**Abstract**

To evaluate the frequency of fentanyl in fatal overdose cases and impaired DUID cases, as well as the range of fentanyl concentrations.

**Objective**

- To determine the demographics and incidence of fentanyl cases including polysubstance abuse.
- To present the drug paraphernalia submitted to drug chemistry relating to fentanyl cases.

**Introduction**

Since 2010, CCME has experienced a large increase in fentanyl-related deaths and fentanyl related DUID cases. CCME is located in Cleveland, Ohio, which is the most populous city in Cuyahoga County (population of ~1.2 million). The increase in fentanyl use has been on the rise in Cuyahoga County over the past 5 years.

**Methods**

- Cases were screened for fentanyl using an ELISA blood screen.
- Positive or elevated fentanyl screens were confirmed by GC/MS.
- Fentanyl was extracted using a Solid Phase method with UCT Clean Screen Solid Phase extraction columns ZSDA/20.
- Separate calibrators containing fentanyl, alfentanil, and sufentanil were monitored in a stock solution.
- Block Certifier® solutions to create a two-point calibration curve, with concentrations from 1 ng/mL–25 ng/mL along with a deuterated internal standard.
- The limit of detection is 0.1 ng/mL.
- The Lower Reporting Limit: 1.0 ng/mL.
- The Quality Control containing fentanyl was made from a 25 ng/mL Alltech stock solution.
- All calibrators, controls, negatives, and samples were prepared for solid phase extraction.
- After extraction and evaporation to dryness, samples were reconstituted with 50 µL of 50 ng/mL.
- Analytes were separated and detected on an Agilent 7890 Gas Chromatograph equipped with a 5975C Agilent GC/MS using a Restek® 5µm capillary column.
- The GC/MS operating parameters were as follows: the oven start temperature was 200°C, run splines: the initial oven temperature was 100°C with a ramp rate of 50°C/min to 200°C. Followed by a 20°C/min ramp which led to a final temperature 300°C, holding for 4 minutes. The total run time was 13.00 minutes, 1.5 µL of sample was injected on the GC/MS using a SIM method.
- Fentanyl was identified using retention time and SIM spectral match using ions nm 245, 189, and 146.

**Results**

- Deaths related to fentanyl increased from 4.8% to 24.8% and all poisoning deaths with concentrations ranging from 0 – 60.0 ng/mL.
- In 2016, CCME has seen fentanyl analogues, including carfentanil, alfentanil, furanylfentanyl, and 3-methylfentanyl.
- Positive DUID fentanyl cases are at levels that are historically considered fatal.
- Since 2010, the Drug Chemistry Lab has seen a 34% increase in submissions containing fentanyl and fentanyl analogues.

**Conclusions**

- Fentanyl use has been on the rise in Cuyahoga County over the last 5 years.
- Our study found that the fentanyl decedents tended to be male relative to the ages of 19-40 years.
- Decedents’ location of incident was evenly distributed between the City of Cleveland and its suburbs.
- DUID cases have increased 100% since 2010 with case concentrations as high as 252 ng/mL of fentanyl. This is much higher than what is considered fatal.
- Therapeutic concentrations are 1-3 ng/mL and toxic concentrations are 3-28 ng/mL.
- DUID fentanyl cases were predominantly recovered from the suburbs (57%) over the City of Cleveland (23%).
- Since the first quarter of 2016, there has been an enormous increase in fentanyl fatalities and DUID cases. Several cases have included fentanyl analogues: acetyl fentanyl, 3-methyl fentanyl, and furanyl fentanyl.
- Drug chemistry has seen a significant spike in fentanyl submissions since 2010 from 2 submissions to 78 submissions in 2016.
- Since July 2015, carfentanil has become a serious concern, with several deaths due to the emergence of the drug, in Cuyahoga County and the State of Ohio.
- The largest fentanyl fatality was seen in Cuyahoga County after the first quarter of 2016. Fentanyl was confirmed in the femoral blood at a concentration of 180.0 ng/mL.
- Fentanyl use has escalated in Cuyahoga County and the State of Ohio over the last two years. The increase has lead to the highest number of overdoses recorded in Cuyahoga County during the month of August 2016.
- Possible causes of fentanyl include:
  - Low cost and high availability of clandestinely produced fentanyl and its precursors.
  - Fraudulent sales of fentanyl to buyers as prescription pills or heroin.
  - Increase in tolerance and addiction of opioid users.
  - The Mexican cartels switch to traffic heroin and fentanyl from marijuana for a greater profit margin.
- One case from 2016 contained only fentanyl analogues: acetyl fentanyl and furanyl fentanyl, not fentanyl itself.
- Referring to Figure 4, the Unknown Location of Incidence could not be determined due to circumstances of the cases.

**References**

1. U.S. Census Bureau, State and County QuickFacts.

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