



Data Brief

Characteristics of non-fatal opioid-related overdoses

Massachusetts Department of Public Health

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Background

The ongoing opioid overdose crisis has claimed the lives of over 25,000 people in Massachusetts since 2000. The opioid overdose death rate more than doubled between 2013 and 2022, from 14.2 to 30.7 deaths per 100,000 residents to 33.5 per 100,000 residents.¹ People who survive one opioid overdose are at risk for another opioid overdose.^{2,3} Public Health surveillance of non-fatal opioid overdose (NFO) is complex and is limited to events only where a patient receives medical services, such as ambulance trips, emergency department visits, or hospitalization. NFOs where medical treatment is not sought, such as when naloxone is administered by non-medical personnel, are not captured in data systems. Up to 50% of patients have been found to refuse emergency medical service transport after overdose reversals.⁴ We used the Public Health Data Warehouse (PHD) to characterize Massachusetts (MA) residents who experienced at least one documented NFO from 2013 through 2021.

Results

From 2013 through 2021, 72,018 Massachusetts residents experienced one or more documented NFOs, totaling 133,295 NFOs and averaging two NFOs per person. For every fatal opioid overdose between 2013-2021, there were an average of 9 NFOs. One of every eleven (6,404 of 72,018) people with an NFO subsequently experienced a fatal opioid overdose. From 2013 to 2021, 60% of the MA residents who experienced a fatal opioid overdose had not had a documented prior NFO. Figure 1 shows the number of NFOs from 2013 through 2021 in MA. The number of NFOs increased by 130% from 2013 to 2017 and then decreased 18% from 2017 to 2021. Notably in 2020, during this decreasing period, the COVID-19 pandemic began. The associated medical service interruptions and social distancing in 2020 and 2021 may have impacted the ability of individuals to seek medical treatment for their NFOs.

¹ Massachusetts Department of Public Health. (2023 June). Data Brief: Opioid-Related Overdose Deaths among Massachusetts Residents. Mass.gov.

² Shrestha, S., Stopka, T.J., Hughto, J.M.W. *et al.* Prevalence and correlates of non-fatal overdose among people who use drugs: findings from rapid assessments in Massachusetts, 2017–2019. *Harm Reduct J* **18**, 93 (2021).

³ Suffoletto B, Zeigler A. Risk and protective factors for repeated overdose after opioid overdose survival. *Drug Alcohol Depend.* 2020 Apr 1;209:107890.

⁴ Kim, JK *et al.*, 2019. "Factors associated with help seeking by community responders trained in overdose prevention and naloxone administration in Massachusetts", *Drug and Alcohol Dependence*, Volume 204, 2019, 107531, ISSN 0376-8716, <https://doi.org/10.1016/j.drugalcdep.2019.06.033>.

**Figure 1. Non-fatal opioid-related overdoses, Massachusetts residents
2013-2021. (n=133,295)**

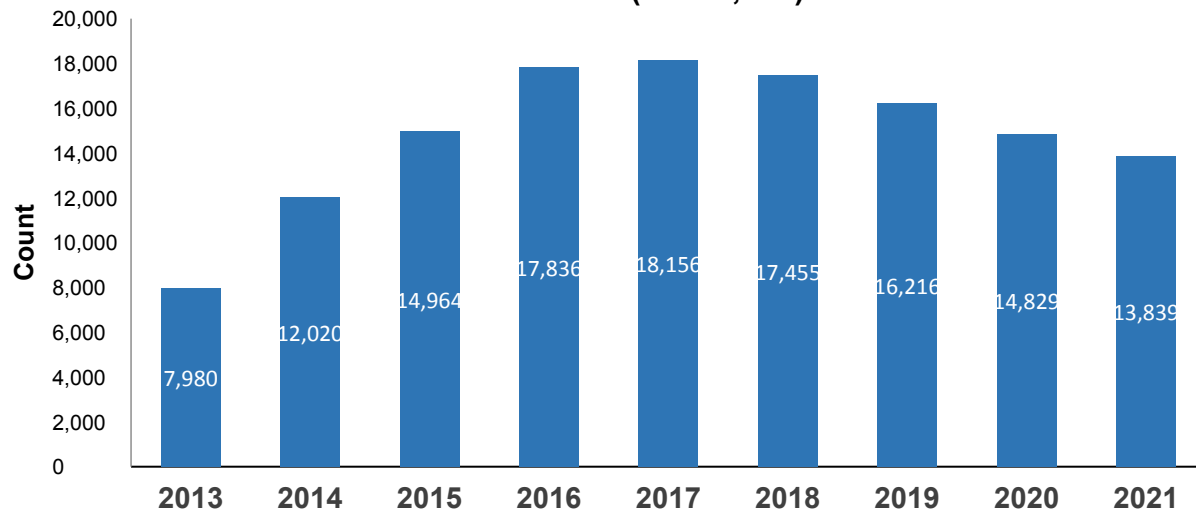


Figure 2 shows the age-adjusted rates of NFO and fatal opioid overdose from 2013 through 2021. The 2021 NFO rate in Massachusetts of 181.4 per 100,000 was five-and one-half times higher than the fatal opioid overdose rate of 32.7 per 100,000 that year. Both the age-adjusted fatal opioid overdose rate and the age-adjusted NFO rate more than doubled between 2013 and 2017 (from 116.1 to 259.5 per 100,000). The age-adjusted fatal opioid overdose rate remained stable from 2017 through 2020 and then increased 9% by 2021, while the age-adjusted NFO rate decreased by 30% from 2017 through 2021 (from 259.5 to 181.4 per 100,000). This decrease may be due to changes in the lethality of the drug supply which is heavily contaminated by fentanyl (as fentanyl contaminated substances may be making opioid overdoses more likely to be fatal), and because of the increasing availability of naloxone in Massachusetts which may result in some NFOs being treated without documented medical care.

Figure 2. Age-adjusted rate of fatal and non-fatal opioid overdose per 100,000 Massachusetts residents, 2013-2021.

