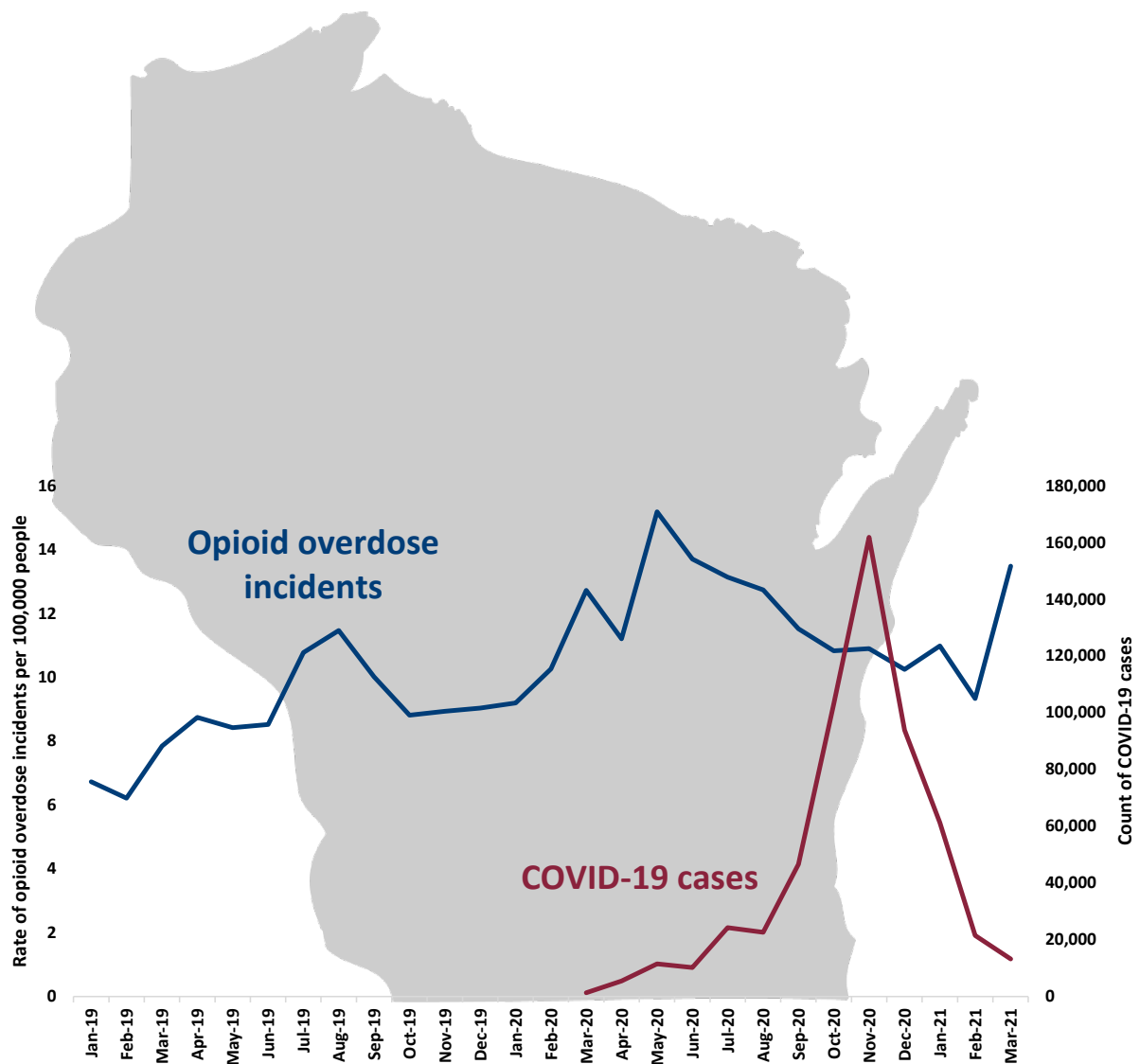


Opioid Overdose Incidents and the COVID-19 Pandemic in Wisconsin



Source: Wisconsin Department of Health Services, Office of Health Informatics
 Data: Wisconsin Ambulance Run Data System (WARDS), pulled April 2021
 COVID data pulled from website in May 2021 (<https://data.dhsgis.wi.gov/datasets/covid-19-historical-data-by-county/data?orderBy=GEOID>)

P-03029 (08/2021)

Executive Summary

It has long been recognized that Wisconsin is in the middle of an opioid overdose crisis. In March 2020, the COVID-19 pandemic hit Wisconsin and created another public health crisis. These have been stressful times for individuals, families, and communities, and there is a concern that adverse behavioral health outcomes may be increasing due to that stress. This report by the Department of Health Services (DHS) Opioid Data Team examines opioid drug overdose incidents in Wisconsin from January 2019 through March 2021.

Rapid data sources such as ambulance runs and syndromic emergency department (ED) hospital visits were examined to look at the near real-time impact of the COVID-19 pandemic and its relationship to the opioid crisis. Both of these data sources were examined because while they do overlap, they do not overlap completely. For example, people may take other means of transport to an ED or may refuse transport to EDs from ambulances.

Key findings include:

