Recurring Emergency Department Visits for Suspected Drug Overdoses and Drug Poisoning Deaths: Linking EpiCenter and Vital Statistics data for Cuyahoga County, OH 2016-2019

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 reports on 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. 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 2019 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, 2016-2019 (n = 2,238)



The mean and median age of individuals with repeat visits were similar among the 2-3 and 4-5 visits groups. However, the 6 or more visits group had an older mean and median age than the other visit groups.

For the total number of repeat visits for suspected drug overdose, 55.2% of the visits mentioned opioid/heroin as the reason.

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=2,123).

Using probabilistic matching methodology, (see Methodology section on page 6 for details), records of individuals with repeat visits to the ED were linked with VS data records of individuals who died from drug poisoning. EC data showed that there were 2,238 individuals that went to the ED multiple times for a suspected drug overdose between July 1, 2016—December 31, 2019.² These individuals were categorized into three visit groups (see Figure 1):

- ♦ 2-3 visits (n=1919),
- ♦ 4-5 visits (n=217) and
- 6 or more times (n=102).

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 EDDue to Suspected Drug Overdose, 2016-2019

	2-3 Visits		4-5 Visits		6+ Visits					
Age Group	Ν	%	Ν	%	Ν	%				
Under 25	229	11.9	18	8.3	4	3.9				
25-34	573	29.9	63	29.0	29	28.4				
35-49	626	32.6	95	43.8	41	40.2				
50 and Over	491	25.6	41	18.9	28	27.5				
Sex										
Female	671	35.0	65	29.9	24	23.5				
Male	1248	65.0	152	70.1	78	76.5				
Race/Ethnicity										
Black	413	21.5	44	20.3	28	27.5				
White	1158	60.3	148	68.2	67	65.7				
Other/Unknown	348	18.2	25	11.5	7	6.8				
Mean Age										
	39.6		39.9		41.8					
Median Age										
	37		38		39.5					
Total										
	1919		217		102					

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

²The timeframe of July 1, 2016—December 31, 2019 will be referred to as 2016-2019 throughout the data brief.

Of the 2,238 individuals with repeat visit records, 168 (7.5%) linked to VS (indicating that they had died from drug poisoning). Those 168 overdose (OD) mortalities visited the ED 486 times between 2016-2019. Figure 2 presents the final number of linked records: 2-3 visits (n=130), 4-5 visits (n=25) and 6 or more visits (n=13).





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 50 and over age group had the highest number of matched records (58 individuals who died from drug poisoning) followed by the 35-49 age group (53 individuals who died from drug poisoning). Non-Hispanic Whites had the highest number of matched records (131 individuals who died from drug poisoning) in all three visit categories followed by non-Hispanic Blacks (33 individuals who died from drug poisoning).



The demographic characteristics of persons with repeat ED visits who died from drug poisoning are presented in Table 2 (n=168). The 50 and over age group had the highest number of OD mortalities in the 2-3 and 6 or more visits groups. The 35-49 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 42.1 for 2-3 visits group, 42.2 for 4-5 visits group and 49 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 7: Demographics of OD Mortalities by Age,

Table 2: Demographics of OD Mortalities by Number of ED Visits, 2016-2019

	2-3 Visits		4-5 Visits	4-5 Visits		6+ Visits				
Age Group	Ν	%	Ν	%	Ν	%				
Under 25	14	10.8	1	4.0	-	-				
25-34	35	26.9	6	24.0	1	7.7				
35-49	37	28.5	11	44.0	5	38.5				
50 and Over	44	33.8	7	28.0	7	53.8				
Sex										
Female	33	25.4	6	24.0	-	-				
Male	97	74.6	19	76.0	13	100				
Race/Ethnicity										
Non-Hispanic Black	23	17.7	5	20.0	5	38.5				
Non-Hispanic White	104	80.0	19	76.0	8	61.5				
Hispanic	3	2.3	1	4.0	-	-				
Education										
Less than High School	33	25.4	8	32.0	3	23.1				
HS Diploma/ GED	58	44.6	11	44.0	5	38.5				
Some College / Degree	24	18.5	3	12.0	2	15.4				
Unknown	15	11.5	3	12.0	3	23.1				
Marital Status										
Never Married	78	60.0	13	52.0	10	76.9				
Married	15	11.5	2	8.0	2	15.4				
Divorced	30	23.1	8	32.0	1	7.7				
Other	7	5.4	2	8.0	-	-				
		Mean A	Age							
	42.1		42.2		49					
Median Age										
	40		46		50					
Total										
	130		25		13					

Non-Hispanic Whites had the highest number of OD mortalities among the 35-49 age group compared to the 50 and over group for non-Hispanic Blacks (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 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.



