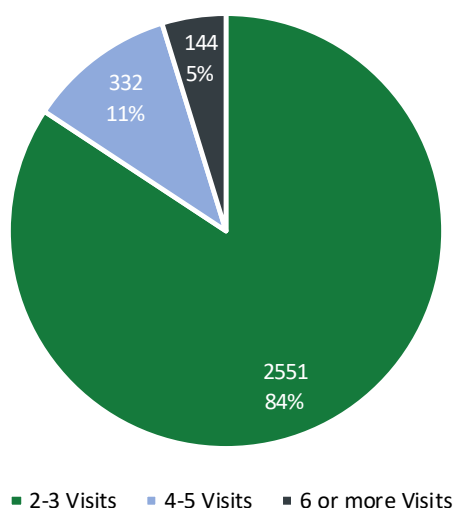


Recurring Emergency Department Visits for Suspected Drug Overdoses and Drug Poisoning Deaths: Linking EpiCenter and Vital Statistics data for Cuyahoga County, OH 2016-2020

Drug overdoses contribute significantly to morbidity and mortality in Cuyahoga County. Research shows that people who have one overdose are more likely to have another.¹ This data brief is the second edition of an innovative, proof of concept data linkage analysis of EpiCenter (EC) emergency department (ED) visit data and Vital Statistics (VS) death certificate data for Cuyahoga County, Ohio. In this edition, these same analyses are conducted adding 2020 VS and EC data and the stimulant classifier in EC. A comparison is also made between the first and second editions of the linkage data briefs.

These analyses were conducted as part of the Cuyahoga County Board of Health's (CCBH) Overdose Data to Action Surveillance strategy; specifically to gain a more complete picture of the burden of drug overdose in our community and inform prevention strategies. CCBH analysts conducted probabilistic matching to link records of individuals visiting the ED multiple times due to suspected overdoses from 2016 to 2020 with records of individuals who died of an overdose due to drug poisoning during this period.

Figure 1: Total Number of Individuals with Repeat Visits to the ED Due to Suspected Drug Overdose, 2016-2020 (n = 3,027)



EC data showed that there were 3,027 individuals that went to the ED multiple times for a suspected drug overdose between January 1, 2016—December 31, 2020. These individuals were categorized into three visit groups (see Figure 1):

- ◆ 2-3 visits (n=2551),
- ◆ 4-5 visits (n=332) and
- ◆ 6 or more times (n=144).

Table 1 presents demographic information of individuals who visited the ED multiple times (before dataset linkage). The 35-49 age group had the highest number of repeat visits compared to other age groups. Men were more likely to have repeat visits than women. Whites were more likely to have repeat visits than Blacks or Other Races.

Table 1: Demographics of Individuals with Repeat Visits to the ED Due to Suspected Drug Overdose, 2016-2020 (n = 3,027)

	2-3 Visits		4-5 Visits		6+ Visits	
Age Group	N	%	N	%	N	%
Under 25	286	11.2	28	8.4	7	4.8
25-34	782	30.6	85	25.6	43	29.9
35-49	828	32.5	142	42.8	57	39.6
50 and Over	655	25.7	77	23.2	37	25.7
Sex						
Female	913	35.8	105	31.6	36	25
Male	1638	64.2	227	68.4	108	75
Race/Ethnicity						
Black	597	23.4	60	18.1	39	27.1
White	1524	59.7	221	66.6	95	66
Other/Unknown	430	16.9	51	15.3	10	6.9
Mean Age						
	39.3		40.1		41.1	
Median Age						
	37		39		37.5	
Total						
	2551		332		144	

The mean age of individuals with repeat visits were similar among visits groups; however, mean age increased as number of visits increased. The 4-5 visits group had the highest median age of individuals with repeat visits.

For the total number of repeat visits for suspected drug overdose, 55.0% of the visits mentioned opioid/heroin and/or stimulants as the reason for the ED visit.

After the records of individuals with repeat visits to the ED for suspected drug overdose were categorized as described, VS data were collected and subset to include only individuals who died from drug poisoning (n=2,614) between 2016-2020.

