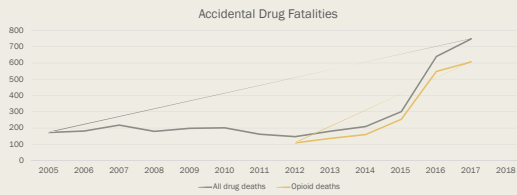


FATAL DRUG OVERDOSES INVOLVING CARFENTANIL: A SERIES OF 434 CASES AT THE PALM BEACH COUNTY MEDICAL EXAMINER OFFICE, 2016-2018

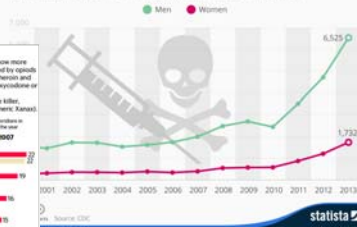
Michael D. Bell, M.D.
 Chief Medical Examiner
 Palm Beach County Medical Examiner Office, Florida
 George S. Behonick, Ph.D., F-ABFT
 Director, Chief Toxicologist
 AXIS Forensic Toxicology

Accidental Drug Fatalities in Palm Beach County, Florida, 2005-2017



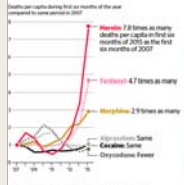
Heroin Deaths in The U.S. Are Skyrocketing

Number of drug-poisoning deaths involving heroin in the U.S. (2000-2013)



Heroin deaths surge in Florida

Deaths caused by heroin and fentanyl (a potent, synthetic alternative) have skyrocketed in Florida. During the first six months of 2015 - the latest data available - there were roughly six times as many deaths per capita as there were during same period in 2007.



Florida's are now more likely to be killed by opioids like morphine, heroin and fentanyl than cardiovascular or the state's lead pharmaceutical killer, aspirin (generic, Kanax).

Deaths per million Floridians in the first 6 months of the year

Drug	2015	2007
Heroin	19	3
Fentanyl	16	3
Morphine	10	2
Alprazolam	10	10
Cocaine	10	10
Diphenhydramine	10	10

This isn't your grandfather's heroin...

- Soluble "cutting agents"
- Snorting is common
- Drug combinations
 - Heroin
 - Fentanyl
 - Fentanyl analogs
 - Cocaine
 - Alprazolam



4

Could it get any worse? Yes, it did.

Ohio coroner links elephant tranquilizer to series of overdose deaths

Tuesday, September 05, 2016 11:30 p.m. EDT

By Steve Bittenbender

(Reuters) - At least eight people in the Cincinnati area who died of heroin drug overdoses since mid-July had traces of a drug used to tranquilize elephants in their bodies, a coroner said Tuesday.

At least five other overdose deaths since mid-July are suspected to be connected to heroin laced with carfentanil, Hamilton County Coroner Lakshmi Sammarco told a news conference.

Carfentanil

- Mu (μ) opioid receptor agonist
- Used to immobilize large wildlife
- Used by Russian Special Forces during the Moscow Theater Hostage siege
- Converted to norcarfentanil in liver and excreted in urine
- Blood concentration measured in pg/ml making detection a challenge
- Will not be detected with standard toxicology procedures
- Intoxication treated with naloxone

Shanku KG, Behonick GS. Detection of carfentanil by LC-MS/MS and reports of associated fatalities in the USA. J Analytical Tox. 2017;41:466-472.
Suzuki J, El-Haddad S. A review: Fentanyl and non-pharmaceutical fentanyl. Drug and Alcohol Dep. 2017;171:107-116

Relative strength of opioid drugs

Table 1: Fentanyl Analog Potencies Relative to Morphine

Fentanyl Analogs	Compared to Morphine
Fentanyl	80 to 100x
Acetylfentanyl	15x
Valerylfentanyl	< 20x
Furanylfentanyl	20x
Butyrylfentanyl	20 to 25x
Acrylfentanyl	100x
3-Methylfentanyl	400x trans and 6000x cis isomers
Carfentanil	10 000 to 100 000x



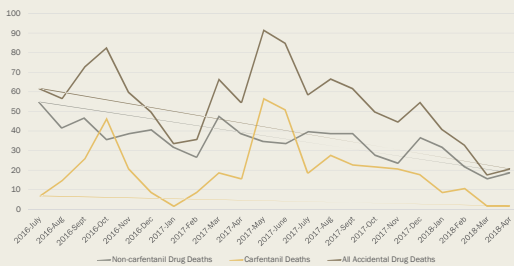
Schueler, H. Emerging synthetic fentanyl analogs. Acad Forensic Path 2017. 7:36-40

