

CAMBRIDGE OPIOID OVERDOSE DATA REPORT 2017

CAMBRIDGE, MA



Cambridge
Public Health
Department

 **CHA**
Cambridge
Health Alliance





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INTRODUCTION

Addiction is a complex disease of the mind and body that can devastate the lives of people who use heroin, prescription painkillers, and other opioids. In 2017, nearly 70,000 people in the U.S. died from an opioid overdose.¹

Massachusetts currently has the ninth highest opioid overdose mortality rate in the country.¹ Under Governor Baker's administration, the Commonwealth has mounted a multifaceted response to the opioid crisis, including enacting breakthrough legislation, revamping the state's prescription monitoring program, and adding more than 1,200 substance use disorder treatment beds to the system since January 2015.²

Locally, city and community partners offer a comprehensive range of services across the continuum of care for substance use disorder prevention, intervention, treatment, and recovery support. For more information, see the Cambridge Public Health Department's recent annual reports: <http://www.cambridgepublichealth.org/publications>.

This Cambridge opioid overdose data report is a result of a multi-year surveillance effort. The report is designed to provide residents, first responders, city officials, health professionals, and the media with timely data to better understand how the opioid crisis is affecting Cambridge. It is hoped that this and future reports will inform the city's prevention and response strategies, and help stakeholders monitor progress in curbing the epidemic.

Report Highlights

In Cambridge, there were **12 confirmed opioid-related overdose deaths among residents in 2017**. In 2016, there were 27 confirmed opioid-related overdose deaths among residents. Many more lives would have been lost if not for the use of naloxone, a drug that reverses the effects of an opioid overdose.

While commercial districts in Cambridge had the highest density of opioid-related overdoses in 2017, **22% of patients transported by ambulance for an opioid-related overdose that year were picked up at a private residence**.

Opioid-related overdoses in Cambridge were almost evenly split between residents and non-residents in 2017: 44% of people who overdosed in Cambridge were residents, according to ambulance data.

Sixty-seven Cambridge residents received care at Cambridge Health Alliance (CHA) sites for opioid-related overdoses in 2017. This group was **predominantly male and white**. The average age was 43.5 years.



A quarter of Cambridge residents who received care at CHA health care sites for opioid-related overdoses in 2017 **had at least one repeat visit.**

Naloxone was administered a total of 218 recorded times to save a life in Cambridge in 2017. More than half of recorded overdose reversals by naloxone were administered by bystanders.

Clients of the AIDS Action Committee's Access: Drug User Health Program **used free naloxone kits 113 times in 2017 to reverse a suspected overdose** in Cambridge. Clients called 911 in 51% of these instances, up from 25% in 2012.

STATE DATA

Fatal Overdoses

The Massachusetts Department of Public Health collects and analyzes data on opioid-related overdose deaths among all Commonwealth residents.

Statewide, there were 1,938 confirmed opioid-related overdose deaths among Massachusetts residents in 2017, representing a 7.5% decrease from confirmed cases in 2016 (2,096 cases) and a 12% increase over 2015 (1,704 cases).³

In Cambridge, there were 12 confirmed opioid-related overdose deaths among residents in 2017 and 27 deaths in 2016. Many more lives would have been lost if not for the use of naloxone, a drug that reverses the effects of an opioid overdose.

There is evidence that fentanyl, an illicitly produced synthetic opioid, is fueling the current opioid epidemic in Massachusetts. Fentanyl is a fast-acting drug with 50 to 100 times the potency of morphine, making it deadlier than other opioids. Starting in 2016, the percentage of opioid-related overdose deaths where fentanyl was present began to exceed that of heroin or likely heroin. Of the 1,775 Massachusetts residents who died from an opioid-related overdose in 2017 and received a post-mortem toxicology screening, 85% tested positive for fentanyl.^{5*}

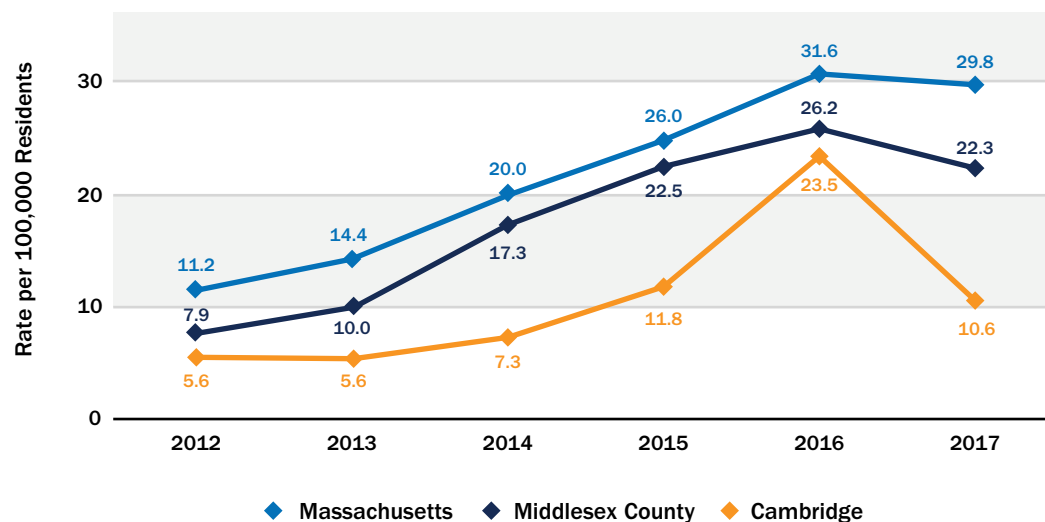
*Note: Of the 1,938 confirmed deaths in 2017, 1,775 cases received a toxicology screening. Of these cases, 1,507 (85%) tested positive for fentanyl, according to state data.

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As depicted in **Figure 1**, the opioid overdose-related death rate in Cambridge remained below that of Middlesex County and Massachusetts in 2015 and 2016. In 2017, however, the Cambridge and Middlesex death rates decreased steeply, while the state rate decreased by 5%.

Figure 1. Opioid-Related Overdose Death Rate in Cambridge, Middlesex County, and Massachusetts, 2012-2017



Note: Opioids include heroin, opioid-based prescription drugs, and other unspecified opioids.