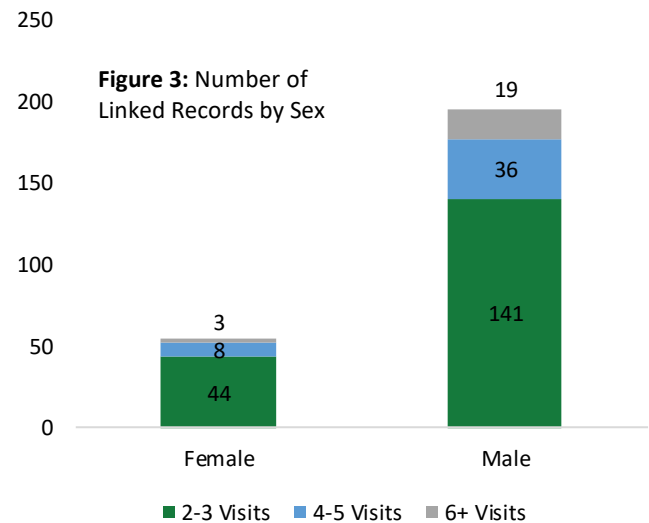
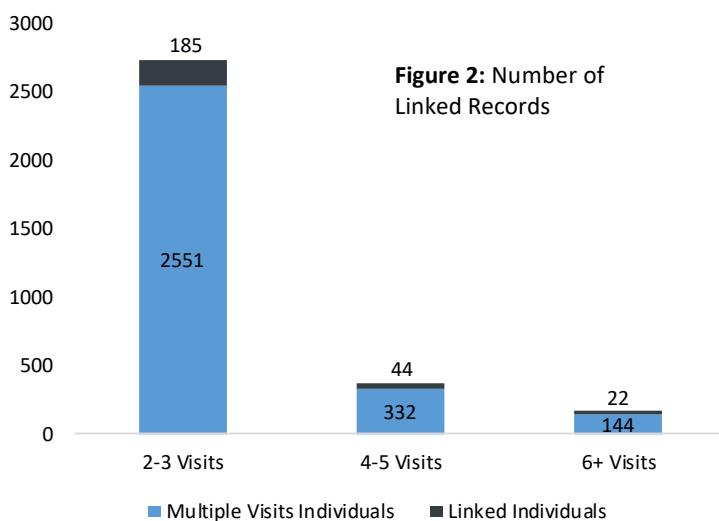
Using probabilistic matching methodology, (see Methodology section on page 7 for details), records of individuals with repeat visits to the ED were linked with VS data records of individuals who died from drug poisoning.

¹Centers for Disease Control and Prevention (CDC). (2020). Nonfatal Drug Overdoses. <https://www.cdc.gov/drugoverdose/nonfatal/index.html>