Carfentanil: Challenge in the Lab

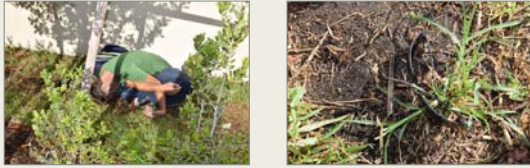


Carfentanil is extremely hard to detect in blood. It is measured in pg/ml. Other opioids are commonly measured in mg/L (heroin) or ng/ml (fentanyl)

Carfentanil Deaths in Palm Beach County



51-year-old man outside business parking lot



45-year-old heroin and cocaine user found at home



30-year-old woman with history of heroin use



23 year old man found in his car at gas station

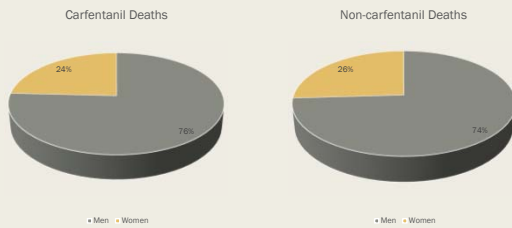


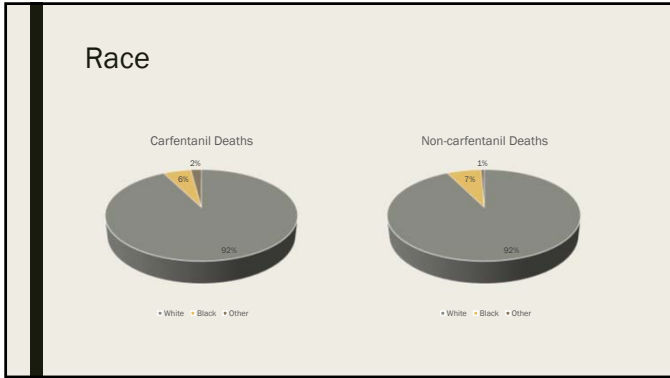
Body cavity fluid negative for drugs (including carfentanil), ethanol = 0.066 g/dL

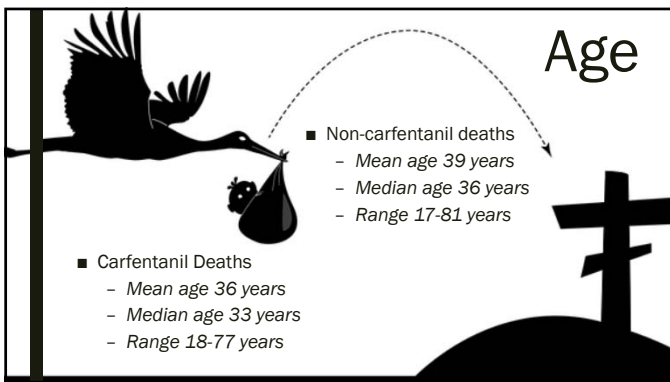
Methods

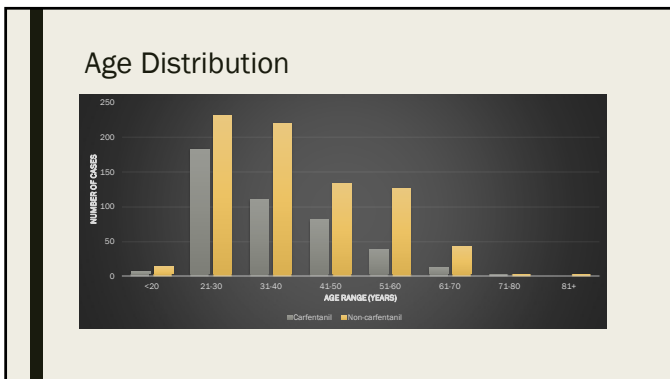
- Retrospective review of all accidental drug fatalities where carfentanil was detected
- July 2016 - April 2018
- Majority of cases had complete autopsies
- Screening, detection and quantitation by LC/MS/MS
- Scene investigation and drug residue testing done in selected cases
- All cases reviewed during weekly peer review meetings