Data Source: Massachusetts Department of Public Health



EMERGENCY MEDICAL SERVICES DATA

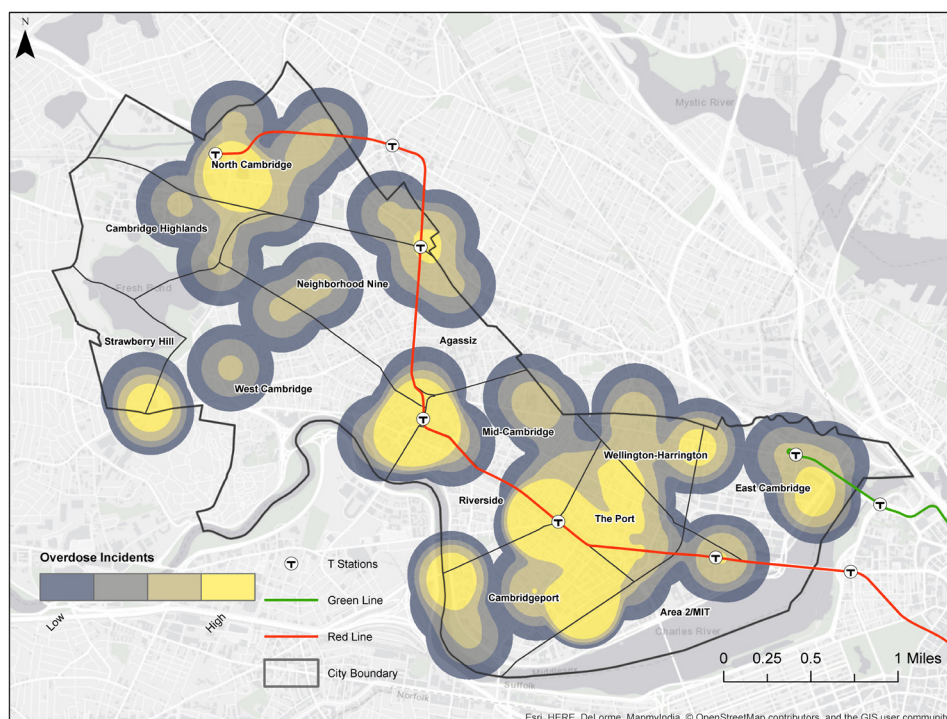
Geography of Overdoses

In Cambridge, first responders from Pro EMS ambulance service and the Cambridge Fire Department are often the first emergency personnel to arrive at the site of an overdose. Data from Pro EMS (which includes fire department data) are invaluable for pinpointing where opioid overdoses occur in the city, determining how frequently naloxone is administered, and learning what populations are at greatest risk.

Figure 2 shows the density of opioid-related overdoses in Cambridge in 2017, based on spatial analysis of Pro EMS data.

How to read the maps in this report: The heat maps are primarily intended as visual tools, and exact overdose counts should not be estimated from the results. Yellow areas indicate the highest density of overdose incidents in 2017. Color categories can be interpreted relative to one another, with yellow areas having more incidents than dark yellow, dark yellow more than gray, and so on. Dark gray areas indicate the lowest density of overdose incidents. Clear areas indicate no incidents. Because the shaded areas have been smoothed to protect privacy, the numbers represented by the color bands are approximations.

Figure 2. Opioid-Related Overdoses in 2017, Cambridge, MA



Data Source: Pro EMS Ambulance Service



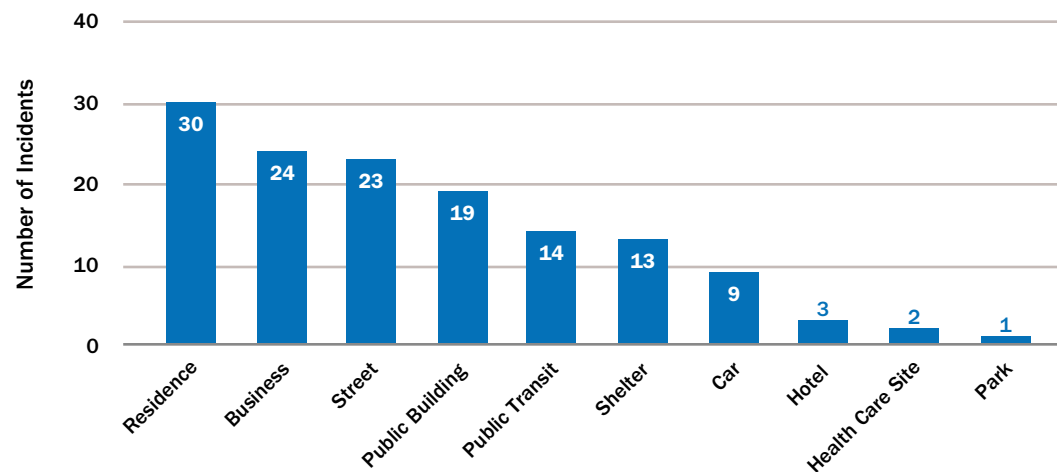
Commercial districts had the highest density of opioid-related overdoses in Cambridge. These incidents were clustered in Central Square, Harvard Square, Alewife, and Porter Square on the Red Line, and near Lechmere on the Green Line. However, overdose incidents occurred in every neighborhood in Cambridge in 2017.

Figure 3 shows the types of places where opioid-related overdoses occurred in Cambridge in 2017, based on Pro EMS data.

Of the 138 ambulance pickups for opioid-related overdoses in 2017, the majority (65%) occurred in public places, such as on the street, in a public building or park, at a business, or in a T station. About 9% of ambulance pickups were from a shelter.

Interestingly, private residences made up nearly a quarter (22%) of ambulance pickups. Whereas opioid-related overdoses in public spaces tended to occur repeatedly in the same locations in Cambridge—such as shelters and commercial squares—overdoses in private residences occurred in homes scattered across the city.

Figure 3. Ambulance Pickups of Suspected Overdose Patients by Location, 2017



Note: There were a total of 138 ambulance pickups in Cambridge for opioid-related incidents in 2017. Twenty-two of these pick-ups had an unknown location category.

Data Source: Pro EMS Ambulance Service

In 2017, Pro EMS ambulance service transported the majority of opioid-related overdose cases to Cambridge Hospital (65%), followed by Mount Auburn Hospital (29%) and Massachusetts General Hospital (3%). Pro EMS typically transports overdose patients to the nearest hospital, unless a patient expresses a preference for another facility (**Table 1**).

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Table 1: Cambridge Opioid-Related Overdose Cases Transported by Pro EMS by Hospital Destination, 2017

Hospital Destination	Incidents	
	Percent	Number
CHA Cambridge Hospital	65.2%	90
Mount Auburn Hospital	29.0%	40
Massachusetts General Hospital	2.9%	4
BIDMC-West	1.4%	2
No Hospital (patient refused)	1.4%	2

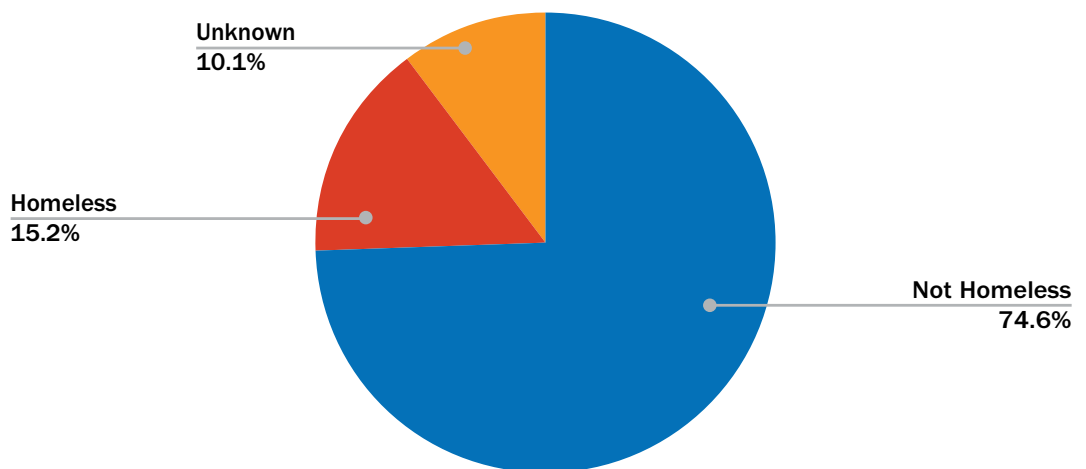
Note: May not add up to 100% due to rounding.

Data Source: Pro EMS Ambulance Service

Homeless Status

Of the 138 opioid-related ambulance pickups that happened in Cambridge in 2017, 75% occurred among people who were housed (**Figure 4**). Approximately 15% of pickups occurred among people who were homeless. Housing status was unknown for 10%.