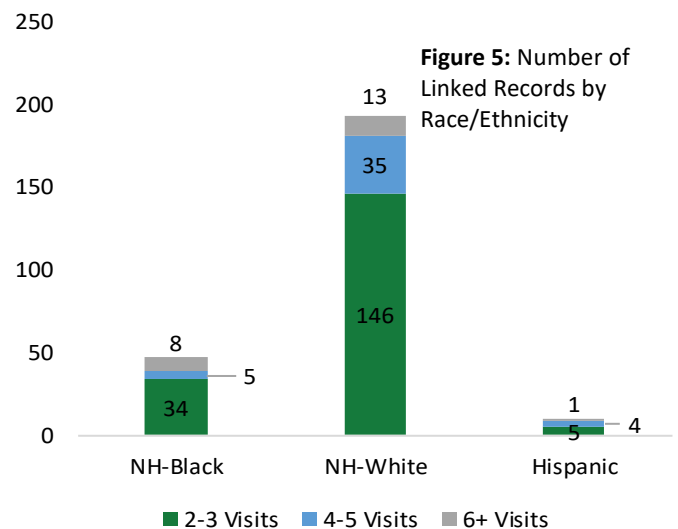
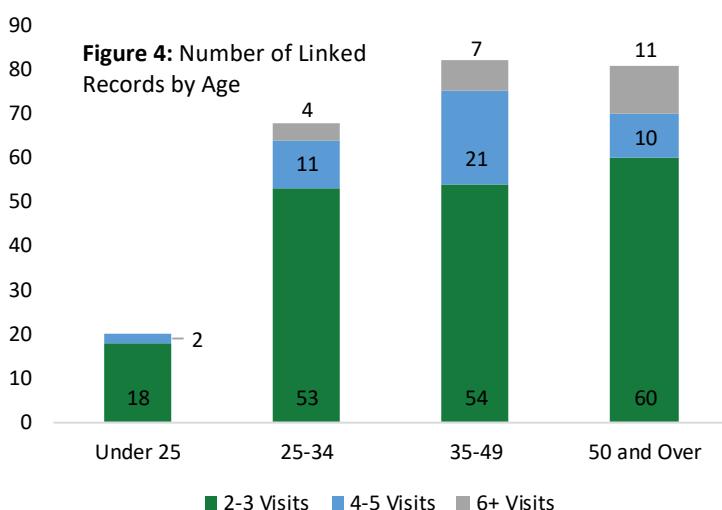
Number of Linked Records

Of the 3,027 individuals with repeat visit records, 251 (8.3%) linked to VS (indicating that they had died from drug poisoning). Those 251 overdose (OD) mortalities visited the ED 778 times between 2016-2020. Figure 2 presents the final number of linked records: 2-3 visits (n=185), 4-5 visits (n=44) and 6 or more visits (n=22). The percentages of linked records increased as the number of visits increased; 7.3%, 13.3% and 15.3% of records were linked for 2-3 visits, 4-5 visits and 6 or more visits, respectively.

The average number of days between visits were calculated for each visit group. For the 2-3, 4-5 and 6 or more visits groups, there were 273 days, 180 days and 136 days between each visit, on average, respectively.



The demographic breakdown of the three visit groups are shown in Figures 3-5. Males had a greater number of matched records than females in all visit groups. The 35-49 age group had the highest number of matched records (82 individuals who died from drug poisoning) followed by the 50 and over age group (81 individuals who died from drug poisoning). Non-Hispanic Whites had the highest number of matched records (194 individuals who died from drug poisoning) in all three visit categories followed by non-Hispanic Blacks (47 individuals who died from drug poisoning).



Demographics of OD Mortalities (Linked Data)

The demographic characteristics of persons with repeat ED visits who died from drug poisoning are presented in Table 2 (n=251). The 50 and over age group had the highest number of OD mortalities in the 2-3 and 6 or more visits group. The 35-49 age group had the highest number of OD mortalities among the 4-5 visits group.

Males, non-Hispanic Whites, those with a high school diploma/GED and never married had the highest number of OD mortalities.

The mean and median ages of each visit group are also presented in Table 2. The average age of an OD mortality was 41.6 for 2-3 visits group, 41.8 for 4-5 visits group and 47.4 for the 6 or more visits group.

Figures 6-7 display further demographic breakdowns of linked individuals who died from drug poisoning by age group. The 50 and over group had the highest number of OD mortalities among both males and females.

Figure 6: Demographics of OD Mortalities by Age, Sex and Race/Ethnicity (n=241)*

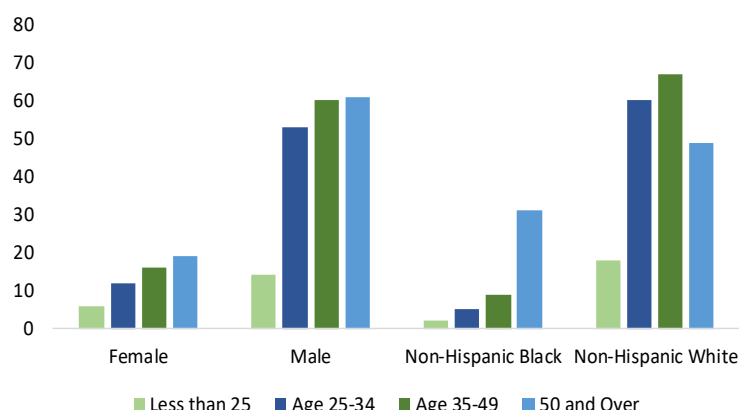


Figure 7: Demographics of OD Mortalities by Age, Educational Attainment and Marital Status (n=241)*