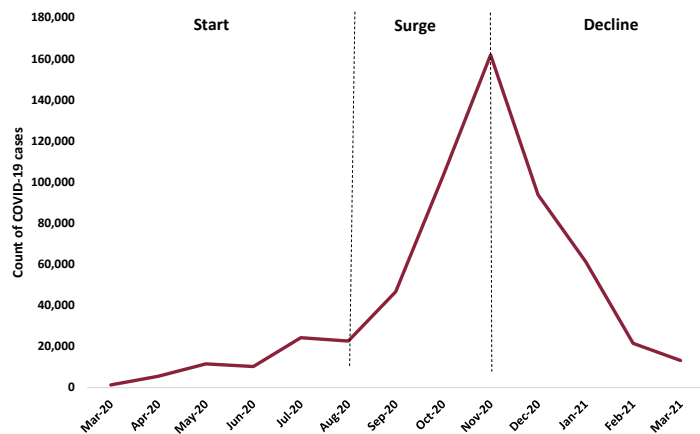
- At the start of the pandemic, around April 2020, there was a decrease in overall ambulance runs and overall ED visits. Possible reasons include: people avoiding medical services during a pandemic, less traveling or safer behaviors during isolation practices, or changes in medical practices due to the pandemic (for example, increase in availability of telehealth and paramedicine practices). These decreases in use of medical services was only seen for about a two-month period and then the number of overall ambulance runs and overall ED visits rebounded. These changes may have impacted the count of opioid overdose incidents during the decreased time period, although that is not known for sure.
- Overall, Wisconsin saw an increase in suspected opioid overdose incidents within both rapid data sources since the COVID-19 pandemic began. Drug misuse and overdose incidents are complex societal issues with many reasons behind them. Possible reasons may include: stress from the pandemic leading to more drug use as a coping mechanism, increased isolation which could increase opportunities for drug misuse or the risk of overdosing alone, and an increased drug market.
- When looking at simple forecast models, ambulance data showed a greater than expected number of suspected opioid overdose incidents during March 2020 through August 2020 before decreasing to below the expected number of incidents. On the other hand, in more recent months, the number of observed suspected opioid overdose incidents is again surpassing the number of expected incidents. ED visits also appeared to surge above expected, but for a shorter duration (April 2020 through June 2020) and then decreased below the forecasted expected levels, where it has stayed. This difference could be explained by the decrease in use of medical services, suggesting that the decrease had more of an impact among ED visits than ambulance runs.
- Impacted counties vary across COVID-19 time periods and do not appear to show a trend with counties impacted by opioid overdose incidents. This suggests that there is not a direct connection between COVID-19 cases and suspected opioid overdose incidents. It is likely that the connection between the pandemic and the rise in suspected opioid incidents is more behavioral and multi-factorial than biological.

It is the conclusion of the DHS Opioid Data Team that there has been an increase in suspected opioid overdose incidents since COVID-19 hit Wisconsin, and that this increase was greater than expected. The burden of these increases are county specific. This suggests that multiple factors correlate with county increases in opioid overdose incidents. The DHS Opioid Data Team recommends close monitoring of the situation as the pandemic continues, and engagement in county-specific prevention and intervention activities.

COVID-19 Data

In March 2020, the COVID-19 pandemic was first detected in Wisconsin by the Department of Health Services (DHS). The pandemic has evolved over time and while Wisconsin is still in the midst of the pandemic, it has changed characteristics since it was first detected. The pandemic went through a gradual increase starting in March 2020, followed by a surge in positive cases in the fall and then a decline. There continues to be a decline as vaccination efforts have ramped up in Wisconsin. Figure 1 shows the progression of the COVID-19 pandemic in Wisconsin over time.

Figure 1: Total number of COVID-19 cases, Wisconsin



Source: Wisconsin Department of Health Services, Office of Health Informatics
 Data: COVID data pulled from website in May 2021 (<https://data.dhs.wisconsin.gov/datasets/covid-19-historical-data-by-county/data?orderBy=GEOID>)

To better understand the impact of the COVID-19 pandemic, the trend was broken into three time periods. The start of the pandemic, March 2020 through August 2020, the surge of the pandemic, September 2020 through November 2020, and the decline of the pandemic, December 2020 through March 2021. While the pandemic is continuing at the time of this report, the data examined ends with the most current month available (March 2021).

Not only did the pandemic change over time, it changed geographically as well. To highlight those changes, the DHS Opioid Data Team examined the counties within the highest quartile of COVID-19 case rates, and looked at how they shifted over time. Table 1 examines the 18 counties with the greatest COVID-19 case rates during the start, the surge, the decline, and then overall through the entire pandemic so far.

Table 1: Counties in the highest quartile for COVID-19 case rates by time period, Wisconsin

Highest Quartile	Start COVID-19 time period			Surge COVID-19 time period			Decline COVID-19 time period			Entire time period (March 2020-March 2021)		
	County	Average COVID-19 cases Avg	Rate per 100,000	County	Average COVID-19 cases Avg	Rate per 100,000	County	Average COVID-19 cases Avg	Rate per 100,000	County	Total COVID-19 cases N	Rate per 100,000
1	Milwaukee	4,012	422.2	Menominee	176	4,043.2	Menominee	58	1,332.4	Menominee	789	18,125.4
2	Iron	20	347.1	Shawano	1,140	2,755.4	Pepin	86	1,171.5	Dodge	11,558	12,954.5
3	Brown	896	343.0	Dodge	2,399	2,688.5	Green	418	1,132.9	Jackson	2,579	12,440.3
4	Racine	668	340.3	Jackson	547	2,638.6	Vilas	236	1,075.3	Barron	5,524	12,029.6
5	Kenosha	495	293.5	Langlade	483	2,434.1	Polk	464	1,051.0	Brown	30,695	11,750.1
6	Walworth	284	274.4	Kewaunee	503	2,432.1	Washburn	166	1,046.1	Trempealeau	3,460	11,666.3
7	Marinette	102	247.8	Oconto	903	2,365.9	Juneau	281	1,042.2	Fond du Lac	12,071	11,642.8
8	Waukesha	928	231.5	Forest	216	2,361.5	Jackson	216	1,039.5	Sheboygan	13,261	11,482.1
9	Trempealeau	69	231.0	Barron	1,083	2,358.4	Barron	476	1,037.1	Oconto	4,314	11,298.5
10	Dodge	194	217.1	Fond du Lac	2,444	2,357.0	Sawyer	166	994.5	Juneau	3,038	11,278.2
11	Waupaca	111	213.5	Sheboygan	2,696	2,334.3	Waukesha	3,948	985.4	Kewaunee	2,304	11,147.7
12	Washington	270	199.7	Calumet	1,186	2,294.6	Washington	1,323	977.0	Chippewa	7,183	11,142.7
13	Oconto	72	187.3	Winnebago	3,875	2,273.7	Chippewa	629	976.1	Shawano	4,607	11,138.5
14	Lafayette	31	182.4	Eau Claire	2,330	2,255.2	Buffalo	131	968.8	Pepin	817	11,129.3
15	Fond du Lac	185	178.3	Crawford	373	2,254.3	Douglas	423	961.9	Eau Claire	11,247	10,887.6
16	Jefferson	150	178.1	Chippewa	1,440	2,233.3	Monroe	441	956.2	Calumet	5,601	10,839.5
17	Rock	281	174.2	Trempealeau	660	2,224.2	Iron	54	921.8	Outagamie	19,884	10,765.4
18	Ozaukee	152	171.4	Florence	97	2,209.1	La Crosse	1,081	911.0	Milwaukee	100,715	10,597.6

Source: Wisconsin Department of Health Services, Office of Health Informatics
 Data: COVID data pulled from website in May 2021 (<https://data.dhs.wisconsin.gov/datasets/covid-19-historical-data-by-county/data?orderBy=GEOID>)
 Start COVID-19 is from March 2020-August 2020; Surge COVID-19 is from September 2020-November 2020; Decline COVID-19 is from December 2020-March 2021

Early in the pandemic, DHS noticed an increasing trend related to opioid overdose incidents. This report examines the correlation between COVID-19 cases and suspected opioid overdose

incidents using rapid data sources: ambulance run and syndromic emergency department (ED) visit data.