Figure 8 presents the different drug types that were involved in the death of OD mortalities. Fentanyl and fentanyl analogues were involved in 94.6% 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, heroin was the next highest contributor of deaths for the 2-3 and 4-5 visits groups. Cocaine was the next highest contributor of deaths for the 6 or more visits group.

Opioid/heroin were mentioned in reason for visit for a large percent of ED visits among linked records: 2-3 visits—70%, 4-5 visits—64% and 6+ visits—85%.

Drug Type Non-Drug Type Non-% % Ν Ν **Hispanic White Hispanic Black** Heroin 35 Heroin 6 26.7 18.2 **Other Opioids** 11 8.4 **Other Opioids** 1 3.0 **Fentanyl and Fentanyl Fentanyl and Fentanyl** 99 75.6 21 63.6 Analogues Analogues Carfentanil 42 32.1 Carfentanil 11 33.3 Cocaine 29 14.5 Cocaine 33.3 11 Methamphetamine 13 9.9 Methamphetamine 1 3.0

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

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

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 26.7% of linked OD mortalities in non-Hispanic Whites compared to 18.2% in non-Hispanic Blacks. Cocaine was involved in 14.5% of linked OD mortalities in non-Hispanic Whites compared to 33.3% in non-Hispanic Blacks. Methamphetamine was more prevalent among linked OD mortalities in non-Hispanic Whites (9.9%) than non-Hispanic Blacks (3.0%).

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

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 285, 107 and 94 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 individuals, were: Parma, Lakewood, Detroit-Shoreway, Old Brooklyn and West Boulevard. The top five neighborhoods where the 4-5 visits group was linked to VS were: West Boulevard, Kamm's, Old Brooklyn, Cudell and Union-Miles. The top five neighborhoods where the 6 or more visits group was linked to VS were: Old Brooklyn, Euclid, Stockyards, University and Union-Miles.

The red outline represents the City of Cleveland. Cleveland represented 60.9% of the total number of repeat ED visits records linked to VS.

Figure 10: Linked Records by Neighborhood, 2016-2019



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 and the prevalent drug types involved in their deaths.

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 Cuyahoga County Drug Overdose Integrated Epidemiologic Profile (DOIEP)¹.

In the future, we hope to explore different linkages and other ways to expand the population of interest. Some next steps:

- Add 2020 data to the sample.
- Add historical stimulant data to see if groups of interest change based on the stimulant type.
- Examine the differences between those that were able to be linked vs those that were not able to be linked.
- Determine if there is a possibility to look across hospital systems.
- Attempt to overlay this group with other treatment or law enforcement data to develop a comprehensive profile of individuals who had repeat visits to the ED for drug overdose and ended up passing away from a drug overdose.

This data brief offers a first-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)¹. 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=2,123).

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=2,238). Next, EC data were categorized into three groups: 2-3 visits (n=1,919), 4-5 visits (n=217) and 6 or more (n=102) visits.

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. 7.5% 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 168 individuals who visited the ED 486 times. The final dataset with visit types were: 2-3 visits— 130 individuals visited the ED 285 times; 4-5 visits—25 individuals visited the ED 107 times; 6 or more visits—13 individuals visited the ED 94 times.

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 and non-standard reporting across hospital systems can make the data hard to interpret. Smaller, specific datasets were used to reduce the percentage of error. For example, instead of all deaths, we focused on deaths due to drug poisoning. Lastly, the sample sizes for visit types were too small to complete any tests assessing statistical significance.

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¹Cuyahoga County Board of Health. (2021). The 2020 Drug Overdose Integrated Epidemiologic Profile (DOIEP). Cuyahoga County, Ohio. https:// www.ccbh.net/overdose-data-dashboard/