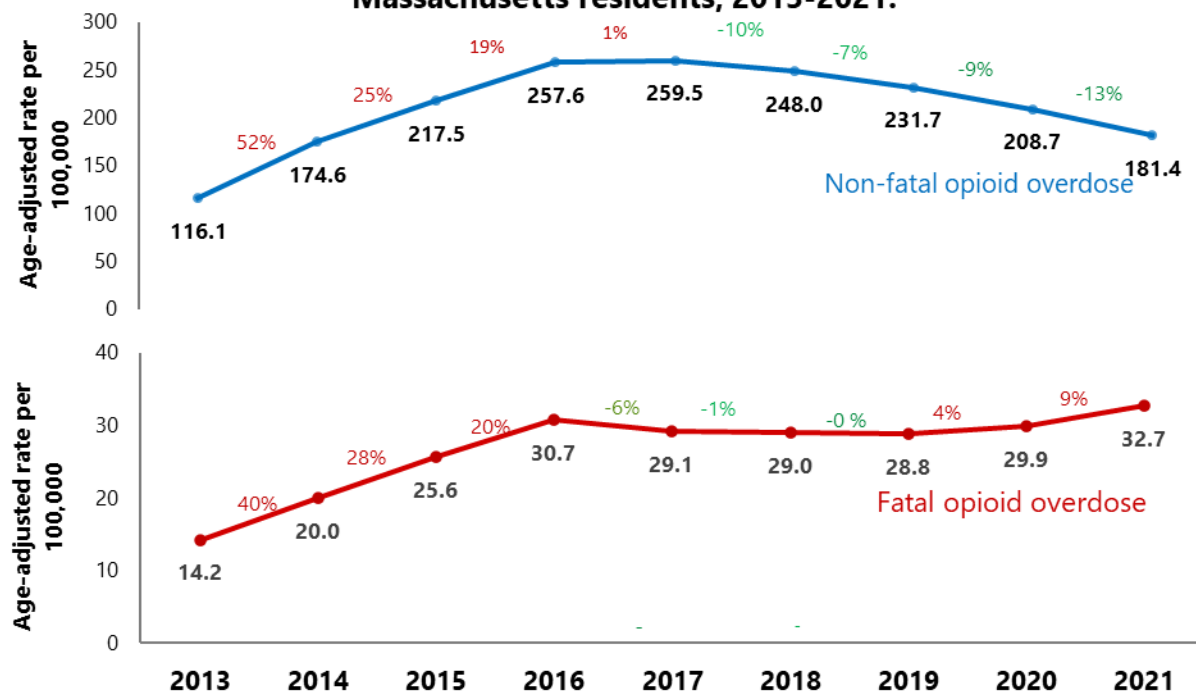


Figure 3 shows the number of NFOs per fatal opioid overdose by year from 2013 through 2021. In 2013, there were under 9 NFOs for every fatal opioid overdose, while in 2021, there were just over six NFOs per fatal opioid overdose, a 23% rate decrease between 2017 and 2021 at a time when the rate of fatal overdose increased 11%.

Figure 3. Number of non-fatal overdoses per fatal opioid overdose, Massachusetts residents, 2013-2021.

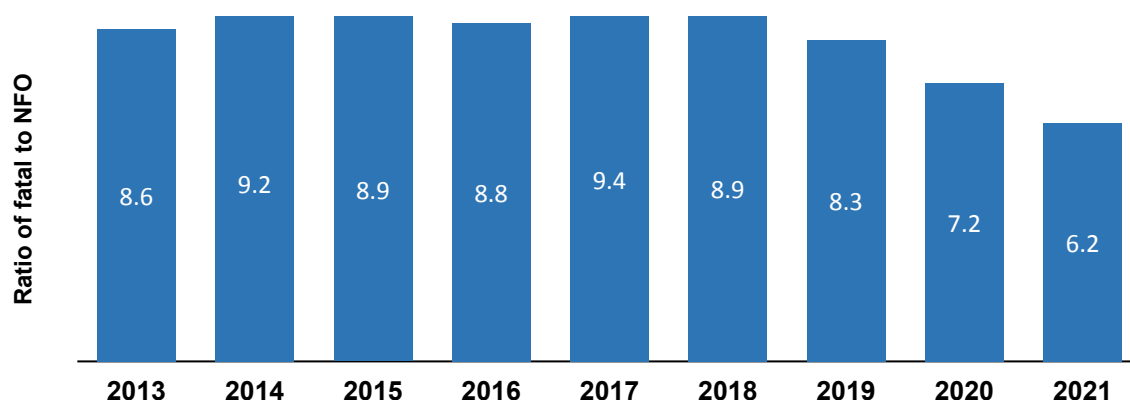


Figure 4 shows the number of NFOs per individual from 2013 through 2021. The majority (65%) of residents experienced one documented NFO, 17% experienced two, and the remaining 18% had three or more NFOs. Of the 16,095 MA residents who experienced a fatal opioid overdose between 2013 and 2021, 60% (9,691) had not experienced a prior documented NFO. Of those

who survived a first NFO, 8.9% (6,404) subsequently experienced a fatal opioid overdose. Four percent (3,092) of those who survived their first NFO experienced a fatal opioid overdose the second time they overdosed. The 3,312 individuals experienced an average of 3.4 NFOs prior to the

Figure 5B. Fatal opioid overdose by sex; MA residents, 2013-2021. (n=16,095)