Ambulance Run Data

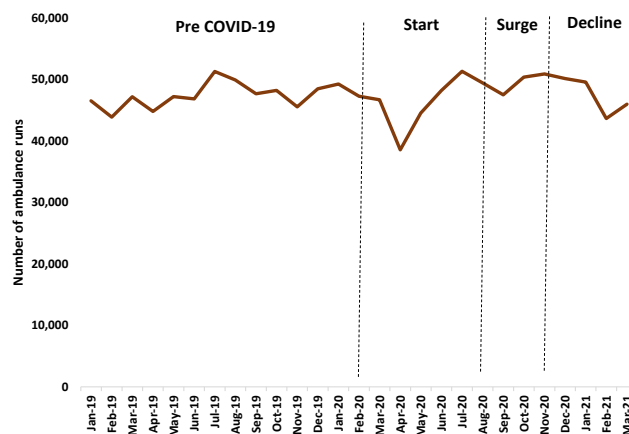
In accordance with Wisconsin Administrative Rule DHS 110.34(8), emergency medical service (EMS) providers have seven days to report ambulance runs into the Wisconsin Ambulance Run Data System (WARDS). This makes ambulance data a rapid data source that can be utilized in ongoing emergency situations like a pandemic. For the last four years, ambulance data have also been used as a tool for rapid surveillance of suspected opioid overdose incidents. Thus, this is an ideal data source to look at the correlation between opioid overdose incidents and the COVID-19 pandemic.

The timeframe for this report was January 2019 through March 2021. January 2019 through February 2020 was coded as pre COVID-19 and, as explained above, the rest of the timeframe was coded as start, surge, and decline to match the COVID-19 time periods. An in-depth discussion of population and case definitions can be found in the technical notes. In short, the population examined was those for whom a 911-response ambulance run (not transfers) was called among those over 10 years old.

Overall Ambulance Runs

On average, Wisconsin had 47,418 ambulance runs per month from January 2019 through February 2020 (pre COVID-19). Figure 2 shows the trend over time for all ambulance runs. During the start of COVID-19, March 2020 through August 2020, Wisconsin averaged 46,442 overall ambulance runs per month. This was a 2% decrease when compared to the average before COVID-19 was detected. Wisconsin saw a large decrease in April 2020 for overall ambulance runs, believed to be due to COVID-19. The average overall ambulance runs then increased during the surge time period, September 2020 through November 2020, to 49,575 runs. This was a 7% increase between the start and surge time periods. Finally, during the decline time period, December 2020 through March 2021, Wisconsin averaged 47,321 monthly ambulance runs per month. The decrease from surge to decline time periods was 5%.

Figure 2: Total number of ambulance runs, Wisconsin



Source: Wisconsin Department of Health Services, Office of Health Informatics
Data: Wisconsin Ambulance Run Data System (WARDS), pulled April 2021

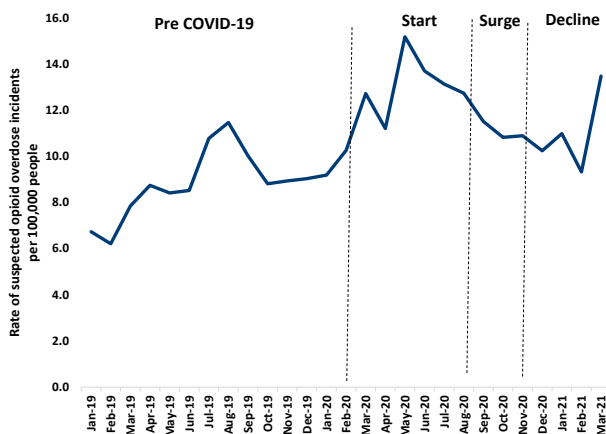
The decrease observed during the start time period might be attributed to fewer people willing to call an ambulance or engage in the health care system. Additionally, some communities are employing ambulatory-divergent services, like paramedicine, to relieve the burden on ambulances and hospitals during the pandemic. These would impact the overall number of ambulance runs recorded.

The increase seen during the surge time period could be explained by the surge in COVID-19 cases. Unfortunately, since more people were getting sick, more ambulance runs needed to

occur. The corresponding decrease seen in the decline period suggests that the increase observed previously was due to COVID-19 cases, and now that the number of cases is declining, the number of overall ambulance runs is returning to pre COVID-19 levels.

Suspected Opioid Overdose Ambulance Runs

Figure 3: Rate of suspected opioid overdose incidents, Wisconsin



Source: Wisconsin Department of Health Services, Office of Health Informatics
 Data: Wisconsin Ambulance Run Data System (WARDS), pulled April 2021
 Suspected opioid overdoses case definition was designed and validated by the Wisconsin Department of Health Services

This section examines suspected opioid overdose incidents specifically. Full case definitions can be found in the technical notes. Briefly, suspected opioid overdose incidents were classified using key term text searches within the ambulance narrative and complaint fields. Since the patient has not seen a clinician at the time of the ambulance run, opioid overdose incidents are considered suspected instead of confirmed. Figure 3 shows the overall trend of suspected opioid overdoses in Wisconsin.

Suspected opioid overdoses averaged 519 incidents per month during the pre COVID-19 time period. This corresponds to a rate of about 8.9 incidents per 100,000 people. During the start time period, the average number of incidents increased to 762 per month (rate of 13.1 per 100,000 people). This was a 47% increase in suspected opioid overdose incidents. The number of incidents decreased during the surge time period, to an average of 644 incidents per month (rate of 11.1 per 100,000 people). This represents a 15% decrease. While the decline time period averaged 640 incidents per month (a rate of 11.0 per 100,000 people), this average is deceptive because there was a large increase during this time period that is being masked by averaging. The percent change was 0.6% from the surge to decline time period.