Figure 4. Opioid-Related Overdoses by Homeless Status, 2017



Note: "Homeless" is marked as either Yes or No in the Pro EMS record at the discretion of the first responder who responded to the incident.

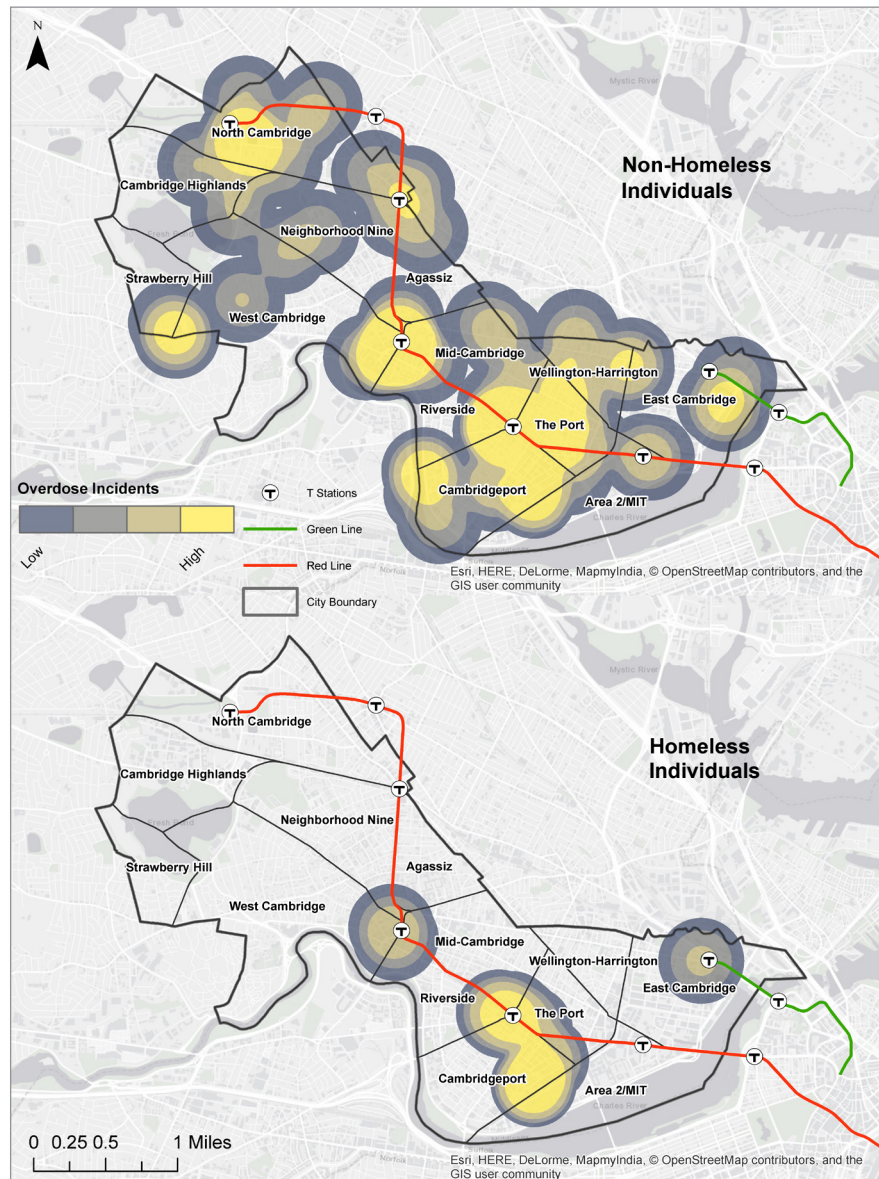
Data Source: Pro EMS Ambulance Service

When comparing the density of opioid-related overdoses between people who are homeless and people who are housed, a striking difference emerges (**Figure 5**). People who are homeless primarily overdose in commercial areas, such as Central Square. An area of high density can also be seen at 240 Albany Street, the city's largest homeless shelter. By contrast, ambulance pickups of housed individuals occurred across the city.

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Figure 5. Opioid-Related Incidents by Homeless Status in 2017, Cambridge, MA



Data Source: Pro EMS Ambulance Service

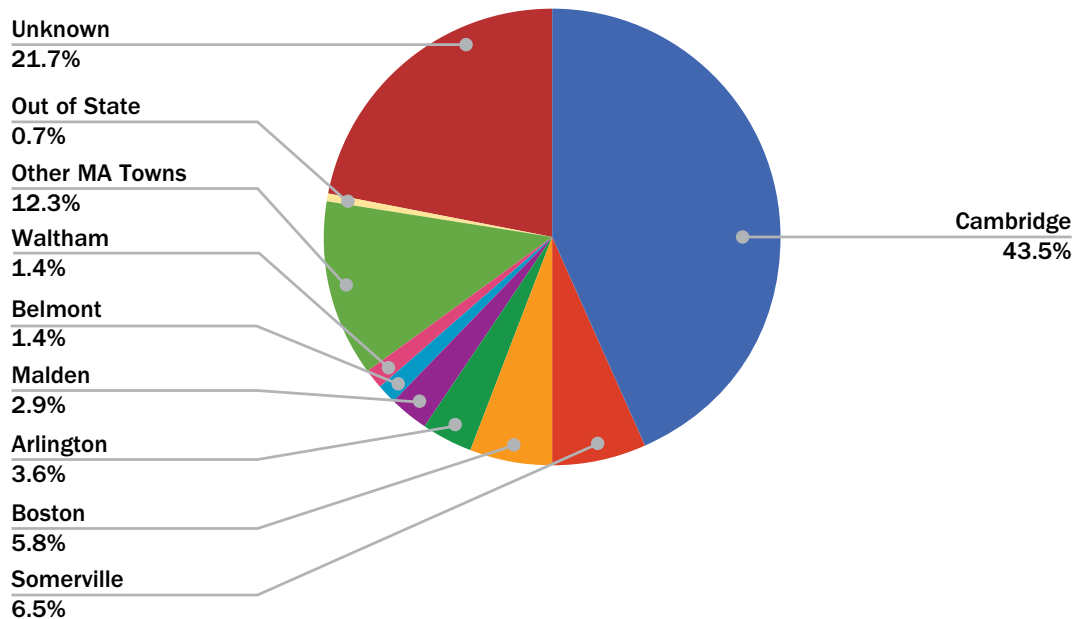
2017 CAMBRIDGE OPIOID OVERDOSE DATA REPORT



Cambridge Residency

Cambridge residents accounted for 44% of all opioid-related ambulance pickups in Cambridge in 2017 (**Figure 6**).