Gender

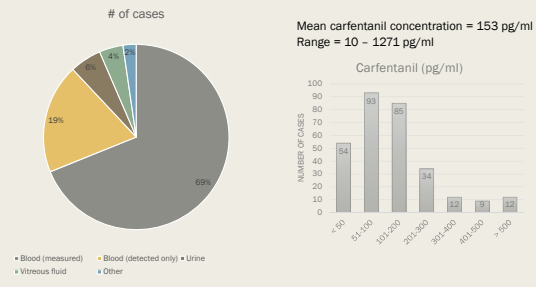




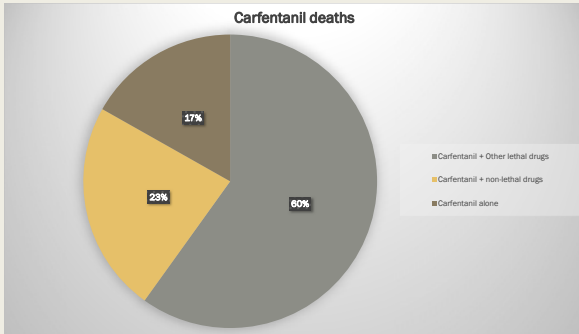




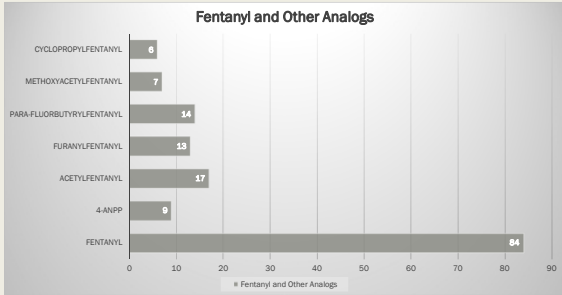
Carfentanil: Detection and Measurement

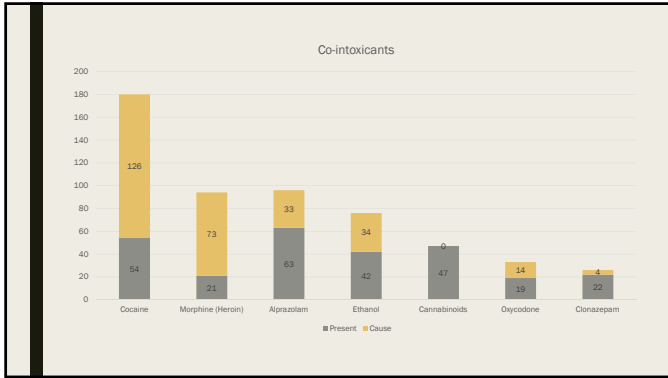


Carfentanil deaths

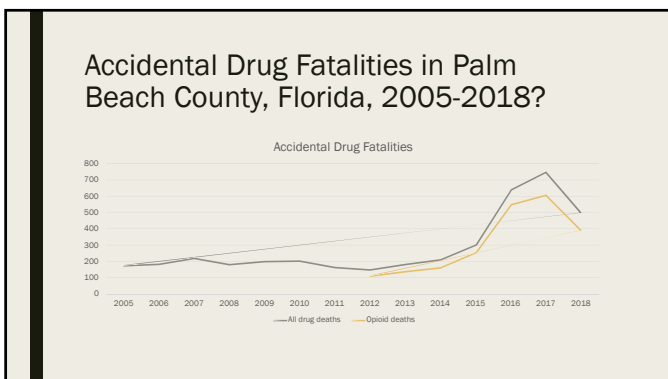


Fentanyl and Other Analogs





- ### Autopsy Findings: Carfentanil deaths
- Fresh needle punctures (37%)
 - Needle "tracks" (19%)
 - Foam in airway (28%)
 - Pulmonary edema (89%)
 - Right lung: mean weight 736 gms
 - Left lung: mean weight 664 gms
 - Dilated bladder (19%)



Summary

- Carfentanil is a synthetic opioid, at least 10,000x more powerful than morphine/heroin
- Introduced into the "heroin" supply in Palm Beach County resulting in hundreds of deaths between 2016 and 2018
- Deadly in small concentrations (pg/ml) and difficult to detect in postmortem blood
- Similar epidemiology to other opioid fatalities
- Potentially lethal co-intoxicants common while "pure" carfentanil overdose fatalities seen in minority of cases