The exact reasons for the changing number of opioid overdose incidents is not known, however, it is interesting that cases increased dramatically during the start time period, when the stress of the pandemic was increasing. The decrease during the surge would suggest that fewer suspected overdose incidents were occurring when Wisconsin was in the grip of the pandemic, maybe due to fear of COVID-19 or wanting to avoid the medical system. Unfortunately, this decrease has not continued into the decline of COVID-19 cases, suggesting that now that the fear is receding, the stress of the pandemic is becoming more prevalent.

While percent changes tell us about the magnitude of change, they do not tell us if the change was statistically significant or if they could be explained by chance. One way to examine this is by looking at the 95% confidence intervals around the calculated rates for the different time periods. Essentially, confidence intervals estimate the amount of variability that could be due to chance. In comparing confidence intervals for rates, if they overlap one another it means that the rates are not statistically different from one another. If they do not overlap, then there is a statistically significant difference between those rates. The confidence intervals for the pre, start, surge, and decline time periods were: (8.2-9.7), (12.2-14.1), (12.3-14.0), and (10.2-11.9) respectively. This tells us that the change in the rate of suspected opioid overdose incidents

from the pre time period to the start time period was statistically significant. This means that the 47% increase seen cannot be due to chance. The changes seen after the start time period, during the surge and decline time periods, were not statistically significant, which means that those percent changes could be due to chance. However, it is interesting to note that the confidence interval for the decline time period and the pre COVID-19 time period do not overlap, which says that the difference between them was statistically significant. The rate for the decline time period was 11.0 incidents per 100,000 people and the pre COVID-19 rate was 8.9 incidents per 100,000 people. This means Wisconsin is still seeing a statistically significant increase currently when compared to before the COVID-19 pandemic was discovered.

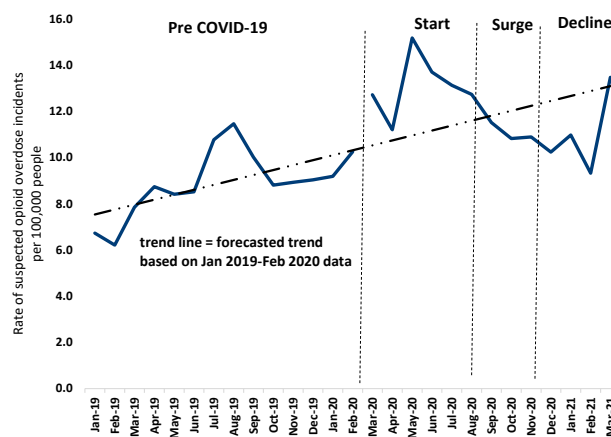
So, had the pandemic not occurred, would Wisconsin still have seen a statistically significant increase in suspected opioid overdose incidents? And what about the current increase, could that be associated with the pandemic? This can be examined by looking at the expected number of suspected opioid overdose incidents and then comparing them to the observed incidents. The DHS Opioid Data Team examined the expected number by looking at the simple linear trend from January 2019 through February 2020 and then forecasting that trend across the next 13 months. Figure 4 shows the observed incidents, with the dotted line showing the forecasted trend.

Figure 4 shows that during the start time period, and a little into the surge time period, the observed number of suspected opioid overdose incidents was above what would be expected based on the pre COVID-19 data. This suggests that the COVID-19 pandemic did have an influence on suspected opioid overdose incidents. There could be a number of factors playing into this, like the stress from the pandemic, the stay-at-home order in Wisconsin, increased access to drugs, and/or social isolation leading to more dangerous drug behaviors.

Interestingly, the observed trend of opioid overdose incidents above expected levels did not continue.

During the surge time period and into the decline time period, the observed number of suspected opioid overdose incidents dropped below the expected levels. This could have been due to the increased fear of the pandemic, causing people to isolate more and not engage in drug seeking behaviors. It could also be due to people being more cautious in order to avoid the medical care systems. There are probably many other reasons for the decrease. What is most concerning, however, is that the trend of observed incidents being less than expected incidents has not continued. In more recent months, Wisconsin is again experiencing incidents of suspected drug overdoses above expected. This could be due to pandemic fatigue and stress. This needs to be closely monitored by DHS to see if it is a continuing trend or just a spike in the data.

Figure 4: Rate of suspected opioid overdose incidents compared to forecasted trend, Wisconsin



Source: Wisconsin Department of Health Services, Office of Health Informatics
 Data: Wisconsin Ambulance Run Data System (WARDS), pulled April 2021
 Suspected opioid overdoses case definition was designed and validated by the Wisconsin Department of Health Services

To examine the impact geographically, the DHS Opioid Data Team looked at the rates of suspected opioid overdose incidents per time period for the counties in the top quartile of COVID-19 case rates. Table 2 shows the highest 18 counties according to their rates of COVID-19 throughout the pandemic and the number of cases for those counties. It then shows the rates and 95% confidence intervals of the average rate of suspected opioid overdose incidents for the different time periods of analysis.

Table 2: Counties in the highest quartile for COVID-19 case rates by time period and their corresponding rates of suspected opioid overdose incidents, Wisconsin