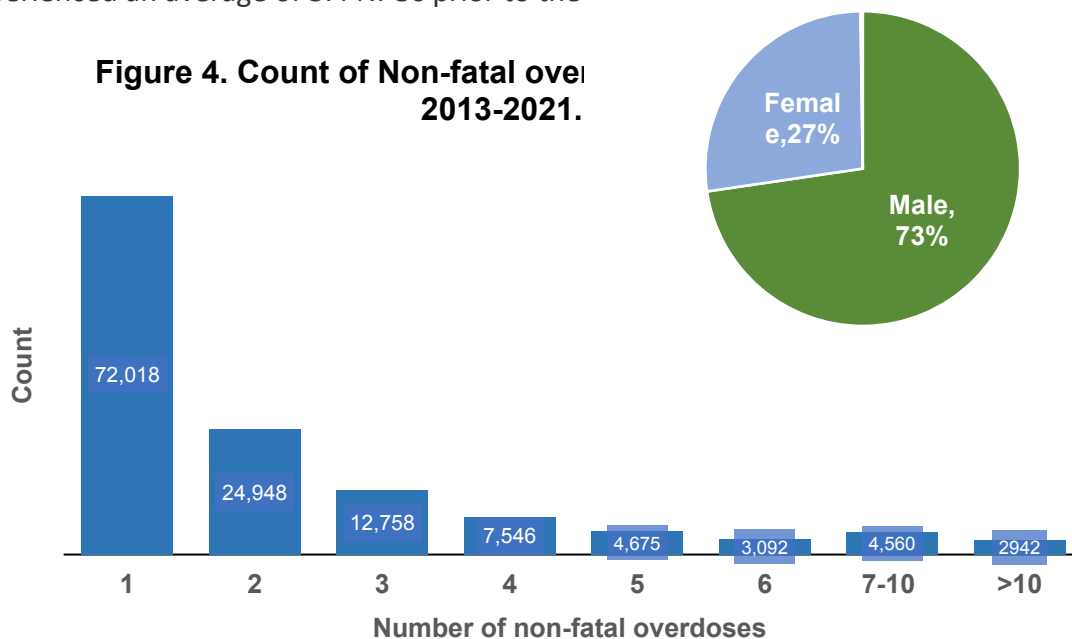
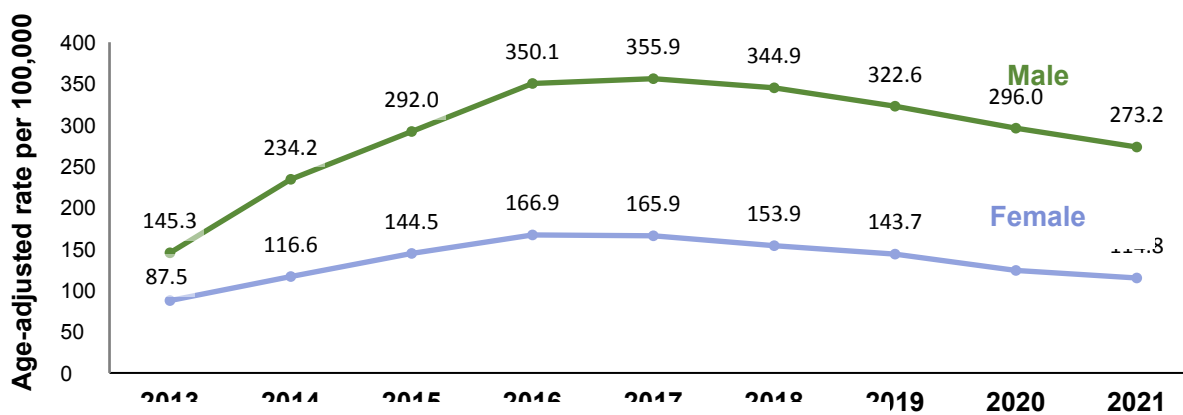


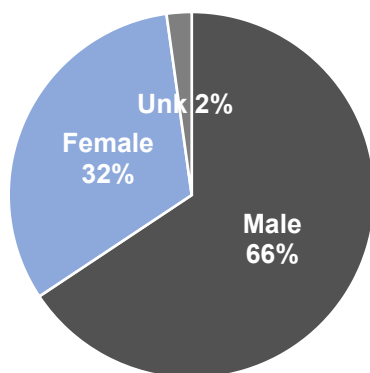
Figure 5 shows the trend by binary sex from 2013 through 2021. During this period, the NFO rate differences between the sexes widened from males experiencing a rate that was 1.7 times higher than females in 2013 to a rate that was 2.4 times higher than females in 2021.

Figure 5. Age-adjusted non-fatal opioid overdose rate by binary sex*. Massachusetts Residents, 2013-2021 (n=133,295)



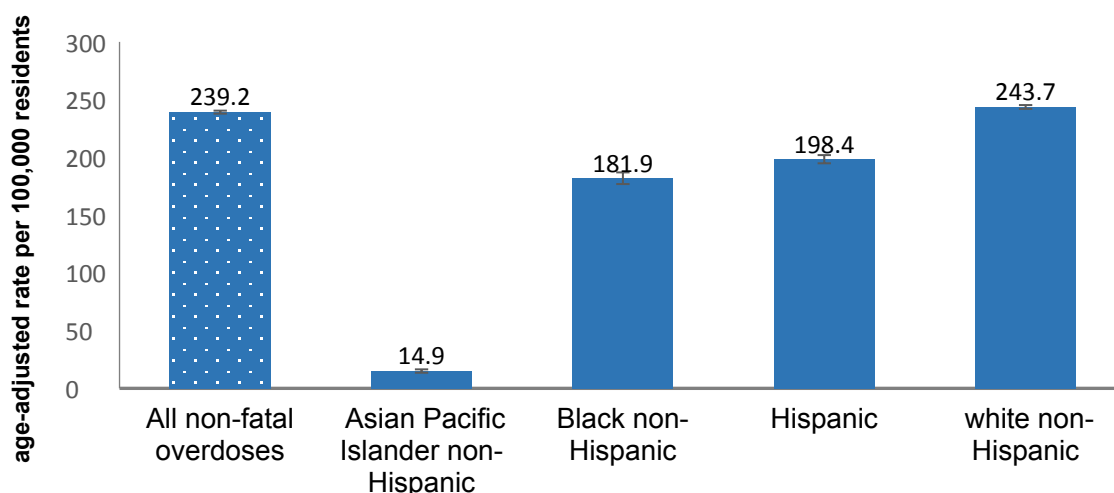
Figures 5A and 5B show the binary sex breakdowns for NFO and fatal opioid overdose. Of the total NFOs between 2013-2021, 66% occurred in males, 32% occurred in females, and 2% were unknown. We see more unknown sex (2% versus 0%) and more overdoses occurring in females in the NFO group compared to the fatal overdose population (32% versus 27%).