Figure 6. Opioid-Related Overdoses in Cambridge by Patient Residence, 2017

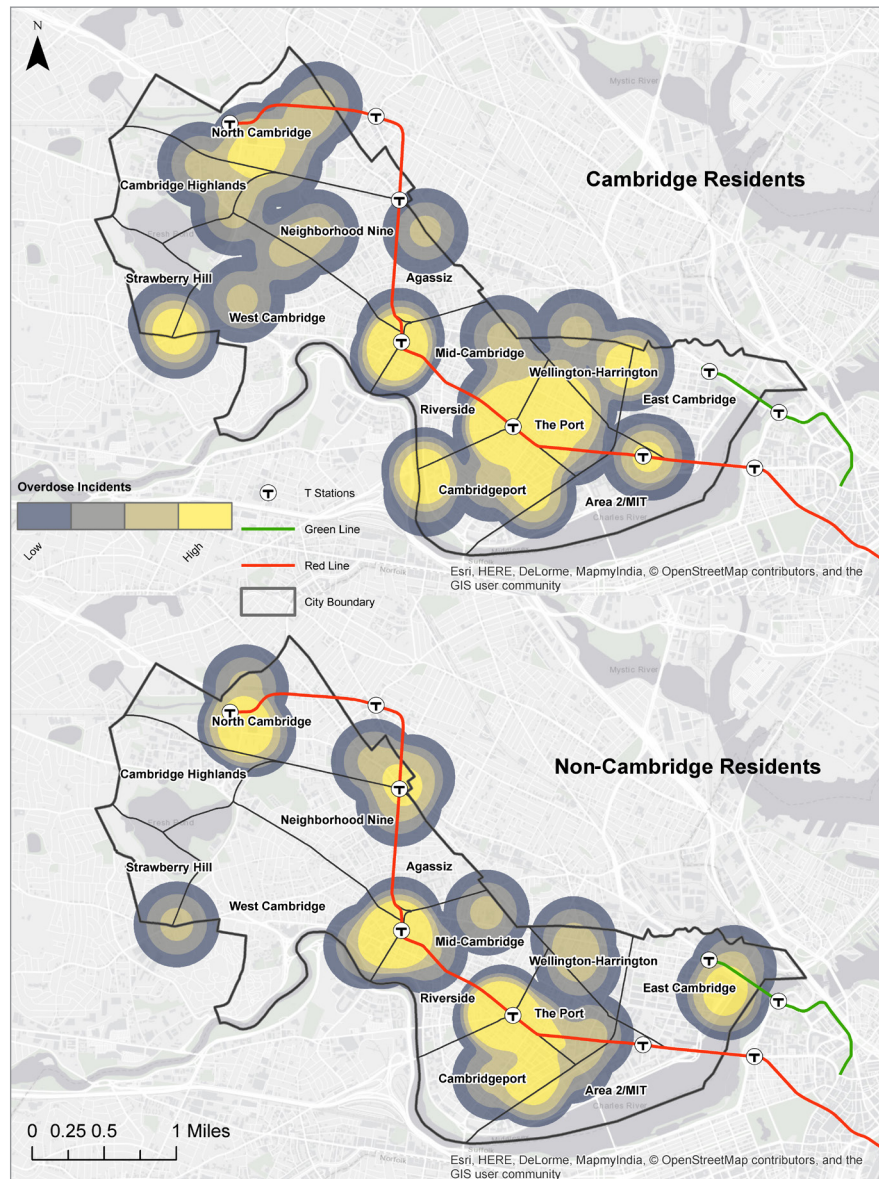


Data Source: Pro EMS Ambulance Service

Opioid-related overdoses occurred among Cambridge residents in every neighborhood in the city in 2017. When comparing heat maps of opioid-related overdoses by Cambridge residency status, ambulance pickups for Cambridge residents covered a broader geography than non-residents, with areas of high density among residents in the Port, Harvard Square, Cambridgeport, and North Cambridge neighborhoods (**Figure 7**).

Ambulance pickups for non-residents were more concentrated in and around commercial districts, notably Alewife, Porter Square, Harvard Square, Central Square, and commercial areas in East Cambridge.

Figure 7. Opioid-Related Incidents by Cambridge Residency in 2017, Cambridge, MA



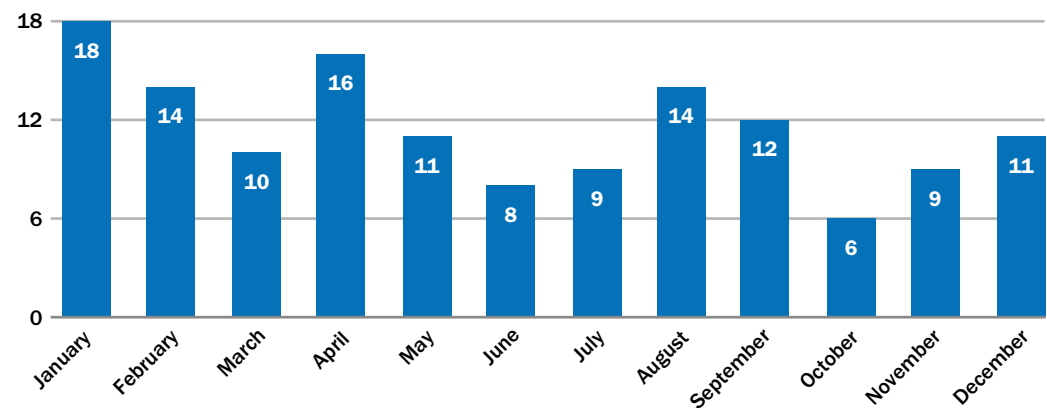
Data Source: Pro EMS Ambulance Service



Seasonality

Time trends for opioid-related pickups (**Figure 8**) show that counts varied by month in 2017. There were peaks in opioid-related incidents in January, April, and August.

Figure 8. Opioid-Related Overdoses in Cambridge by Month, 2017



Data Source: Pro EMS Ambulance Service



CAMBRIDGE HEALTH ALLIANCE HOSPITAL DATA

Hospital Visits

Cambridge Health Alliance (CHA) is one of the primary health care systems that serves Cambridge. To better understand the opioid crisis in Cambridge, the health department investigated opioid-related hospital visits among Cambridge residents at all CHA health care sites in the metro Boston area. This category includes all hospital visits for overdoses that were related to opioids.

In 2017, 67 Cambridge residents visited CHA health care sites for opioid-related incidents a total of 97 times (**Table 2**). Approximately 25% of these individuals had at least one repeat visit.

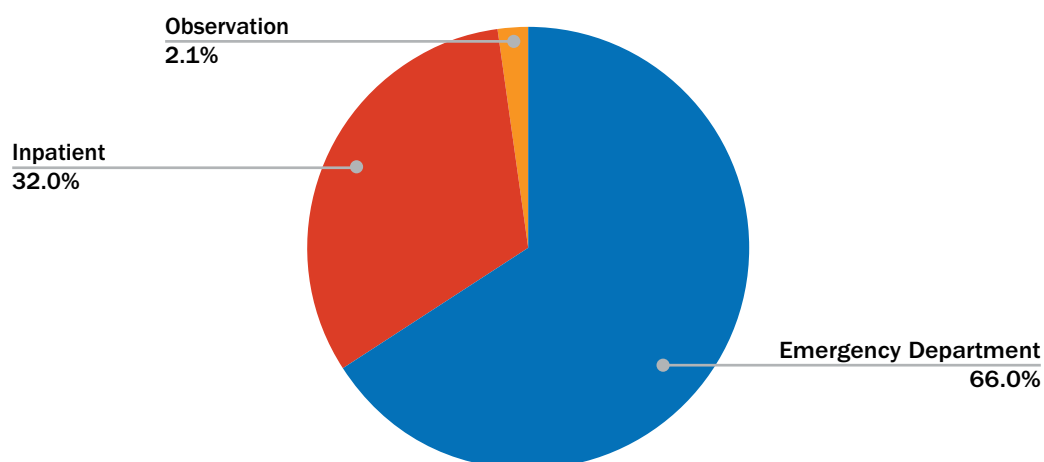
Table 2: Opioid-Related Overdoses Among Cambridge Residents Who Received Care at Cambridge Health Alliance in 2017

Total number of opioid-related overdoses	97
Total number of unique individuals	67
Average number of overdoses per individual	1.4

Data Source: Cambridge Health Alliance, Business Analytics Unit, 2017

Of all opioid-related hospital visits among Cambridge residents at CHA sites, 66% of incidents were discharged directly from the emergency department, 32% were admitted to the hospital as inpatients, and 2% were admitted to the hospital on observation status (**Figure 9**).

