);
Y10 (Poisoning by and exposure to nonopioid analgesics, antipyretics and antirheumatics, undetermined intent);
Y11 (Poisoning by and exposure to antiepileptic, sedative-hypnotic, antiparkinsonism and psychotropic drugs, not elsewhere classified, undetermined intent);
Y12 (Poisoning by and exposure to narcotics and psychodysleptics [hallucinogens], not elsewhere classified, undetermined intent); Y13 (Poisoning by and exposure to other drugs acting on the autonomic nervous system, undetermined intent);
Y13 (Poisoning by and exposure to other drugs acting on the autonomic nervous system):
Y14 (Poisoning by and exposure to other and unspecified drugs, medicaments and biological substances, undetermined intent)