County	COVID-19 cases during epidemic so far		Suspected opioid overdose incidents in ambulance data							
	N	Rate per 100,000	Pre COVID-19 time period		Start COVID-19 time period		Surge COVID-19 time period		Decline COVID-19 time period	
			Avg Rate per 100,000	Confidence Interval	Avg Rate per 100,000	Confidence Interval	Avg Rate per 100,000	Confidence Interval	Avg Rate per 100,000	Confidence Interval
Menominee	789	18,125.4	50.9	(-16.1 - 117.9)	99.5	(5.8 - 193.3)	38.3	(41.4 - 157.7)	68.9	(-9.1 - 146.9)
Dodge	11,558	12,954.5	7.1	(1.6 - 12.7)	12.0	(4.8 - 19.1)	5.6	(7.0 - 16.9)	7.3	(1.7 - 12.9)
Jackson	2,579	12,440.3	4.5	(-4.6 - 13.6)	7.2	(-4.3 - 18.8)	12.9	(-8.2 - 22.7)	8.4	(-4.1 - 20.9)
Barron	5,524	12,029.6	2.3	(-2.1 - 6.8)	2.5	(-2.1 - 7.2)	5.8	(-4.4 - 9.5)	4.9	(-1.5 - 11.3)
Brown	30,695	11,750.1	4.9	(2.2 - 7.6)	7.3	(4.1 - 10.6)	8.9	(3.7 - 11.0)	10.3	(6.4 - 14.2)
Trempealeau	3,460	11,666.3	2.2	(-3.1 - 7.5)	1.7	(-3.0 - 6.4)	1.1	(-2.1 - 5.5)	3.4	(-3.2 - 10.0)
Fond du Lac	12,071	11,642.8	7.8	(2.4 - 13.2)	14.0	(6.8 - 21.2)	11.6	(7.4 - 20.5)	11.3	(4.9 - 17.8)
Sheboygan	13,261	11,482.1	6.4	(1.8 - 11.1)	9.7	(4.0 - 15.3)	5.5	(5.4 - 13.9)	7.8	(2.7 - 12.9)
Oconto	4,314	11,298.5	2.2	(-2.5 - 7.0)	2.2	(-2.5 - 6.9)	4.4	(-4.4 - 8.8)	5.9	(-1.8 - 13.6)
Juneau	3,038	11,278.2	7.7	(-2.8 - 18.2)	11.1	(-1.5 - 23.7)	13.6	(-2.8 - 25.1)	13.9	(-0.2 - 28.0)
Kewaunee	2,304	11,147.7	0.7	(-2.9 - 4.3)	2.4	(-4.3 - 9.1)	1.6	(-3.1 - 7.9)	3.6	(-4.6 - 11.8)
Chippewa	7,183	11,142.7	4.4	(-0.7 - 9.6)	4.1	(-0.8 - 9.1)	5.2	(-1.4 - 9.7)	3.1	(-1.2 - 7.4)
Shawano	4,607	11,138.5	3.6	(-2.2 - 9.4)	5.2	(-1.7 - 12.2)	9.7	(-4.2 - 14.7)	6.0	(-1.4 - 13.5)
Pepin	817	11,129.3	1.0	(-6.2 - 8.1)	0.0	0.0	0.0	0.0	0.0	0.0
Eau Claire	11,247	10,887.6	7.9	(2.5 - 13.3)	10.8	(4.5 - 17.2)	6.1	(6.0 - 15.6)	6.1	(1.3 - 10.8)
Calumet	5,601	10,839.5	2.3	(-1.8 - 6.5)	0.0	0.0	1.9	(-3.8 - 3.8)	2.9	(-1.7 - 7.5)
Outagamie	19,884	10,765.4	5.1	(1.8 - 8.4)	8.6	(4.3 - 12.8)	8.1	(4.5 - 12.7)	8.1	(4.0 - 12.2)
Milwaukee	100,715	10,597.6	21.2	(18.2 - 24.1)	34.2	(30.5 - 38.0)	26.2	(31.0 - 37.5)	26.0	(22.8 - 29.3)

Source: Wisconsin Department of Health Services, Office of Health Informatics
 Data: COVID data pulled from website in May 2021 (<https://data.dhsgis.wi.gov/datasets/covid-19-historical-data-by-county/data?orderBy=GEOID>)
 Wisconsin Ambulance Run Data System (WARDS), pulled April 2021
 Start COVID-19 is from March 2020-August 2020; Surge COVID-19 is from September 2020-November 2020; Decline COVID-19 is from December 2020-March 2021

There is no discernible pattern across counties with regards to COVID-19 case rates and suspected opioid overdose incident rates. The areas with the highest COVID-19 burden were not necessarily the areas with the greatest suspected opioid overdose incidents. Dodge County had a very high burden of COVID-19 cases but these are relatively low compared to suspected opioid overdose incidents. In looking at the confidence intervals around the rates of overdose incidents, aside from Milwaukee County, the confidence intervals from the different time periods overlap, suggesting that the changing rates were not statistically significant. Since some of these counties had very wide confidence intervals, like Menominee County, which shows small numbers with a lot of variability. This makes rate estimates unstable, resulting in extremely wide confidence intervals which will decrease the likelihood of finding statistical significance.

Milwaukee County, on the other hand, had very narrow confidence intervals, which suggests a greater number of incidents with less variability. Milwaukee's increase during the start time period was statistically significant, although none of the other changes were. This follows the pattern statewide, with a statistically significant increase during the start of the pandemic. All in all, Table 2 shows the geographic variability across COVID-19 cases and suspected opioid overdose incidents. This variability continued throughout the analyzed time periods. For the most part, counties appear to follow the statewide trend of an increase during the start time period, followed by a decrease.

Ambulance data are not the only rapid surveillance data source available in Wisconsin. There are also syndromic hospitalization data among emergency departments (ED). While ED visits are related to ambulance runs, they are not exactly the same populations. Some people arrive to the ED through other means than ambulances, and some ambulance patients refuse transport to the ED. Thus, while these populations overlap, they do not exactly match one another, so the next step was to examine suspected opioid overdoses in the ED population.

Emergency Department (ED) Data

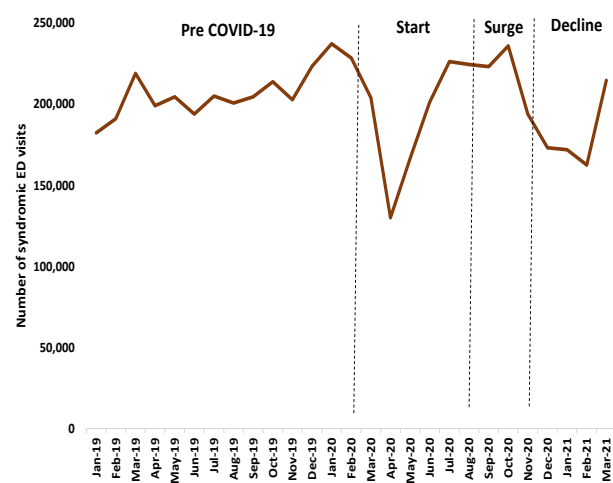
ED visits at discharge are a main data source for information on non-fatal opioid overdose incidents. However, there is a time lag between when the visit occurred and when the information is available to DHS (often 4–6 months), making this data source ill-suited for use during an emerging situation. There is another data source, called ESSENCE, which is a syndromic surveillance system looking at ED visits in a more rapid fashion (for example, nightly). Syndromic means that a visit is classified based on a grouping of symptoms (a syndrome) rather than a diagnosis. Syndromic data is not as clean as discharge data.