Figure 9. Opioid-Related Overdoses by Encounter Type Among Cambridge Residents at CHA, 2017



Data Source: Cambridge Health Alliance, Business Analytics Unit, 2017



Following an emergency department visit or hospitalization, most opioid-related visits (80%) resulted in patients being discharged to “home” (Table 3).

Table 3: Discharge Disposition Among Cambridge Residents With an Opioid-Related Overdose at CHA in 2017		
Location	Overdose Incidents	Percent
Home	78	80.4%
Transferred/Admitted to Other Facility	8	8.2%
Left Against Medical Advice	6	6.2%
Other	5	5.2%

Note: May not add up to 100% due to rounding.

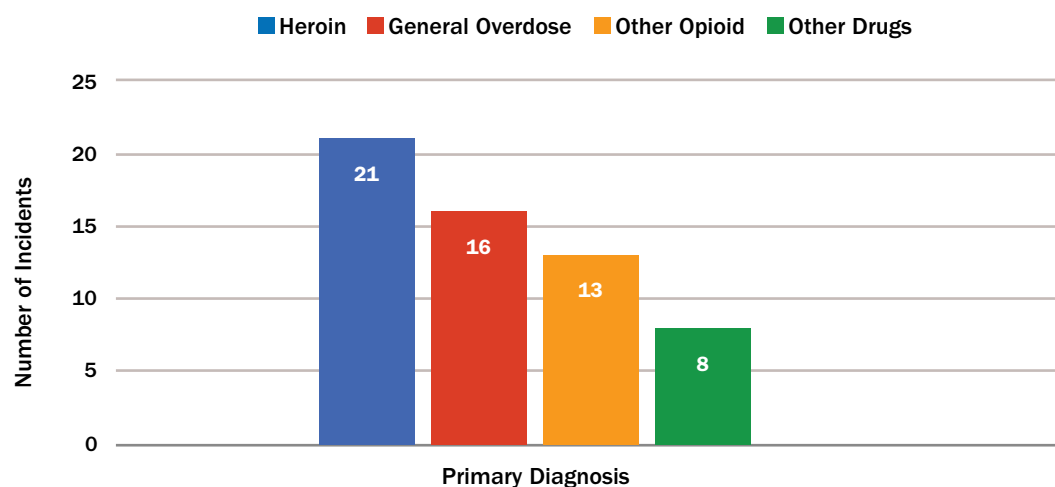
Data Source: Cambridge Health Alliance, Business Analytics Unit, 2017



Primary Diagnosis

Heroin was the biggest single driver of opioid-related hospital overdoses among Cambridge residents who received care at CHA sites in 2017 (**Figure 10**). However, toxicology screens are only ordered for a small number of suspect opioid-related incidents; therefore, it is impossible to know how many incidents involved fentanyl.

Figure 10. Primary Diagnosis of All Overdose-Related Overdoses Among Cambridge Residents at CHA, 2017



Data Source: Cambridge Health Alliance, Business Analytics Unit, 2017

Note: In a hospital record, a patient's diagnosis can be listed in either the primary diagnosis section or a non-primary diagnosis section. The primary diagnosis section indicates the main reason that the patient was brought to the hospital. This chart only represents the primary diagnosis code.

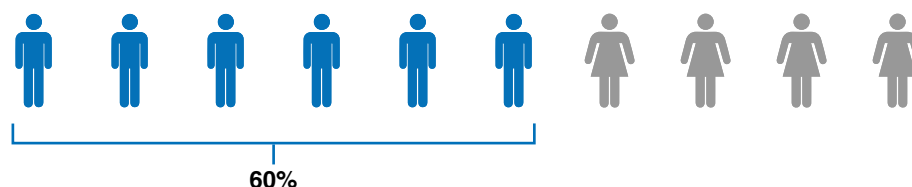
The "Heroin" and "General Overdose" categories both describe when a patient's primary diagnosis is an opioid-related overdose. The category "Other Opioid" includes opium, methadone, synthetic opioids (such as fentanyl), and other legal prescription opioids. "Other Drugs" refers to incidents that were related to narcotics, but not necessarily opioids (which are a subset of narcotics). Specific drugs are coded based on the judgment of the ordering physician.

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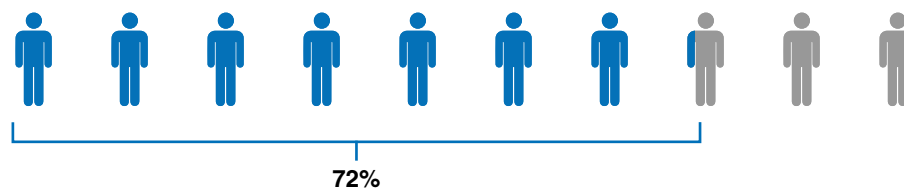
Demographics

Among Cambridge residents who visited CHA in 2017 for opioid-related overdoses:

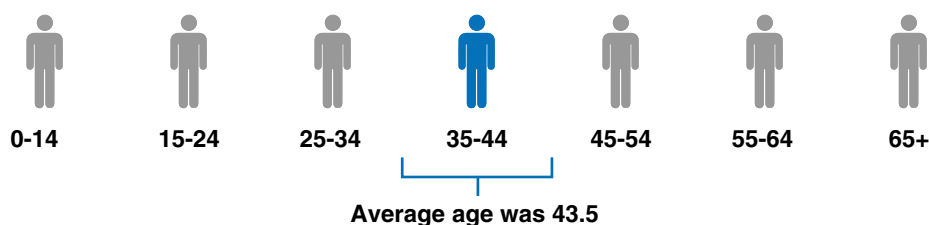
Male



White



Average Age



In 2017, 67 Cambridge residents received care at CHA sites for opioid-related overdoses. This group was predominantly male and white, and disproportionately represented residents in the 25-54 age category (**Figures 11-16**).

White residents were disproportionately represented among the CHA overdose cases. White residents comprise 62% of the city's population, but made up 72% of the cases. Black residents, who comprise 10% of the city's population, accounted for 12% of the cases. Hispanic and Asian residents, who comprise 9% and 15% of the city's population, accounted for 7.5% and 1.5% of the cases, respectively.



Figure 11. Opioid-Related Overdoses by Gender Among Cambridge Residents at CHA, 2017