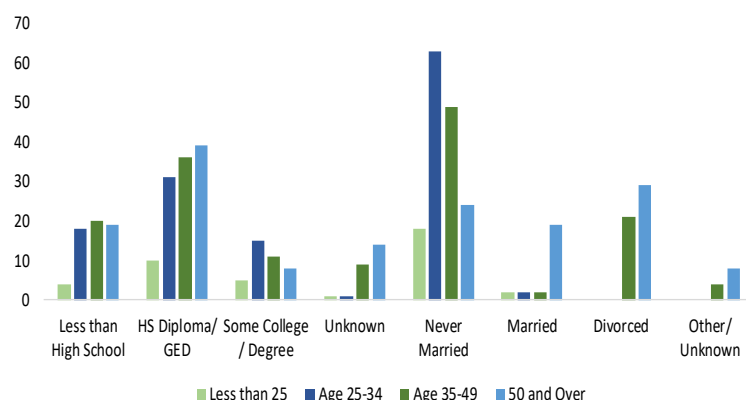


Table 2: Demographics of OD Mortalities by Number of ED Visits, 2016-2020 (n=251)

	2-3 Visits		4-5 Visits		6+ Visits	
Age Group	N	%	N	%	N	%
Under 25	18	9.7	2	4.6	-	-
25-34	53	28.7	11	25.0	4	18.2
35-49	54	29.2	21	47.7	7	31.8
50 and Over	60	32.4	10	22.7	11	50.0
Sex						
Female	44	23.8	8	18.2	3	13.6
Male	141	76.2	36	81.8	19	86.4
Race/Ethnicity						
Non-Hispanic Black	34	18.4	5	11.4	8	36.4
Non-Hispanic White	146	78.9	35	79.5	13	59.1
Hispanic	5	2.7	4	9.1	1	4.5
Education						
Less than High School	46	24.9	12	27.3	6	27.2
HS Diploma/ GED	87	47.0	24	54.6	10	45.4
Some College / Degree	33	17.8	5	11.4	3	13.6
Unknown	19	10.3	3	6.8	3	13.6
Marital Status						
Never Married	118	63.8	28	63.6	17	77.3
Married	20	10.8	4	9.1	2	9.1
Divorced	37	20.0	11	25.0	2	9.1
Other	10	5.4	1	2.3	1	4.5
Mean Age						
	41.6		41.8		47.4	
Median Age						
	39		42		48	
Total						
	185		44		22	

Non-Hispanic Whites had the highest number of OD mortalities among the 35-49 age group while non-Hispanic Blacks had the highest number of OD mortalities among the 50 and over age group (Figure 6).

The 35-49 age group had the highest number of linked OD mortalities among those with less than a high school education; the 50 and over age group had the highest number among those with a high school diploma/GED; the 25-34 group had the highest number among individuals with some college/college degree (Figure 7).

The 25-34 age group had the highest number of OD mortalities among never married individuals; those 50 and over represent the highest number of OD mortalities among both married and divorced individuals (Figure 7).

*Other Race/Ethnicity groups are not shown due to very small numbers.