DHS has been using the ESSENCE system to monitor suspected opioid overdose incidents in Wisconsin for the last four years. These overdoses are deemed suspected because the diagnosis may not be finalized at the time the ED visit data is transferred into the data system. It also uses a mixture of codes and keyword searches for the case definition, described in more detail in the technical notes section. Currently, this information is sent to local and tribal health departments in the form of weekly “alerts” when a county has more suspected opioid overdose incidents than expected.

ESSENCE data and ambulance run data are both useful in examining the opioid crisis, because while the populations in both systems overlap, they do not overlap completely. There are individuals who are driven to the ED by a friend or family member, bypassing ambulances, and there are individuals who refuse transport to a hospital once an ambulance has been called, bypassing EDs. Looking at both systems enables us to form a more complete picture of overdose incidents in Wisconsin.

Overall ESSENCE Visits

Figure 5: Total number of ED visits, Wisconsin



Source: Wisconsin Department of Health Services, Office of Health Informatics
Data: ESSENCE syndromic surveillance system, pulled April 2021

As with the ambulance data, ESSENCE visits decreased early in the pandemic but then rebounded. Figure 5 shows the trend in total ED visits from January 2019 through March 2021. Like the ambulance data, the COVID-19 time periods have been added to the figure.

On average, Wisconsin had 207,681 total ED visits during the pre COVID-19 time period, which was from January 2019 through February 2020. This average decreased 7% during the start time period for 192,251 ED visits from March 2020 through August 2020. During the surge time period, total ED visits increased to 217,783 visits on average, which represented a 13% increase. Finally, during the decline time period, average total ED visits declined to 180,698 visits, a 17% decrease.

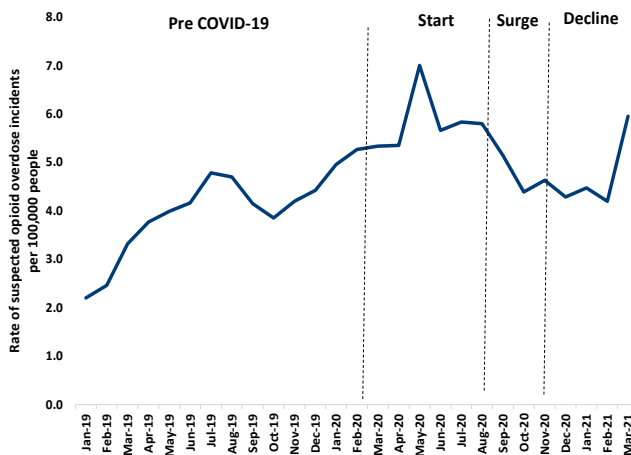
The extreme dip in total ED visits is likely explained by the COVID-19 pandemic, as people started to avoid the medical care systems or use alternative care like telehealth. However, this decrease did not last long, with total ED visits rebounding in about three months. This is similar

to what was seen in the total ambulance run data as well, further highlighting the avoidance of the medical care system. The increase during the surge time period is likely explained by the surge in COVID-19 cases that needed hospitalization. The subsequent decline could have been due to vaccination efforts and the decrease in cases seen in Wisconsin. However, this does not explain why the decrease after the surge was so extreme. It is similar to the decrease seen at the start of the pandemic, so it may also represent avoidance of the medical care system. This extreme decrease was not seen in the ambulance data, suggesting that there were differences in care-seeking behavior in those who used ambulances and those who visited EDs. It does appear that total ED visits are rebounding back to their pre-pandemic levels, with March 2021 being the start of that rebound, so the cause of the second decrease is easing.

Suspected Opioid Overdose ESSENCE Visits

As mentioned previously, the suspected opioid overdose definition uses a combination of medical codes and keyword searches among the chief complaint, discharge diagnosis, and triage notes. This definition was part of a collaborative effort with the Center for Disease Control and Prevention (CDC) and 33 states (including Wisconsin) to create a quality case definition, enabling a national examination of suspected opioid overdoses. The technical notes section has further details on the case definition.

Figure 6: Rate of suspected opioid overdose incidents, Wisconsin



Source: Wisconsin Department of Health Services, Office of Health Informatics
 Data: ESSENCE syndromic surveillance system, pulled April 2021
 Suspected opioid overdoses incident definition was designed and validated by the CDC

Figure 6 shows the trend in suspected opioid overdose incidents among ED visit data. The data shows there was an increase already occurring in suspected opioid overdose incidents during 2019, before COVID-19. The average number during the pre COVID-19 time period was 233 suspected opioid overdose incidents per month, or a rate of 4.0 per 100,000 people. This increased to a rate of 5.8 per 100,000 people, or an average of 339 incidents per month during the start time period. During the surge time period, there were around 274 suspected opioid overdose incidents (rate of 4.7 per 100,000 people).

Finally, during the decline time period, there were around 275 incidents per month (rate of 4.7 per 100,000 people).

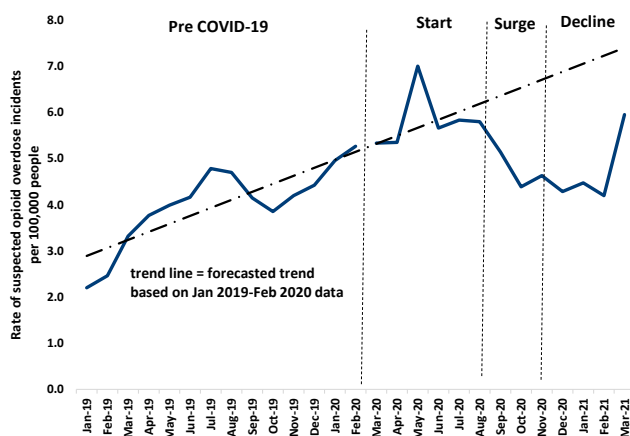
The percent changes between time periods was about a 45% increase from pre COVID-19 to the start time periods, about a 19% decrease from start to surge time periods, and then no change during the surge to decline time periods. Like the ambulance data, there was a large increase at the start of the pandemic, followed by a decrease for a number of months and then another increase starting to appear. It is believed that the stress of the pandemic and the isolation practices played a role in the increasing number of suspected opioid overdose incidents at the beginning of the pandemic. However, it is unclear what is causing the increase in recent months. It could be that during the surge in COVID-19, people became more cautious and this cautiousness is wearing off, so incidents are increasing; pandemic-fatigue could be coming into play; or it could be some other factor. There are many factors influencing suspected opioid overdose incidents related to COVID-19 and its impact on mental health.