**Figure 5A. Non-fatal opioid-related overdose by sex.
MA residents, 2013-2021. (n=133,295)**



The average age for an NFO between 2013 and 2021 was 39.1 years old, which is 2.0 years younger than those who experienced a fatal opioid overdose in the same period. Figure 6 shows the statewide age-adjusted rate of NFO by known race and Hispanic ethnicity. The overall age-adjusted NFO rate from 2013 through 2021 was 239.0 per 100,000 residents. The highest rate was among white non-Hispanic residents at 243.7 NFOs per 100,000, followed by Hispanic residents at 198.4 per 100,000, then Black non-Hispanic residents at 181.9 per 100,000. Asian/Pacific Islander non-Hispanic residents' rate of 14.9 per 100,000 was sixteen times lower than statewide. The rate for American Indian/Alaska Native residents is not calculated as the population group is combined with the "Other" race in the PHD.

Figure 6. Age-adjusted rate of non-fatal overdose per 100,000 by race* and Hispanic ethnicity. Massachusetts residents 2013-2021 (n=133,295).

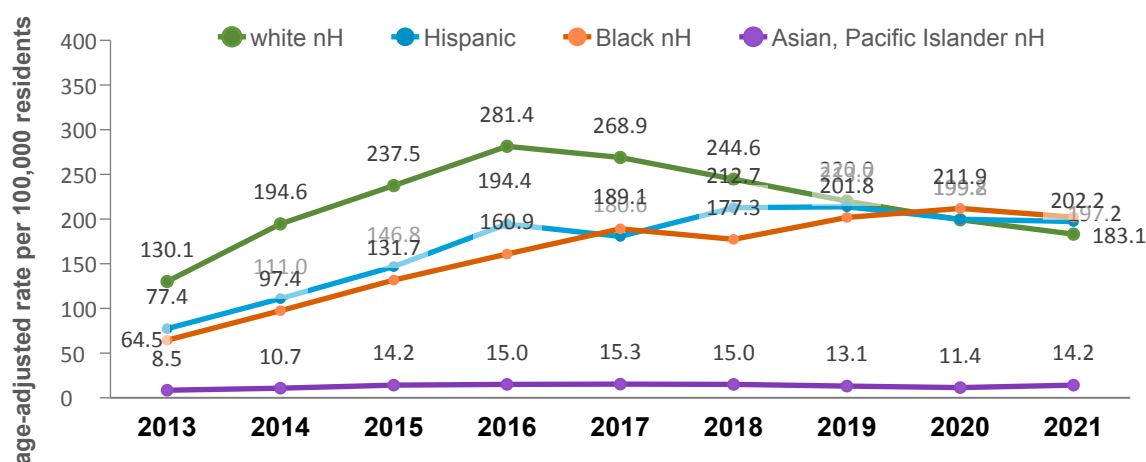


*Rates for American Indian and Alaska Natives are not calculated as they are combined with 'Other races' in the PHD. 18,340 records with missing race are excluded.

Figure 7A presents the overall age-adjusted NFO rate by race and Hispanic ethnicity by year. Age-adjusted rates for all group increased between 2013 and 2016, at which point we see changes by race and Hispanic ethnicity. The rate for white non-Hispanic residents decreased

35% between 2016 and 2021 (from 281.4 to 183.1 per 100,000). Rates for Black non-Hispanic residents increased through 2017, decreased 6% until 2018 and then increased 12% from 2017 to 2020 (from 189.1 to 211.9 per 100,000), and finally decreased 5% in 2021. The rate for Hispanic residents decreased 7% from 2016 to 2017, then increased 15% from 2017 to 2019 (from 180.6 to 213.7 per 100,000) and then decreased 8% through 2021. The rates for Asian/Pacific Islander non-Hispanic residents increased 80% from 2013 to 2017, and then decreased 7% through 2021. Age-adjusted NFO rates for American Indian/Alaska Native residents are not shown in these figures because they are combined with 'Other' races in the PHD.

**Figure 7A. Age-adjusted rate of non-fatal opioid overdose by race* and Hispanic ethnicity
Massachusetts residents, 2013-2021**



* Notes: Rates for American Indian and Alaska Natives are not shown as they are combined with 'Other race' in the PHD; nH=non-Hispanic. 18,340 records with missing race and Hispanic ethnicity excluded.

Figure 7B shows the age-adjusted NFO rates for male residents by race and Hispanic ethnicity. Across all races and ethnicities, male residents experienced higher age-adjusted NFO rates than female residents. Rates for Hispanic male residents increased nearly 400% from 2013 to 2019, including a 7% drop from 2016 to 2017, and then decreased 10% from 2019 to 2021. The age-adjusted rate for Black non-Hispanic male residents increased 280% from 2013 to 2020 (from 89.0 to 335.1 per 100,000) which included a 6% drop from 2017 to 2018, and then a final 10% decrease from 2020 to 2021. The age-adjusted rates for white non-Hispanic male residents increased by 130% from 2013 to 2016 (from 161.9 to 371.5 per 100,000), and then declined steadily 33% between 2016 and 2021. The rates for male Asian/Pacific Islander male residents were the lowest of the four groups despite increasing 67% from 2013 to 2021, ending at a rate of 20.7 per 100,000 in 2021.

Figure 7B. Age-adjusted rate of non-fatal opioid overdose by race* and Hispanic ethnicity. Male Massachusetts residents, 2013-2021.