Drug Types Involved in OD Mortalities (Linked Data)

Figure 8: Drug Types Involved in OD Mortalities by Visit Type**

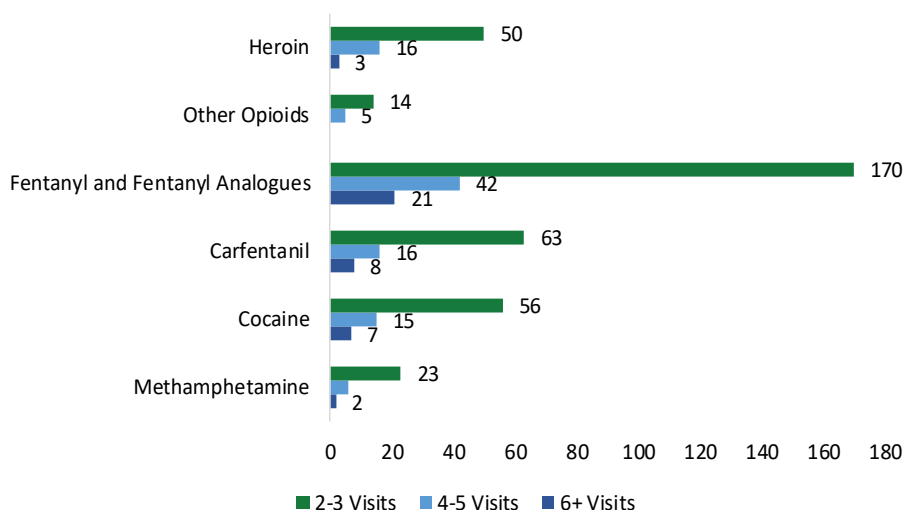


Figure 8 presents the different drug types that were involved in the death of OD mortalities. Fentanyl and fentanyl analogues were involved in 92.8% of deaths and were the most frequently indicated contributor of death regardless of number of preceding ED visits for suspected drug overdose.

Other than fentanyl and fentanyl analogues, including carfentanil, cocaine, was the next highest contributor of deaths for the 2-3 and the 6 or more visits groups. Heroin was the next highest contributor of deaths for the 4-5 visits group.

Opioid/heroin and/or stimulants were mentioned in reason for visit for a large percent of ED visits among linked records: 2-3 visits—70%, 4-5 visits—68% and 6+ visits—77%, respectively.

Figure 9: Drug Types Involved in OD Mortalities by Race/Ethnicity**

Drug Type Non-Hispanic White	N	%	Drug Type Non-Hispanic Black	N	%
Heroin	55	28.4	Heroin	12	25.5
Other Opioids	17	8.8	Other Opioids	1	2.1
Fentanyl and Fentanyl Analogues	180	92.8	Fentanyl and Fentanyl Analogues	43	91.5
Carfentanil	64	33.0	Carfentanil	21	44.7
Cocaine	52	26.8	Cocaine	21	44.7
Methamphetamine	29	15.0	Methamphetamine	2	4.3

Figure 9 displays the drug type involved in the OD mortalities by race/ethnicity. Similarly to number of ED visits, fentanyl and fentanyl analogues and carfentanil were prevalent in both race/ethnicity groups analyzed and were frequent contributors of death. Heroin and cocaine were the next drug types involved most often in OD mortalities for non-Hispanic Whites and non-Hispanic Blacks.

Heroin was involved in 28.4% of linked OD mortalities in non-Hispanic Whites compared to 25.5% in non-Hispanic Blacks. Cocaine was involved in 26.8% of linked OD mortalities in non-Hispanic Whites compared to 44.7% in non-Hispanic Blacks. Methamphetamine was more prevalent among linked OD mortalities in non-Hispanic Whites (15.0%) than non-Hispanic Blacks (4.3%).

Chi-square analyses² were conducted to determine if there were any associations between race/ethnicity and specific drug involvement at the time of death. It was found that there was a significant association between non-Hispanic Blacks and cocaine involvement at the time of death ($p < .05$) and between non-Hispanic Whites and methamphetamine involvement at time of death ($p = .0495$). There were no other significant associations between race/ethnicity and other specific drug involvement at the time of death.

**Combination of drugs are usually involved in drug overdose deaths and individual deaths may be reported in more than one category.

²For more information on Chi-square analyses, refer to the Methodology section on page 7.