Like the ambulance data, another component to examine with the trend of suspected opioid overdose incidents is statistical significance. Like the ambulance data, the change from the pre COVID-19 time period to start time period is statistically significant. The 95% confidence interval for the pre COVID-19 time period was 3.5-4.5, while the start time period was 5.2-6.5. These confidence intervals do not overlap, meaning that the increase seen was statistically significant. The surge time period had a confidence interval of 4.2-5.3. Since this overlaps with the start time period, even just a little, it means that the decrease seen between start and surge was not statistically significant. Finally, the confidence interval for the decline time period was 4.2-5.3, which makes sense because the counts and rates were the same for the two time periods.

Figure 7 looks at forecasting. As a reminder, the forecasted trend was based on the observed suspected opioid overdose incidents during the pre COVID-19 time period. This trend was then applied to the next 13 months and the observed cases during those months were plotted in Figure 7.

The surge during the start time period was above expected, however, the rest of the observed suspected opioid overdose incidents were below expected. Unlike the ambulance data, the recent increase does not fall above the trend line.

Figure 7: Rate of suspected opioid overdose incidents compared to forecasted trend, Wisconsin



Source: Wisconsin Department of Health Services, Office of Health Informatics
 Data: ESSENCE syndromic surveillance system, pulled April 2021
 Suspected opioid overdoses incident definition was designed and validated by the CDC

This suggests that for the ED visit data, the only influence of COVID-19 was early on in the pandemic. It is not known why this is different than the ambulance data. The differences could be related to the nature of overdose incidents, the underlying population differences of these two data systems, or factors related to COVID-19. It will be important to monitor the ED visits in the upcoming months to see if the opioid overdose incidents continue to rise and if they cross the forecasted trend line.

Finally, to look for geographic patterns, the DHS Opioid Data Team examined the rates of suspected opioid overdose incidents in ED visits by county compared to their total COVID-19 case rate. Table 3 shows the top 18 counties' COVID-19 rates and their corresponding rates of suspected opioid overdose incidents.

Table 3: Counties in the highest quartile for COVID-19 case rates by time period and their corresponding rates of suspected opioid overdose incidents, Wisconsin

County	COVID-19 cases during epidemic so far		Suspected opioid overdose incidents in syndromic data							
	N	Rate per 100,000	Pre COVID-19 time period		Start COVID-19 time period		Surge COVID-19 time period		Decline COVID-19 time period	
			Avg Rate per 100,000	Confidence Interval	Avg Rate per 100,000	Confidence Interval	Avg Rate per 100,000	Confidence Interval	Avg Rate per 100,000	Confidence Interval
Menominee	789	18,125.4	8.2	(-18.7 - 35.1)	11.5	(-20.4 - 43.3)	0.0	0.0	17.2	(-21.8 - 56.2)
Dodge	11,558	12,954.5	2.8	(-0.7 - 6.3)	5.8	(0.8 - 10.8)	2.6	(-0.7 - 6.0)	5.0	(0.4 - 9.7)
Jackson	2,579	12,440.3	6.5	(-4.5 - 17.6)	7.2	(-4.3 - 18.8)	11.3	(-3.2 - 25.7)	6.0	(-4.5 - 16.6)
Barron	5,524	12,029.6	2.0	(-2.1 - 6.1)	2.2	(-2.1 - 6.4)	1.5	(-2.0 - 4.9)	1.6	(-2.1 - 5.3)
Brown	30,695	11,750.1	2.7	(0.7 - 4.6)	5.4	(2.6 - 8.2)	5.2	(2.5 - 8.0)	7.5	(4.2 - 10.8)
Trempealeau	3,460	11,666.3	0.5	(-2.0 - 3.0)	0.6	(-2.1 - 3.3)	0.0	0.0	2.5	(-3.2 - 8.3)
Fond du Lac	12,071	11,642.8	8.7	(3.0 - 14.4)	1.6	(-0.8 - 4.0)	5.1	(0.8 - 9.5)	2.7	(-0.5 - 5.8)
Sheboygan	13,261	11,482.1	3.3	(0.0 - 6.6)	6.8	(2.0 - 11.5)	2.6	(-0.3 - 5.5)	4.1	(0.4 - 7.8)
Oconto	4,314	11,298.5	0.7	(-2.0 - 3.5)	0.9	(-2.1 - 3.8)	3.5	(-2.4 - 9.4)	3.9	(-2.4 - 10.2)
Juneau	3,038	11,278.2	3.4	(-3.6 - 10.5)	5.6	(-3.3 - 14.5)	4.9	(-3.5 - 13.4)	3.7	(-3.6 - 11.0)
Kewaunee	2,304	11,147.7	0.3	(-2.2 - 2.9)	0.8	(-3.1 - 4.7)	0.0	0.0	0.0	0.0
Chippewa	7,183	11,142.7	1.8	(-1.5 - 5.0)	2.1	(-1.4 - 5.6)	1.0	(-1.4 - 3.5)	1.6	(-1.5 - 4.6)
Shawano	4,607	11,138.5	0.9	(-2.0 - 3.7)	1.6	(-2.3 - 5.5)	3.2	(-2.2 - 8.7)	3.6	(-2.2 - 9.4)
Pepin	817	11,129.3	2.9	(-9.4 - 15.3)	0.0	0.0	0.0	0.0	3.4	(-9.9 - 16.8)
Eau Claire	11,247	10,887.6	1.9	(-0.7 - 4.6)	3.5	(-0.1 - 7.2)	2.6	(-0.5 - 5.7)	3.4	(-0.2 - 6.9)
Calumet	5,601	10,839.5	3.6	(-1.6 - 8.8)	6.1	(-1.6 - 12.9)	3.9	(-1.5 - 9.2)	6.3	(-0.5 - 13.1)
Outagamie	19,884	10,765.4	1.3	(-0.3 - 3.0)	2.1	(0.0 - 4.2)	2.3	(0.1 - 4.6)	2.8	(0.4 - 5.3)
Milwaukee	100,715	10,597.6	8.6	(6.7 - 10.4)	11.4	(9.2 - 13.5)	8.2	(6.4 - 10.0)	8.5	(6.6 - 10.4)

Source: Wisconsin Department of Health Services, Office of Health Informatics
 Data: COVID data pulled from website in May 2021 (<https://data.dhsgis.wi.gov/datasets/covid-19-historical-data-by-county/data?orderBy=GEOID>)
 ESSENCE syndromic surveillance system, pulled April 2021
 Start COVID-19 is from March 2020-August 2020; Surge COVID-19 is from September 2020-November 2020; Decline COVID-19 is from December 2020-March 2021

As with the ambulance data, there is no discernible geographic pattern among those counties with the greatest rate of COVID-19 cases. Suspected opioid overdose incidents in ED visits vary across counties and across time periods. No county has any statistically significant changes over the time periods. Most counties do show an increase in the start time period, but again, that change is not statistically significant for any county.