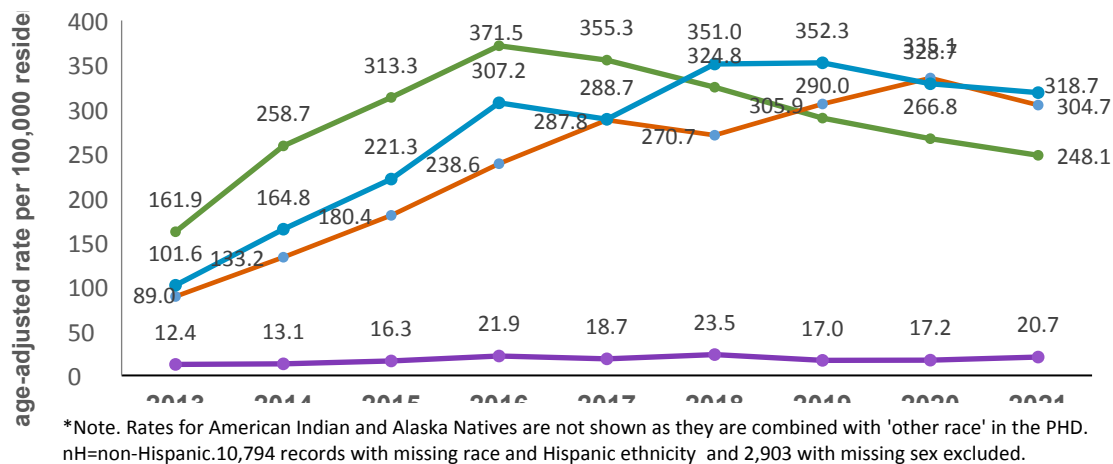
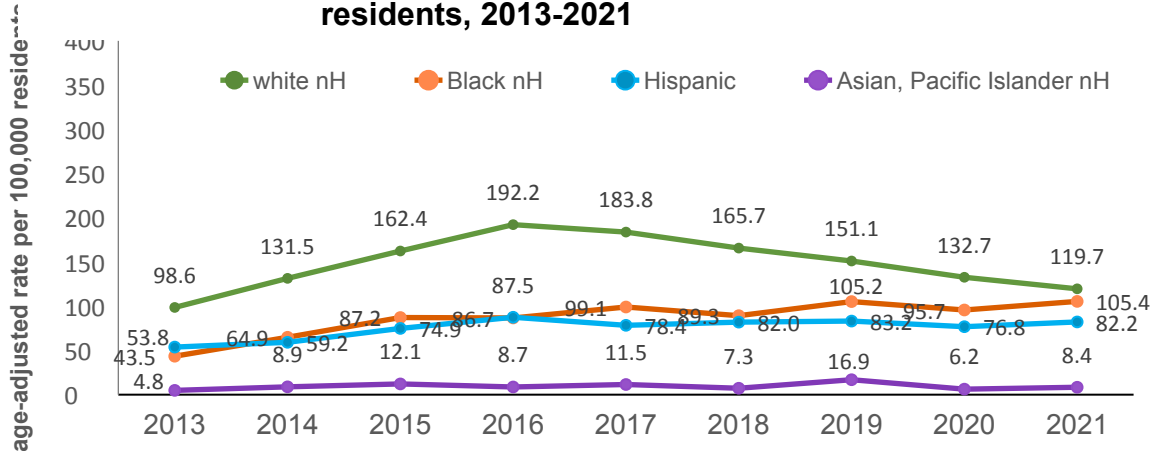


Figure 7C shows the age-adjusted NFO rate for female residents by race and Hispanic ethnicity. The age-adjusted rate for white non-Hispanic female residents was the highest of the groups. The rate for white non-Hispanic female residents increased 95% from 2013 to 2016 (from 98.6 to 192.2 per 100,000), and then decreased steadily 38% to 2021. The rate for Hispanic female residents increased 12% (from 53.8 to 87.5 per 100,000) between 2013 and 2016, and then decreased 5% to 82.2 per 100,000 in 2021, ending as the highest rate of the groups. From 2013 through 2019, the age-adjusted NFO rate for Black non-Hispanic female residents increased by 142% (from 43.5 to 105.2 per 100,000) and then stabilized until 2021. Notably the trend included two years with decreasing rates: 6% from 2015 to 2016, and 10% from 2017 to 2018. While experiencing the lowest rates of the four groups, the age-adjusted rate for Asian/Pacific Islander female residents increased 253% from 2013 to 2019 (from 4.8 to 16.9 per 100,000), then decreased 50% from 2019 to 2021 (to 8.4 per 100,000).

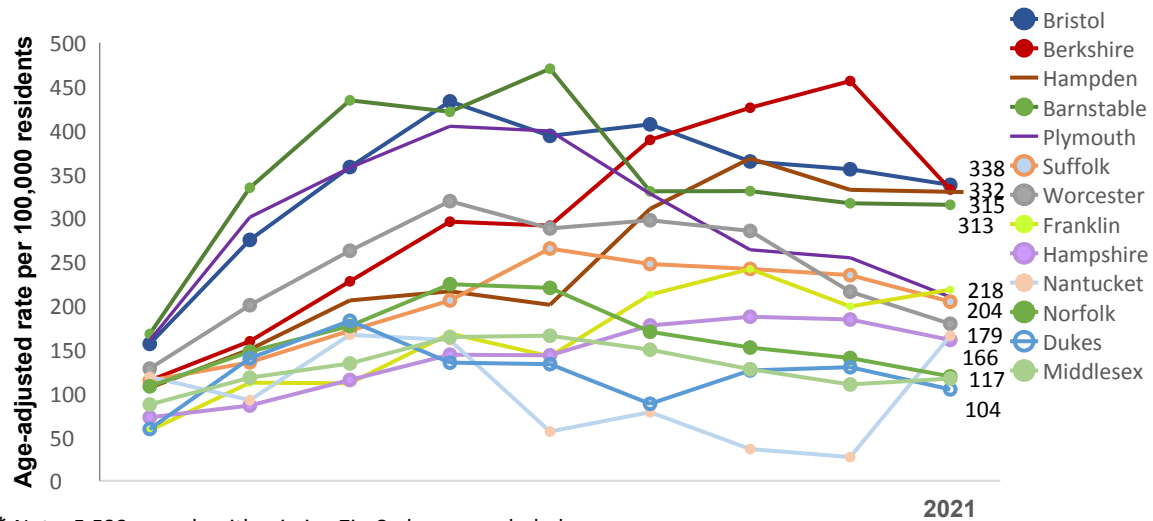
Figure 7C. Age-adjusted rate of non-fatal opioid overdose by race* and Hispanic ethnicity. Female Massachusetts residents, 2013-2021



* Note. Rates for American Indian and Alaska Natives are not shown as they are combined with 'Other race' in the PHD; nH=non=Hispanic; 4,643 records with missing race and Hispanic ethnicity and 2,903 with missing sex are excluded.