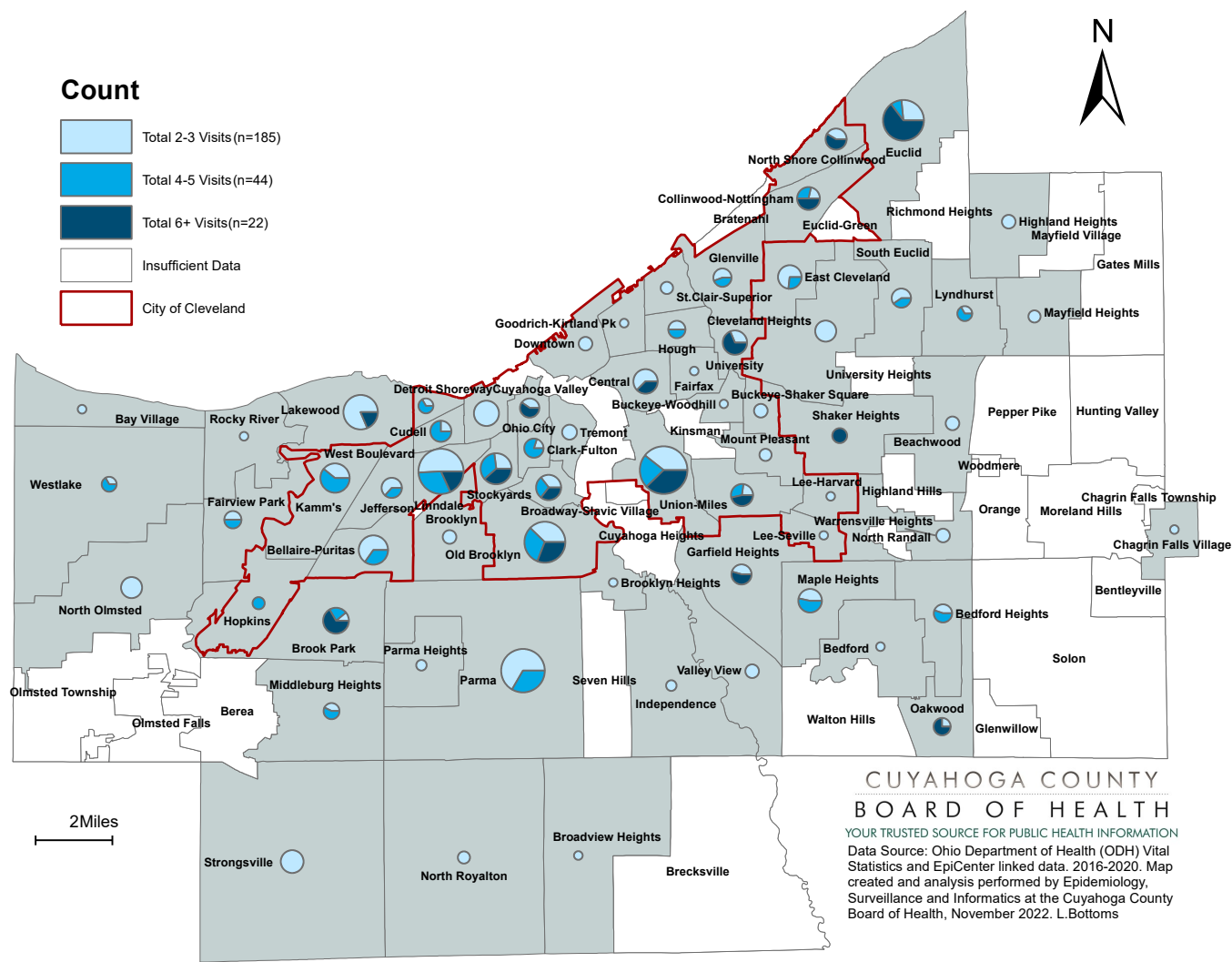
Geographic Display of OD mortalities (Linked Data)

Figure 10 displays the VS and EC linked records by residence at time of death for the three different repeat ED visit groups. Individuals in the 2-3 visits group, 4-5 visits group and 6 or more visits group visited the ED 419, 188 and 171 times, respectively. Each pie represents the proportion of categorized number of ED visits in each neighborhood. For example, a neighborhood that had all three groups in terms of number of visits linked to VS would show three different colors.