Conclusion

In this report, the DHS Opioid Data Team examined suspected opioid overdose incidents from two rapid data sources: ambulance runs and ED visits. These data sources are kept separately because they look at slightly different populations. This analysis shows that in both data systems, there was a statistically significant increase early on in the pandemic and that the observed number of incidents was greater than expected, suggesting that factors associated with the pandemic were influencing the number of opioid overdose incidents. However, this effect was temporary in both systems, with cases decreasing below expected after that point. It is important to note that in both data systems, these decreases were not statistically significant, which means that the DHS Opioid Data Team cannot rule out the influence of chance.

Another concerning trend was that the suspected opioid overdose incidents appear to be increasing again. Within the ambulance run data, the observed numbers were greater than expected, but for the ED visits data, the observed numbers were still below expected. This difference could be due to factors related to the data systems, factors related to how people interact with these different medical systems during a pandemic, or related to COVID-19 factors. Further monitoring is needed to see if the recent increase is a simple uptick or a growing trend, and among the ED visits, it will be interesting to see if the observed cases of opioid overdose incidents go above the expected number of cases.

Neither data system showed a pattern related to geography, suggesting that other factors are related to these associations. This highlights that Wisconsin is very different geographically and

that DHS needs to monitor what is happening on a statewide level and county level. It also suggests that intervention and prevention activities need to be planned with the county and its specific factors in mind.

Overall, Wisconsin experienced a dual public health crisis with the COVID-19 pandemic and the opioid crisis. This crisis was demonstrated in different data systems with different data variations. It is the recommendation of the DHS Opioid Data Team that DHS continue to monitor these crises and to work on county-level intervention and prevention activities, as neither of these crises appears to be ending.

Technical Notes

There are two rapid data systems used for examining non-fatal opioid overdoses, the ambulance run system (WARDS) and the syndromic surveillance system (ESSENCE). COVID cases were examined from case counts provided on the DHS website.

COVID-19 Cases

Case counts for COVID were obtained from the DHS webpage "COVID-19 Historical Data by County." This table provides new positive cases of COVID-19 and cumulative positivity at the county level by day. This data was then analyzed by month, adding up the frequency of new positive cases by day for each county. Rates were then calculated using the 2019 Census Population information.

WARDS (ambulance runs)

The WARDS system is run by DHS and requires that emergency medical providers report ambulance run information within seven days of an incident. In examining the data, the DHS Opioid Data Team found that allowing three weeks of lag time results in more complete data, as some of the smaller providers are not able to report within seven days. Currently DHS has about 90% coverage of all providers in Wisconsin, which DHS feels is representative of the state as a whole.

For this report the DHS Opioid Data Team looked at data from January 2019 through March 2021. This timeframe was further broken down into "pre COVID-19", "start", "surge", and "decline" time periods. Pre COVID-19 was defined as January 2019 through February 2020, start was defined as March 2020 through August 2020, surge was from September 2020 through November 2020, and decline was from December 2020 through March 2021. In March 2020, the COVID-19 pandemic was detected and the Wisconsin stay-at-home order was issued.

The population examined from the ambulance data included all 911-response ambulance runs. This means that medical transfers were excluded. Other people excluded were those less than 11 years old. This exclusion decision were made because the original use for the analysis of ambulance data was for opioid overdoses, and it was determined that the overdoses in children were probably the result of accidental ingestion. Availability of data influenced the population analyzed in this report.

The suspected opioid overdose case definition was derived by using key word searches in the impression, complaint, and narrative data fields. Keywords included overdose, poisoning, opioid, heroin, and Narcan®. There were also exclusionary terms and phrases, for example, "denies drug use" and "withdrawal." If an ambulance run contained these key terms and did not contain the exclusionary terms, that run was designated as a suspected opioid overdose. The term suspected was used because a clinician had not seen the patient at the time of the ambulance run and because keywords were used in the definition. Key word searches are useful but are

not as clear cut as coded data. This case definition was validated against hospital discharge data and was deemed accurate.

ESSENCE (syndromic surveillance system)

The ESSENCE system is run by the CDC and contains information from hospital ED visits. This data is different from the hospital discharge data in that it is more rapid in nature. ESSENCE accepts nightly data feeds from about 90% of Wisconsin ED departments. These nightly feeds include a mixture of patients who have been discharged and patients who are still undergoing care. Thus, not all cases in ESSENCE have been discharged and coded. As with WARDS, DHS feels that 90% coverage is a good representation of the state as a whole.

The population in ESSENCE included all ED visits in the system. These visits all came from Wisconsin facilities and included all patients seen in the ED at those facilities. As such, some of the patients described in this data do not reside in Wisconsin, but all of them went to a Wisconsin facility. There was no age restriction put on this data, so the visits described are all-inclusive.

The data system is called syndromic because it can be utilized to look at syndromes rather than just diagnoses. This is done by looking at narrative fields like triage notes for key terms. The suspected opioid overdose case definition was derived by using a mixture of medical codes (ICD-10 codes) and keyword searches. This definition was created by the CDC, in collaboration with around 30 states (including Wisconsin). It was validated by comparing the definition on a national level to ambulance and hospital discharge data. For those visits that have been discharged, medical codes for opioid overdoses were used to include them in the definition. For those visits that had not been discharged, keyword searches among the compliant and triage notes were used. As with the ambulance data, keywords included overdose, heroin, opioid, etc. Due to the mixed nature of records, and the fact that the data is so rapid, DHS designates opioid overdoses from this system as suspected as well.

The above systems are not perfect, but they are timelier than other traditional data systems. They have been leveraged to better inform prevention and intervention activities with data.