Figure 8 shows the age-adjusted NFO rate by year and MA county of residence. Characterizing the NFOs by the county of residence highlights spatial differences across the state. Ten of the fourteen counties in MA had decreasing age-adjusted NFO rates since the peak in 2017. Four western MA counties saw large increases from 2017 to 2020, and then leveled or decreased between 2020 and 2021. Specifically, the rate in Berkshire County increased 57% through 2020 (from 291.1 to 456.1 per 100,000), then declined 27%. The rate in Hampden County increased 65% (from 200.8 to 332.0 per 100,000) then decreased 9%. The rate in Franklin County increased 41% (from 142.0 to 198.9 per 100,000) and then increased 10%. The rate in Hampshire County increased 28% (from 143.2 to 184.0 per 100,000) and then decreased 12%. While most counties saw a rate decrease from 2020 to 2021, Nantucket County (500%), Middlesex County (6%), Essex County (2%), and Franklin County (10%) increased.

Figure 8. Age-adjusted rate of non-fatal opioid-related overdose by county, Massachusetts 2013-2021.



To examine NFOs in rural communities we used definitions created by the MA State Office of Rural Health. We classified cities and towns as urban, rural, or most rural. Figure 9 shows the NFO rate by urban, rural, and most rural from 2013 through 2021. From 2013 through 2017, urban communities experienced the highest age-adjusted NFO rates, peaking in 2017 (at 260.4 per 100,000). Between 2017 and 2018, the age-adjusted rate for the most rural communities increased nearly 50% (from 217.9 to 310.1 per 100,000), to the highest rate of the three groupings from 2018 to 2021. Across the state, rates of NFOs in all rural and urban classifications have declined since their peak in 2017 and 2018. The rate of NFOs among the most rural communities have been the highest in the state since 2018; by 2021, they were 24% higher than the statewide rurality average (252.6 versus 203.6 per 100,000).

Figure 9. Age-adjusted rate of non-fatal opioid overdoses by rurality*. Massachusetts residents, 2013-2021.

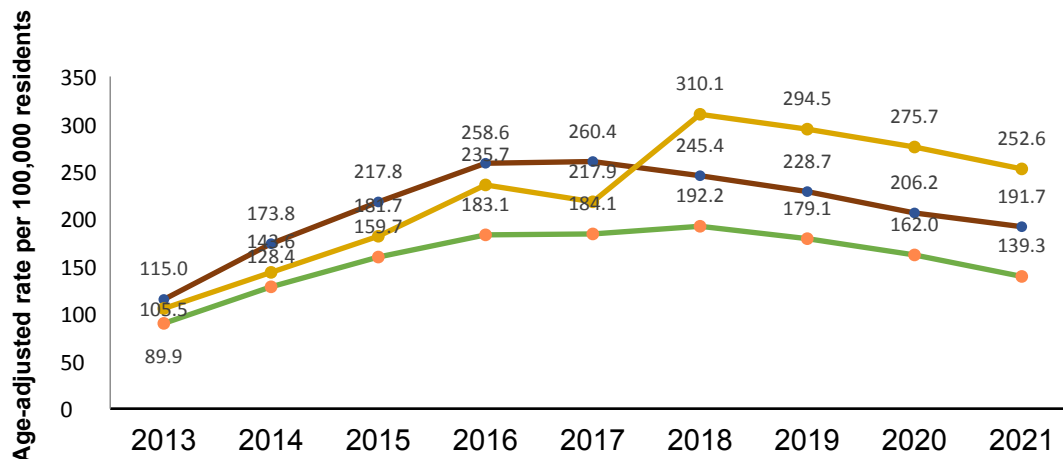
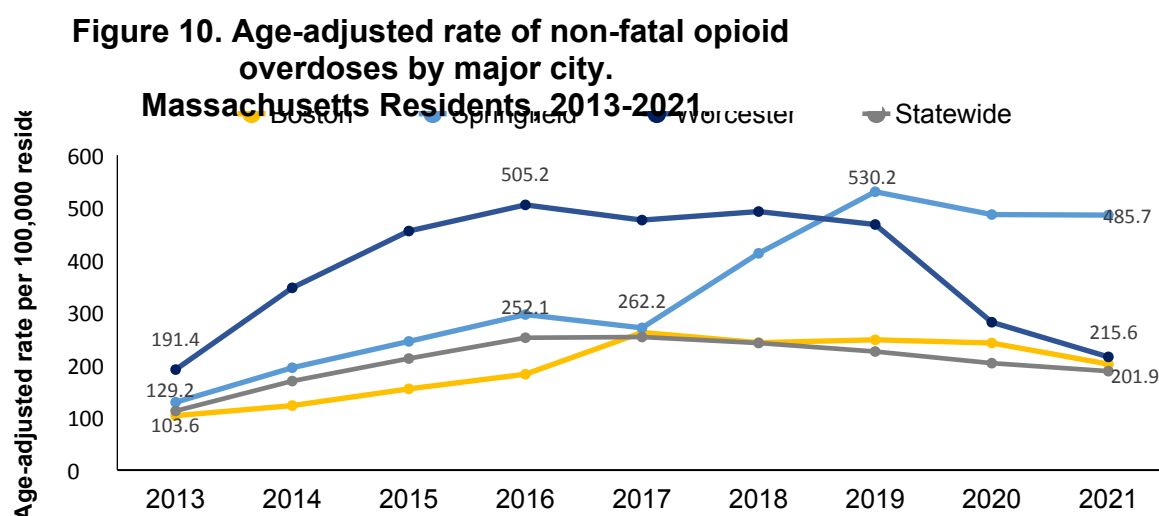