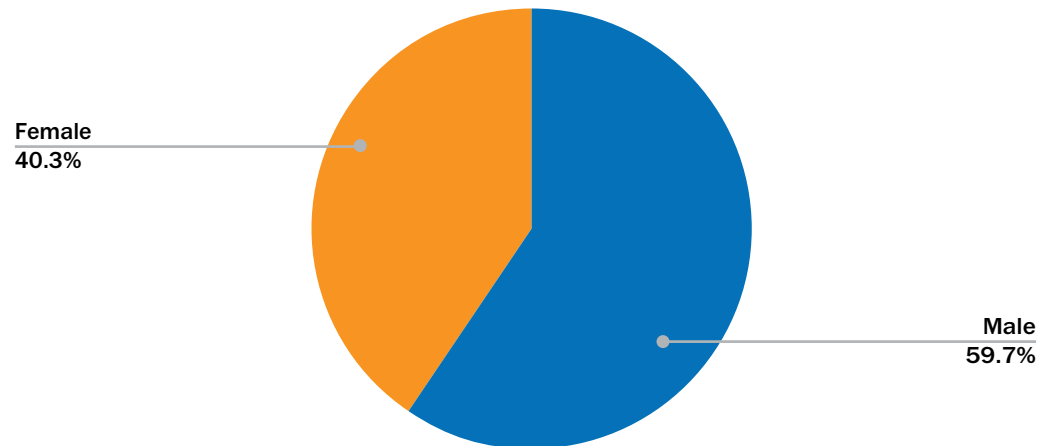
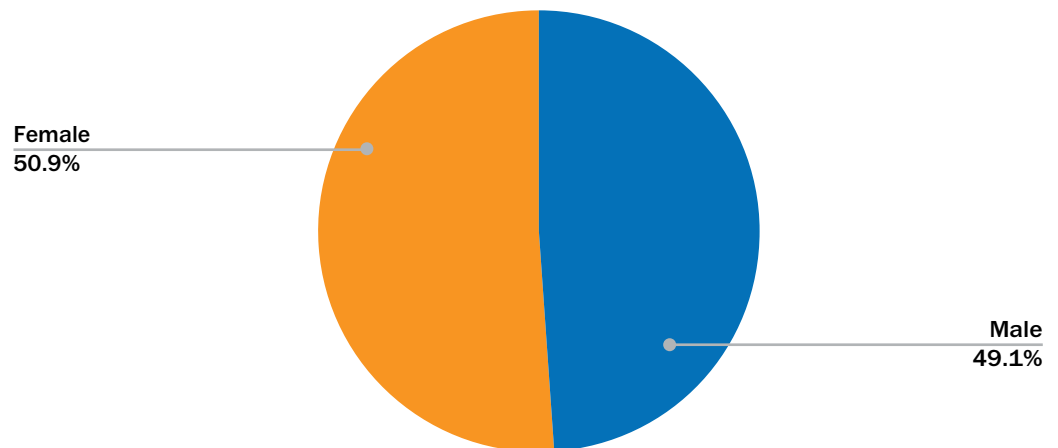


Figure 12. Cambridge Residents by Gender, 2017



Note: Sixty-seven Cambridge residents received care at CHA sites in 2017 for opioid-related overdoses.



Figure 13. Opioid-Related Overdoses by Age Group Among Cambridge Residents at CHA, 2017

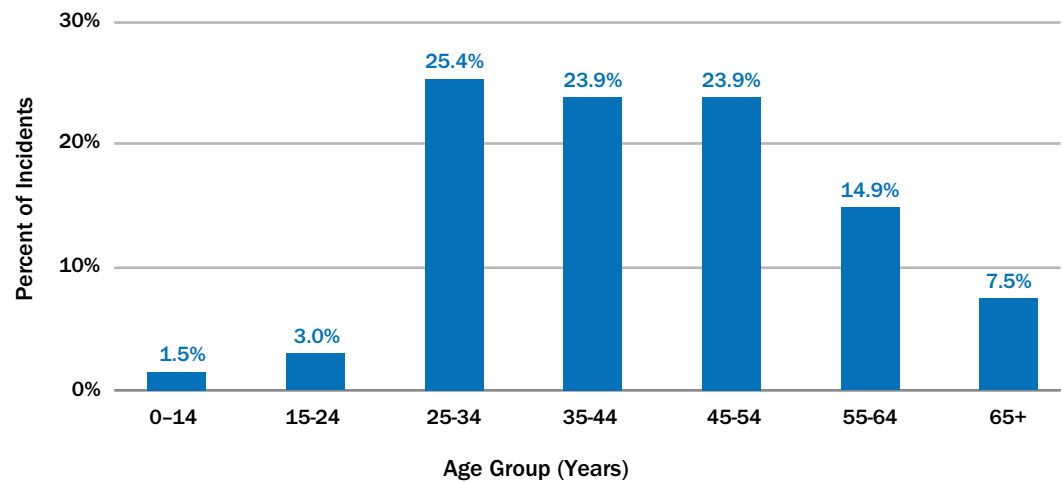
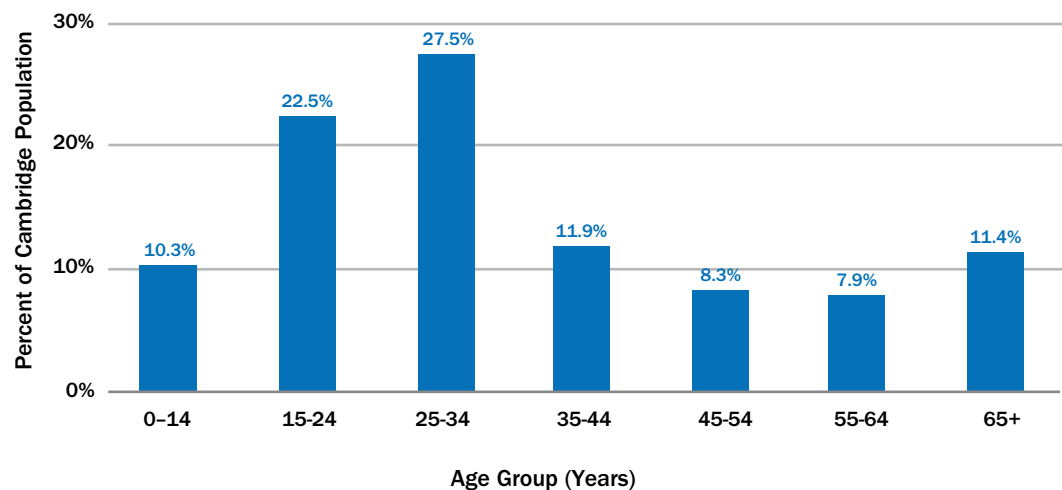


Figure 14. Cambridge Residents by Age Group, 2017



Note: Sixty-seven Cambridge residents received care at CHA sites in 2017 for opioid-related overdoses.



Figure 15. Opioid-Related Overdoses by Race Among Cambridge Residents at CHA, 2017