The top five neighborhoods where the 2-3 visits group was linked to VS, in terms of total visits, were: Parma, West Boulevard, Lakewood, Broadway-Slavic Village, and Old Brooklyn. The top five neighborhoods where the 4-5 visits group was linked to VS were: Parma, West Boulevard, Broadway-Slavic Village, Kamm's and Old Brooklyn. The top five neighborhoods where the 6 or more visits group was linked to VS were: Euclid, Broadway-Slavic Village, Old Brooklyn, Brook Park and Union-Miles.

The red outline represents the City of Cleveland. Cleveland represented 56.8% of the total number of repeat ED visits records linked to VS.

Figure 10: Linked Records by Neighborhood, 2016-2020



Changes in Key Indicators of Linked Data and OD Mortalities

Two distinct profiles of those that died from drug poisoning after repeat ED visits for overdose were identified in this data brief: Non-Hispanic White, 35-49, high school diploma/GED and never married; and non-Hispanic Black, 50 and over, high school diploma/GED and never married. These trends are similar to what was observed in the first edition of this linkage analysis as well as the Cuyahoga County Drug Overdose Integrated Epidemiologic Profile (DOIEP)³.

The current edition of the linkage analysis mirrored results from the first edition. Figure 11 highlights the similarities and differences in key indicators between the first and second edition of both linkage analysis data briefs. Some main differences between editions includes the age group of the linked individuals based on visit group, drug involvement based on visit group, the top five neighborhoods for each visit group and the total number of repeat ED visits records linked to VS in the City of Cleveland.

Figure 11: Comparison of Key Indicators Since the Last Edition

	July 1, 2016 - December 31, 2019	January 1, 2016 - December 31, 2020
Number of individuals that went to the ED multiple times for a suspected drug overdose	2,238	3,027
2-3 visits	1,919	2,551
4-5 visits	217	332
6 or more visits	102	144
Number of deaths due to drug poisoning	2,123	2,614
Number of linked records and number of visits	168 (7.5%) visited the ED 486 times	251 (8.3%) visited the ED 778 times
Demographics of linked individuals: age, sex and race/ethnicity	50 and over highest number of OD mortalities in the 2-3 and 6 or more visits groups; 35-49 highest number in 4-5 visits group	35-49 highest number of OD mortalities in the 2-3 and 4-5 visits groups; 50 and over highest number in 6 or more visits group
	Males higher numbers than females (77% vs 23%)	Males higher numbers than females (78% vs 22%)
	NH-Whites highest number of OD mortalities in 35-49 age group; NH-Blacks highest number in 50 and over age group	NH-Whites highest number of OD mortalities in 35-49 age group; NH-Blacks highest number in 50 and over age group
Drug types involved in overdose mortalities	Fentanyl and fentanyl analogs highest contributor of deaths	Fentanyl and fentanyl analogs highest contributor of deaths
	Heroin next highest contributor of deaths for the 2-3 and 4-5 visits group; cocaine next highest for 6 or more visits group	Cocaine next highest contributor of deaths for the 2-3 and 6 or more visits group; heroin next highest for 4-5 visits group
Top five neighborhoods where visit groups were linked to Vitals Statistics	Old Brooklyn, West Boulevard, Parma, Broadway-Slavic Village, Stockyards	Broadway-Slavic Village, West Boulevard, Parma, Euclid , Old Brooklyn
2-3 visits	Parma, Lakewood, Detroit-Shoreway , Old Brooklyn and West Boulevard	Parma, West Boulevard, Lakewood, Broadway-Slavic Village , Old Brooklyn
4-5 visits	West Boulevard, Kamm's, Old Brooklyn, Cudell and Union-Miles	Parma , West Boulevard, Broadway-Slavic Village , Kamms, Old Brooklyn
6 or more visits	Old Brooklyn, Euclid, Stockyards , University and Union-Miles	Euclid, Broadway-Slavic Village , Old Brooklyn, Brook Park , University
Cleveland representation of the total number of repeat ED visits records linked to VS.	60.9%	56.8%