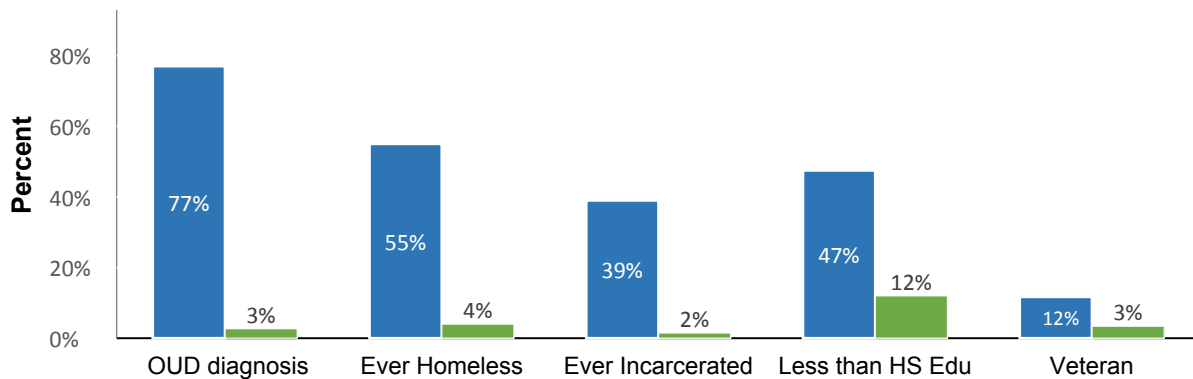
Figure 10 shows the age-adjusted NFO rates from 2013 to 2021 for the three largest cities in Massachusetts: Boston, Springfield, and Worcester. NFO rates for all three were above the statewide average, and there were very different patterns in the NFO rates among the three cities by year. Boston had the lowest rates of the three cities. The rate in Boston increased 153% between 2013 and 2017 (from 103.6 to 262.2 per 100,000) then decreased 23% from 2017 to 2021 (to 201.9 per 100,000). The rate in Springfield increased 130% from 2013 to 2016, decreased 8% for one year, 2016 to 2017, then increased 97% between 2017 and 2019 (to 530.2 per 100,000), and then dropped 8% between 2019 and 2021 (to a rate of 485.7 per 100,000 in 2021). In 2021 Springfield's NFO rate was more than twice as high as Worcester's and Boston's. The NFO rate in Worcester increased 160% from 2013 to 2016 (from 191.4 to 505.2 per 100,000) then stabilized until 2019 and decreased 8% from 2019 to 2021 (to 215.6 per 100,000).



Note, 5,532 records with missing Zip Codes are excluded.

Figure 11 shows the percent of the NFO population versus all MA residents in selected population groups. Nearly sixty percent of the individuals who experienced NFOs between 2013-2021 had been diagnosed with opioid-use disorder (OUD) before their first NFO, and 18% were diagnosed following the first NFO. Overall, 77% of individuals who experienced a documented NFO received an OUD diagnosis at some point, almost twenty-six times higher than the 3% of MA residents diagnosed with OUD. More than half (55%) of residents who experienced an NFO had been homeless at some time from 2011 through 2021, compared to 4% of all MA residents during the same period. And over a third (39%) of residents who experienced an NFO had been incarcerated between 2011 and 2021, compared to 1.4% of all MA residents during the same period. Nearly 50% of the residents who experienced a documented NFO had less than a high school education, which is almost four times higher than the rate in all MA residents with a known education level in the PHD. Twelve percent of residents who experienced an NFO were known veterans, which is more than triple the 3.4% of residents known to be veterans in the PHD.

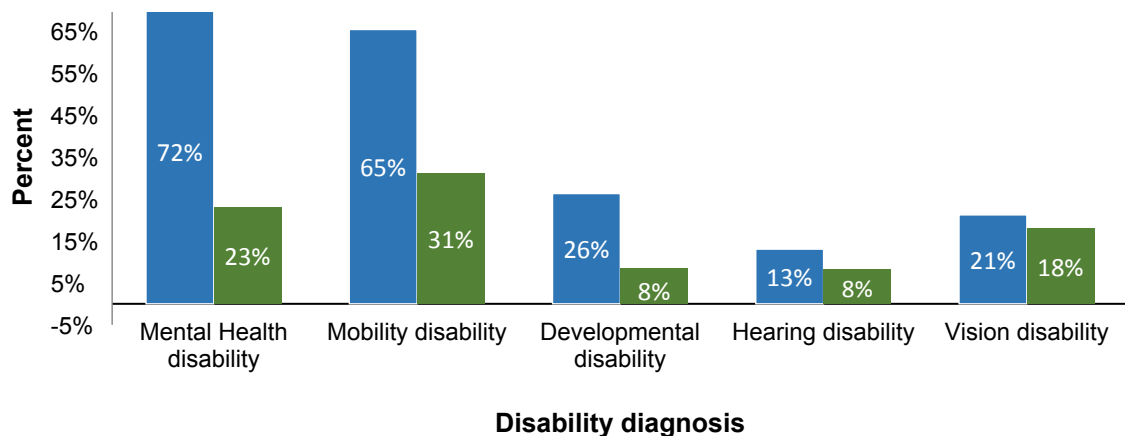
Figure 11. Percent of population groups who experienced a non-fatal opioid overdose. MA residents 2013-2021. (n=72,018)



*MA population prevalence based on 2011-2021; HS=High School.

Figure 12 characterizes residents who experienced an NFO and were identified as having a disability in the PHD. People with disabilities are likely to experience structural ableism and barriers to accessing health care, which may hamper their ability to seek medical help and manage health issues, including chronic pain and substance use disorder. Among residents who experienced an NFO, 72% (52,198) had a mental health disability diagnosis between 2013 and 2021 which is three times higher than the 23% of MA residents. Sixty five percent (47,100) had a mobility disability diagnosis, more than double the 31% of all MA residents. Twenty-six percent (18,928) of residents experiencing an NFO were diagnosed with developmental disabilities, more than three times the rate of all MA residents in the PHD (8%). Thirteen percent (9,380) of residents experiencing an NFO had a hearing disability diagnosis, nearly double the 8% of MA residents in the PHD. Twenty-one percent (15,265) of residents experiencing an NFO had vision disabilities, which is slightly higher than the 18% of all MA residents in the PHD.

Figure 12. Non-fatal overdose by disability status. Massachusetts residents, 2013-2021. (n=72,018)



*Note MA resident population based on 2011-2021 prevalence.