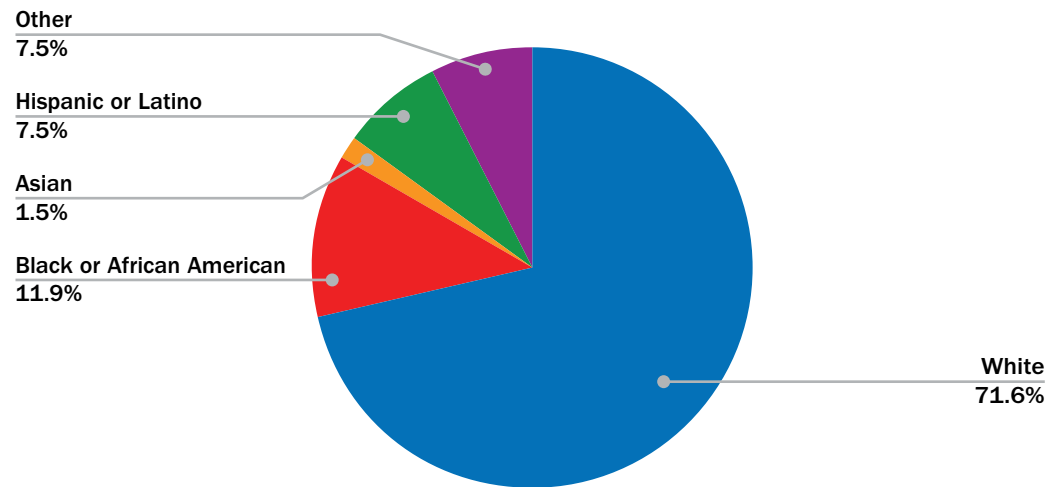
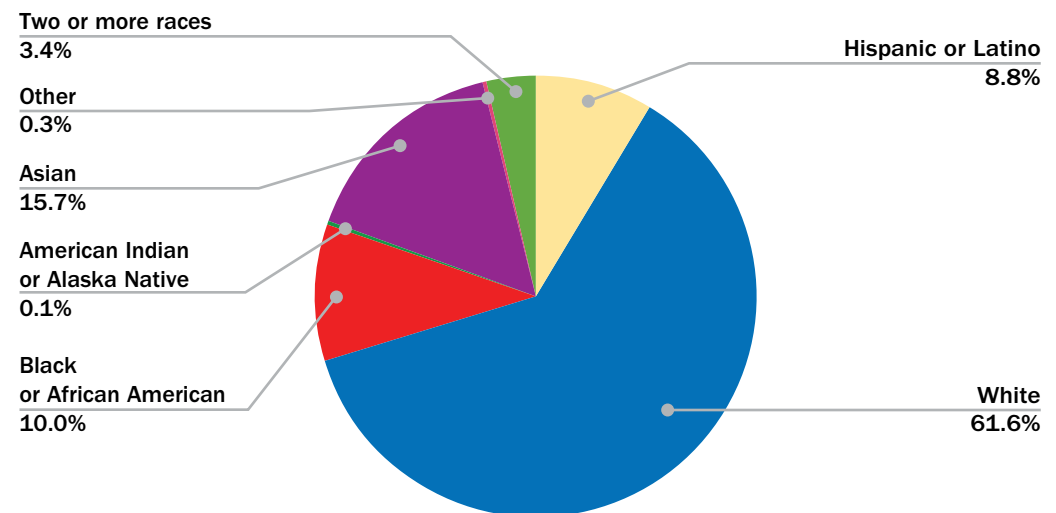


Figure 16. Cambridge Residents by Race and Ethnicity, 2017



Note: Sixty-seven Cambridge residents received care at CHA sites in 2017 for opioid-related overdoses.



MASSACHUSETTS OVERDOSE EDUCATION AND NALOXONE DISTRIBUTION PROGRAM DATA

What is Naloxone? Naloxone (also known by its brand name, Narcan) is a medication that can reverse an opioid overdose. It blocks opioids from attaching to opioid receptors in the brain.

Naloxone is active for about 30 to 90 minutes in the body. If you give someone naloxone to reverse an opioid overdose, it may wear off before the effects of the opioids wear off. The person could overdose again. This depends on several things, including:

- The person's metabolism (how quickly the body processes things).
- How much drug the person used in the first place.
- If the person uses again.

Naloxone cannot be used to get high and cannot be misused. If you give naloxone to someone who is not overdosing, there are no ill effects.

Cambridge is fortunate to have an Overdose Education and Naloxone Distribution (OEND) site. AIDS Action Committee's Access: Drug User Health Program, located in Central Square, offers a variety of services, including HIV/HCV/STI testing and overdose response trainings for individuals who are likely to experience or witness an overdose. Training includes how to prevent and recognize an opioid overdose, what to do if one occurs, the importance of calling 911, how to perform rescue breathing, and how to administer naloxone.

Participants who complete this training are eligible to receive a free naloxone kit. Access clients administer naloxone for a suspected overdose at a high rate.

1,662 Naloxone kits (3,324 doses) were distributed by Access in 2017

51% of kits were refills

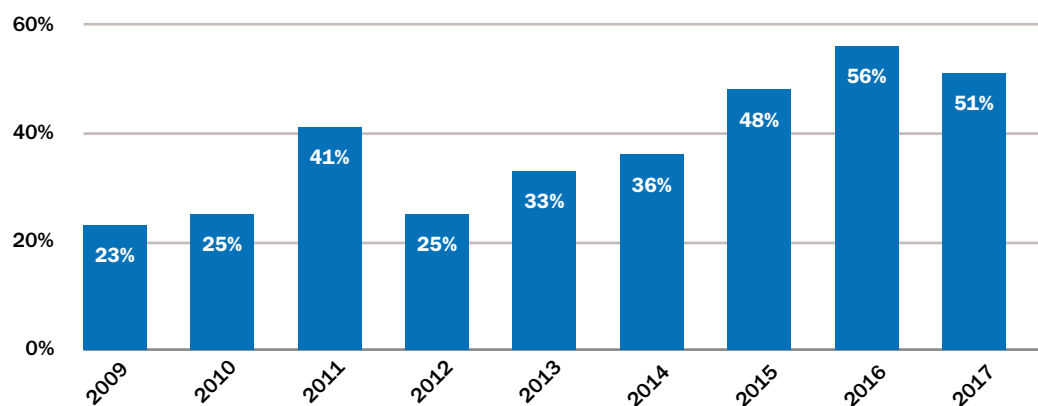
Anyone who returns to Access for a new kit after administering naloxone is required to complete an "overdose report-back and naloxone refill" form. This form gathers important information about where and how the naloxone was used, the demographics of the rescuer, and how many times naloxone was used in a particular zip code. The form also asks Access clients if 911 was called after naloxone was administered. It is likely that many more Access kits were used for overdose reversals in 2017 than were reported back to the program.



It is critical that people who have overdosed receive medical attention—even if they have received naloxone—because there is a chance they could re-overdose if the dose of opioid was too strong.

Figure 17 shows the proportion of naloxone rescue attempts in Cambridge by Access clients in which 911 was called. Naloxone rescue attempts resulting in a 911 call have nearly doubled since 2012. Of the 113 overdoses reported to Access in 2017, clients called 911 in about half (51%) of the incidents, which is up from 25% in 2012 but down slightly from 56% in 2016.

Figure 17. Naloxone Rescue Attempts by Access Clients that Results in a 911 Call, 2009–2017



Data Source: Massachusetts Overdose Education Naloxone Distribution (OEND) Site



The Massachusetts Good Samaritan Law protects people who call 911 to report an overdose from being charged with possession of a controlled substance.

Many potentially fatal overdoses can be prevented if the victim receives timely and appropriate medical attention.

What the law does:

- Increases the likelihood that witnesses will call 911 during an overdose.
- Protects people from prosecution for possession of controlled substances when calling 911.
- Saves lives and gives people who use opioids a chance to get help for their addiction.
- Provides legal protection for medical professionals who prescribe naloxone, or people who possess and/or administer naloxone to someone appearing to have an opioid overdose.

What the law does not do:

- Does not interfere with law enforcement securing the scene at an overdose.
- Does not prevent prosecution for drug trafficking.
- Does not prevent prosecution for outstanding warrants.

For more information, please visit <http://www.mass.gov/MakeTheRightCall>.

Administration of Naloxone

Table 4 lists known naloxone administrations at opioid-related incidents in Cambridge. When responding to a suspected opioid-related incident, Pro EMS records whether naloxone was administered to the patient and who administered it. If known, Pro EMS also records whether a bystander administered naloxone to a suspected opioid overdose patient prior to EMS arrival.

When refilling naloxone kits, Access records naloxone use where 911 was not called. By combining total administrations by bystanders recorded in both Pro EMS and OEND data, the Cambridge Public Health Department estimates that there were 113 total known naloxone administrations by bystanders in Cambridge in 2017, and 219 known naloxone administrations overall. This is most likely an undercount.