³Cuyahoga County Board of Health. (2022). The 2021 Drug Overdose Integrated Epidemiologic Profile (DOIEP). Cuyahoga County, Ohio. <https://www.ccbh.net/overdose-data-dashboard/>

Conclusion

This data brief provided a proof-of-concept analysis of two linked data sources at the record level. Individuals who visited the ED multiple times due to suspected drug overdose according to EC data were categorized into three visit groups and linked to VS death certificate data; specifically deaths due to drug poisoning. This data brief also examined the demographics of those linked individuals, prevalent drug types involved in their deaths and comparisons between linkage data brief editions.

In this edition, we were able to add the first half of 2016 data and 2020 data to the sample as well as historical stimulant data of individuals who visited the ED due to suspected drug overdose involving stimulants. Adding these additional data changed the geographic landscape of linked individuals and OD mortalities. While Cleveland still has the majority of cases, suburbs outside of Cleveland increased in numbers. In the future, we hope to explore different linkages and other ways to expand the population of interest including an attempt to overlay this group with other treatment or law enforcement data.

This data brief offers a look at linked overdose data sources at record level. We hope the findings of this data brief drive further discussion about populations at high risk for drug overdoses in Cuyahoga County and support prevention efforts.

Methodology

Ohio Department of Health Vital Statistics (VS) and EpiCenter (EC) data were used for this analysis (more information about these data sources can be found in the DOIEP)³. Both datasets were cleaned to ensure variable names matched and only variables of interest were included. The EC dataset was subset to include only individuals who visited the ED more than once for a suspected drug overdose and was sorted by visit date. The VS dataset was subset to include only those with “Drug Poisoning” as a cause of death (n=2,614).

EC data were then un-duplicated keeping the most recent ED visit date and obtaining the actual number of individuals that went to the ED on multiple occasions (n=3,027). Next, EC data were categorized into three groups: 2-3 visits (n=2,551), 4-5 visits (n=332) and 6 or more visits (n=144).

Structured Query Language (SQL) procedure was used in SAS to sort and link VS and EC datasets by date of birth, race and sex. Each record linkage produced a score with 17 being the highest score; indicating all values matched. Each variable of interest was assigned a weight with DOB being the highest weighted variable. 8.3% of EC multiple visit records were matched to VS records. All matched records with a score of 17 were reviewed and linked to the visit group dataset.

The final dataset used for analyses consisted of 251 individuals who visited the ED 778 times. The final dataset with visit types were: 2-3 visits—185 individuals visited the ED 419 times; 4-5 visits—44 individuals visited the ED 188 times; 6 or more visits—22 individuals visited the ED 171 times.

In order to examine the relationship between race/ethnicity (NH-Black and NH-White) and drug involvement at time of death, a chi-square test was conducted in SAS. A chi-square test is used to examine the association between two categorical variables. A p-value of .05 or less will indicate statistical significance. A statistically significant p-value does not signify causation between two variables.

ArcMap 10.8 was used to geocode and map geographical location of linked individuals by place of residence at time of death.

Limitations

This is a proof of concept analysis. EC data are de-identified to some degree with no first or last names providing chance for error. Additionally, classifiers do not capture all overdoses, non-standard reporting across hospital systems can make the data hard to interpret and not all hospitals report to EpiCenter. Smaller, specific datasets were used for linking to reduce the percentage of error. For example, instead of all deaths, we focused on deaths due to drug poisoning.

Suggested Citation: L.Bottoms-McClain. Cuyahoga County Board of Health (2023). Recurring Emergency Department Visits for Suspected Drug Overdoses and Drug Poisoning Deaths: Linking EpiCenter and Vital Statistics data for Cuyahoga County, 2016-2020. <https://www.ccbh.net/overdose-data-dashboard/>

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