Data to Action

Considering the risk associated with an opioid-related overdose and the importance of health system response with life-saving measures, the following are important areas for promotion and expansion in Massachusetts:

- [EMS naloxone leave-behind programs](#) can improve access to naloxone for people who experience a non-fatal opioid overdose and call 911 while reducing future opioid overdose deaths. This is particularly important in the most rural areas where we are seeing high rates of non-fatal opioid overdose.
- [EMS use of buprenorphine to treat opioid withdrawal symptoms](#) post overdose to increase patient comfort and potential for engagement in care and treatment. A training module for EMTs on working with people who use drugs is available [here](#).
- Implementation of hospital-based addiction consult teams and bridge clinics to improve access to and engagement in substance use related care and treatment for those experiencing non-fatal opioid overdoses. This can include engagement of the populations of focus identified in this report along with community follow-up and peer support.
- [Access to naloxone](#), which is now available [in the pharmacy over the counter](#) as well as via prescription or statewide standing order.
- Increased access to FDA-approved Medications for Opioid Use Disorder. Training for prescribers is available [here](#).
- Promotion of harm reduction resources at each non-fatal opioid overdose health system touchpoint including both directly providing resources such as naloxone, fentanyl test strips, and safer consumption supplies, as well as making strong referrals to [local harm reduction programs](#) and statewide services such as to the [Massachusetts Overdose Prevention Helpline](#).

Methods

We used the Massachusetts Department of Public Health's Public Health Data Warehouse (PHD) to conduct a retrospective analysis of non-fatal opioid overdoses between 2013 and 2021. These data were made available through special legislation, [M.G.L c. 111 s. 237](#) of 2017. Non-fatal opioid overdose is defined as any individual with an ambulance response related to an acute opioid overdose, or any emergency department, outpatient observation, or inpatient hospital discharge with an ICD-9-CM or ICD-10-CM code for opioid poisoning, with no subsequent death record within three days. We used the Bureau of Substance Addiction Services (BSAS) treatment records, prescription monitoring program, Department of Mental Health, and Medical Insurance records to identify opioid use disorder (OUD) and MOUD prescriptions, and a combined demographic dataset to identify priority population groups.

Detailed Definitions

- **Opioid-related overdose** in the Acute Care Hospital Case Mix data was identified using ICD-9 and ICD-10 Overdose search codes: T400X1A, T400X2A, T400X3A, T400X4A, T400X1D, T400X2D, T400X3D, T400X4D, T401X1A, T401X2A, T401X3A, T401X4A, T401X1D, T401X2D, T401X3D, T401X4D, T402X1A, T402X2A, T402X3A, T402X4A, T402X1D, T402X2D, T402X3D, T402X4D, T403X1A, T403X2A, T403X3A, T403X4A, T403X1D, T403X2D, T403X3D, T403X4D, T404X1A, T404X2A, T404X3A, T404X4A, T404X1D, T404X2D, T404X3D, T404X4D, T40601A, T40601D, T40602A, T40602D, T40603A, T40603D, T40604A, T40604D, T40691A, T40692A, T40693A, T40694A, T40691D, T40692D, T40693D, T40694D, 96500, 96501, 96502, 96509, 9701, E8500, E8501, E8502
- **Opioid-related overdose** in the MATRIS data includes all runs where the patient would most likely have died if medical intervention was unavailable. It captures patients who display symptoms of an acute overdose of opioids, such as respiratory depression, loss of consciousness, blue/pale/cold skin, and/or cardiac arrest following opioid use. Another indicator includes patients with improving symptoms following EMS or bystander naloxone administration.
- **Fatal opioid overdose:** Death certificates were searched for the following International Classification of Disease (ICD-10) codes for mortality from the underlying cause of death field to identify poisoning/overdose: X40-X44, X60-X64, X85, and Y10-Y14. All multiple cause of death fields were then used to identify an opioid overdose death: T40.0, T40.1, T40.2, T40.3, T40.4, and T40.6.
- **Opioid Use Disorder (OUD)** was identified where an individual had any indication of MOUD treatment (found in the Bureau of Substance Addiction Services (BSAS), the All-Payer Claims Database (APCD), or the Prescription Monitoring Program), or OUD treatment (found in BSAS and the Department of Mental Health (DMH) records), two or more self-reported opioid overdoses in BSAS, or a diagnosis of opioid abuse or dependence in the APCD, Case Mix or the DMH datasets, characterized by the ICD 9 or ICD 10 diagnosis codes:
304.00, 304.01, 304.02, 304.70, 304.71, 304.72, 305.50, 305.51, 305.52, F11.10, F11.120, F11.121, F11.122, F11.129, F11.13, F11.14, F11.150, F11.151, F11.159, F11.181, F11.182, F11.188, F11.19, F11.20, F11.220, F11.221, F11.222, F11.229, F11.23, F11.24, F11.250, F11.251, F11.259, F11.281, F11.282, F11.288, F11.29.
- **Opioid Treatment:** J0570, J0571, J0572, J0573, J0574, J0575, J0592, S0109, G2067, G2068, G2069, G2070, G2071, G2072, G2078, G2079, H0020, HZ94ZZZ, HZ84ZZZ; Q9991, Q9992
- **Developmental disabilities** are a group of conditions, beginning before age 22 (often at birth or early childhood), which delay or alter the typical course of development in bodily function, learning, language, sensation, or behavior.
- **Hearing disabilities** includes anyone with a total or partial inability to perceive and/or process sounds at the same volume or frequency as a person with typical hearing. This includes people whose hearing is augmented by technologies such as hearing aids and cochlear implants. Hearing disability does not distinguish between people primarily using ASL (or another signed language or manual communication system) and those primarily using spoken or written English.

- **Mobility disability** affects movement, particularly but not always ambulation. The presence of a mobility disability does not denote a complete inability to move or even to walk; a mobility disability may, for example, affect a person's breathing or balance in such a way as to make walking difficult without affecting the legs at all.
- **Vision disability** is defined as eyesight which cannot be corrected to a “normal” level. This may present as an impairment in visual acuity (where the eye does not perceive objects with typical clarity at standard distances), or in visual field (where the eye cannot see as wide an area as usual without moving the eyes or turning the head). This category does not include differences in visual perception such as myopia or presbyopia that can be corrected with eyeglasses or contact lenses.