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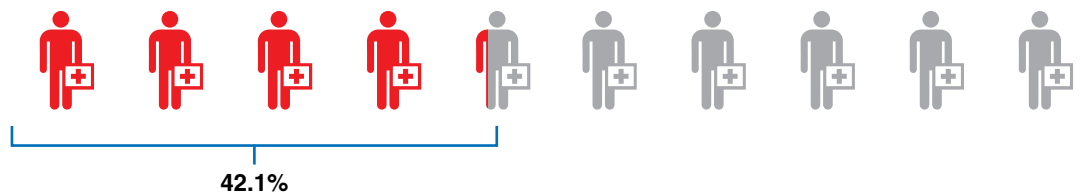
Table 4: Known Naloxone Administrations for Opioid-Related Overdoses in Cambridge, 2017

Administrator	Total #	% of Total
Bystanders	114	56.4%
Pro EMS	52	25.7%
Fire Department	18	8.9%
Police Department	15	7.4%
Other Health Care Professional	3	1.5%
Total	202	100%

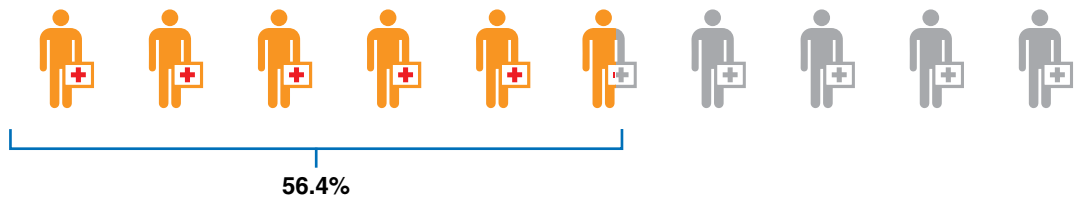
Data Source: Pro EMS Ambulance Service

Known naloxone administrations for opioid-related overdose in Cambridge in 2017:

By a first responder



By a bystander





RESOURCES

Everyone has a role to play when it comes to preventing death from overdose. Depending on your role in the community, there are different ways you can help stem the tide of the opioid epidemic.

Go to **<http://odprevention.org>** to find more information about local treatment and support resources and next steps.

The Massachusetts Substance Abuse Information Helpline: Provides free, confidential information and referrals to over 600 treatment programs funded or licensed by the state. (800) 327-5050 | **www.helpline-online.com**

Learn to Cope: A support group for parents and other family members coping with a loved one addicted to opioids or other drugs. (508) 738-2027 | **www.learn2cope.org**

Wicked Sober: Free consultations for people with addiction and their loved ones. (855) 953-7627 | **www.wickedsober.com**

Access Drug User Health Program: Free, safe, and confidential space for drug users to access resources and services, including free naloxone. (617) 599-0246 | **<http://www.aac.org/programs-services/needle-exchange/>**

PAATHS: One-stop shop for information about or access to addiction treatment services. (855) 494-4057 | **<http://www.bphc.org/whatwedo/Recovery-Services/paaths-connect-to-services/Pages/paaths.aspx>**

Cambridge Police Special Investigations Unit: Conducts investigations and assists overdose victims seeking treatment and recovery services. (617) 349-3360

Narcotic Anonymous: Support meetings (866) 624-3578 | **www.newenglandna.org**

Alcoholics Anonymous: Support meetings (978) 957-4690 | **www.aaboston.org**

Behavioral Health Treatment Services Locator (800) 662-4357 | **www.findtreatment.samhsa.gov**



METHODS

The Cambridge Public Health Department assessed four existing community-level data sources to develop a timelier, more comprehensive overdose surveillance system.

Key Data Sources	Data Supplied
Pro EMS ambulance service	Geographic information, naloxone usage, demographic data
Cambridge Health Alliance	Monthly overdose data, underlying conditions
Access: Drug User Health Program	Overdoses not captured by ambulance or hospital data
Massachusetts Department of Public Health	Official state numbers on mortality, emergency department visits, and hospitalizations

All EMS incidents that were likely related to opioids were pulled from the Pro EMS FirstWatch system. Epidemiologists at the Cambridge Public Health Department used narrative reports for each incident, as well as patient vital signs and naloxone response, to categorize each incident by overdose status. This method of classification was used from January 1, 2017 to May 17, 2017.

Classification Algorithm

From May 17, 2017 to present, a machine learning algorithm was used to classify EMS incidents. Using natural language processing models in the programming language R,⁶ the narrative text of new incidents were compared to previously manually classified data.

A corpus of approximately 1,500 manually classified incidents were used to generate a document matrix to train a Support Vector Machine (SVM), which is a type of supervised learning model.⁷ New data were classified using this model. Epidemiologists at the Cambridge Public Health Department verified incidents that were not conclusively labeled. As of December 2018, the algorithm had an accuracy of 87.56%, a sensitivity of 68.75%, and a specificity of 95.04%. For more information, please contact the Division of Epidemiology and Data Services.

Geocoding

Geocoded EMS data provided a picture of non-fatal overdoses at the neighborhood level, and incident addresses were heat-mapped to visualize patterns and high-volume locations. Kernel density estimates were calculated to mask point data location and visualize the neighborhood-level burden of non-fatal overdoses. Incidents were categorized by gender, homeless status, and town/city of residence.

Hospital data were collected from Cambridge Health Alliance locations based on overdose-related ICD-10 codes. F11.10 and select codes within T40 (T40.0, T40.1, T40.2, T40.3, T40.4, T40.6, and T40.69, excluding underdosing) were used to extract suspect opioid overdose incidents from the Cambridge Health Alliance Epic system. SAS version 9.4 was used for all analyses.

If you have any questions about this report, please contact epidept@challiance.org.



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Vivian Li

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Sarah Ruiz, MSW

Cambridge Police Department

Rebecca Leonard

ENDNOTES

¹ Centers for Disease Control and Prevention. Drug Overdose Mortality by State: 2017. Retrieved January 30, 2019. https://www.cdc.gov/nchs/pressroom/sosmap/drug_poisoning_mortality/drug_poisoning.htm

² Office of Governor Charlie Baker and Lt. Governor Karyn Polito. Baker-Polito. (October 2018). Media Release: Administration Further Expands Access to Opioid Reversal Medication. Retrieved on January 30, 2019. <https://www.mass.gov/news/baker-polito-administration-further-expands-access-to-opioid-reversal-medication>

³ Massachusetts Department of Public Health. (November 2018). Data Brief: Opioid-Related Overdose Deaths Among Massachusetts Residents. Retrieved December 10, 2018. <https://www.mass.gov/files/documents/2018/11/16/Opioid-related-Overdose-Deaths-among-MA-Residents-November-2018.pdf>

⁴ Massachusetts Department of Public Health. (August 2018). Data Brief: Overdose Deaths by City/Town. Retrieved October 12, 2018. <https://www.mass.gov/files/documents/2018/08/22/Opioid-related%20Overdose%20Deaths%20by%20City%20Town%20-%20August%202018.pdf>

⁵ Massachusetts Department of Public Health. (May 2017). Data Brief: Opioid-Related Overdose Deaths Among Massachusetts Residents. Retrieved December 14, 2018. <https://www.mass.gov/files/documents/2018/05/22/Opioid-related%20Overdose%20Deaths%20among%20MA%20Residents%20-%20May%202018.pdf>

⁶ R Core Team (2018). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. <https://www.R-project.org>

⁷ Max Kuhn. Contributions from Jed Wing, Steve Weston, Andre Williams, Chris Keefer, Allan Engelhardt, Tony Cooper, Zachary Mayer, Brenton Kenkel, the R Core Team, Michael Benesty, Reynald Lescarbeau, Andrew Ziem, Luca Scrucca, Yuan Tang, Can Candan and Tyler Hunt.