Opioids and Heroin and Their Role in DUI

August 2016
Stephanie Weber
Senior Chemist – Forensic Toxicology
Wisconsin State Laboratory of Hygiene
Madison, WI
Overview of WSLH Forensic Toxicology Section

- 30+ years of forensic testing in Wisconsin
- American Board of Forensic Toxicology (ABFT)-accredited laboratory
- Historically, >20,000 per year (OWI and postmortem)
- Approx. 25-30% cases require drug testing
About me!

- Born in Green Bay, WI
- Attended UW-Madison (Chemistry)
- 4 years at WI State Lab of Hygiene
- Audited WI DRE school spring 2016
About me!
Heroin

- Common drug of abuse
- Three main alkaloids in opium
  - Codeine
  - Morphine
  - Thebaine
- Formulated from the opium in poppies
  - Paste is collected and morphine is extracted
  - Morphine then is chemically changed to Heroin
Tox report: Where's the Heroin?

- Heroin half-life ~6 minutes
- 6-Monoacetylmorphine (6-MAM) – proof of heroin use
- Morphine + Codeine
  - Morphine : Codeine > 1.0 indicates heroin use
  - Codeine – impurity resulting from manufacturing process
Heroin Dilution vs. Adulteration

- **Dilution**
  - Adds bulk to heroin
  - Increase profits
  - Lactose, sugar, milk, etc.

- **Adulteration**
  - Affects the properties of heroin
Heroin Adulterants

- Diphenhydramine & theophylline (CNS Depressants)
  - Bronchodilators
  - Increase airflow to lungs by decreasing resistance in airway

- Caffeine (CNS Stimulant)
  - Causes heroin to vaporize at lower temperatures
  - More efficient smoking
Heroin Adulterants

- Quinine
  - Common adulterant for IV users
  - Mimics initial rush of shooting up

- Scopolamine
  - Low doses – sedation
  - High doses – euphoria
Heroin Paraphernalia

- OWI case – driver with paraphernalia
  - Razor blades – cut pills in half
  - Tin foil – used to move furniture
  - White powder in flashlight cap – debris from cutting Rx pills in half
  - Scale – weighing darts
Heroin Seizures

- New York City, NY

Courtesy of U.S. Department of Justice
Microgram Bulletin LE
Heroin Seizures

- Laredo, TX

Courtesy of U.S. Department of Justice Microgram Bulletin LE
Heroin Case

- Driver called in by citizens
  - Swerving all over highway
  - Nearly striking median
- Initially stopped half in traffic when pulled over
- Arresting officer observed:
  - Slow speech
  - Constricted pupils
- Prescribed Suboxone and Clonazepam
Heroin Case DRE Evaluation

- Psychophysical Indicators
  - Romberg
  - Walk and Turn
  - One Leg Stand (Left & Right)
  - Finger to Nose
Heroin Case DRE Evaluation

- Clinical Indicators
  - Pulse
  - Blood pressure
  - Body temperature
  - Pupils
  - Muscle tone
Heroin Case DRE Evaluation

• Signs of Ingestion
  • Subject was very shy about showing her arms
  • DRE got a quick glance and saw track marks
  • Red nasal passages

• Admitted to having paraphernalia on her
  • Went into bathroom with female officer
Heroin Case Tox Report

- Codeine = 22
- Morphine = 310
- 6-MAM = 53

- Highest 6-MAM confirmed in a Wisconsin State Lab of Hygiene case
Methadone

- Maintenance therapy
  - Supposed to satisfy cravings for opioids without the "high"
- Pain management
  - Very addictive – some doctors won’t prescribe
- >500 ng/mL can indicate abuse
Methadone Tolerance

• Over time, user may build up tolerance to the drug
  • Need more of the drug to feel effects

• When first starting prescription, doctors monitor dosage to find the appropriate dose
  • New prescription and/or dose – more potential for impairment
Methadone Impairment

- 2011 – Madison WI
- Driver struck pedestrian soon after leaving Methadone clinic
- Officer observed droopy eyelids, slow speech, and constricted pupils
Methadone and Other Drugs

• Rare to find methadone-only use
  • Out of 415 methadone cases in WI from 2012-2016, 12 were methadone-only

• Combination with CNS depressants
  • Alprazolam (Xanax) (104 cases)
  • Increases impairment potential
    • Coordination
    • Respiratory depression
    • Heart rate
Methadone Case Toxicology

- Methadone = 210 ng/mL
- Alprazolam = <10 ng/mL

- Based on toxicology results alone – methadone impairment trumps alprazolam
Methadone Case DRE Evaluation

• Stopped for operating after revocation and driving very close to curb
• Psychophysical Indicators
  • Walk and turn
  • Broke instructional stance
  • Missed heel to toe several times
• Romberg – 30 seconds in 40 seconds
• One Leg Stand – Left Foot
  • Put foot down once
  • Swayed side to side
Methadone Case DRE Evaluation

• Psychophysical Indicators cont.
  • One Leg Stand – Right Foot
    • Put foot down five times
    • Swayed front to back
  • Finger to nose
    • Pad of finger
    • Told to put hand down
Methadone Case DRE Evaluation

- Clinical Indicators
  - HGN, VGN: Present
    - Had a hard time keeping eyes open
  - Angle of onset: 30
  - Lack of convergence: Present
  - Pupil size
    - Room: 2.5 mm
    - Near total darkness: 6.5 mm
    - Direct: 2.5 mm
    - Reaction to light: “Slow”
Methadone Case DRE Evaluation

- Clinical Indicators cont.
  - Pulse – normal
  - Blood Pressure – normal
    - On the nod
  - Body temperature – normal
  - Muscle tone – flaccid
- Signs of Ingestion
  - Heat bumps on tongue
- Admitted to Methadone use 19 hrs prior at clinic
Methadone Case Tox Interpretation

• Methadone = 210 ng/mL
• Alprazolam = <10 ng/mL

• Amended interpretation
  • Methadone may have contributed
  • VGN – Alprazolam at high dose for individual
**Buprenorphine**

- Partial agonist
  - Less driving impairment on average than methadone
- 30 – 40x strength of morphine
- Suboxone
  - Buprenorphine + Naloxone
- Like other opioids – tolerance is possible
Buprenorphine

- Ceiling effect
  - Point at which increases in dose do not increase effect
  - Respiratory depression but not analgesia?
Buprenorphine Administration

- Sublingual
  - Mouth sores/reddening
- Injection
- Implant
  - Probuphine
  - Newly approved by FDA
  - Four one-inch rods in upper arm
  - Good for 6 months
Buprenorphine Case DRE Eval

- Subject rear-ended another vehicle

- Initial observations
  - 2.5 mm pupil estimation
  - Droopy eyelids
  - Appeared drowsy
  - Dry mouth and slow, raspy speech
  - Prescription for Zubsolv (generic Suboxone)
Buprenorphine Case DRE Eval

• Psychophysical Indicators
  • Romberg Balance
    • One-inch sway forward
    • Estimated 30 seconds in 38 seconds
  • Walk and Turn
    • Improper turn
    • Stopped at step nine before turning
Buprenorphine Case DRE Eval

- Psychophysical Indicators cont.
  - One Leg Stand – Left Foot
    - Swayed two inches to the right
    - Difficult time counting
  - Stated she "couldn't do the test even if she was sober"
Buprenorphine Case DRE Eval

- Psychophysical Indicators cont.
  - One Leg Stand – Right Foot
    - Put foot down one time
  - Finger to Nose
    - Used pad all six times
Buprenorphine Case DRE Eval

• Clinical Indicators
  • HGN – none
  • LOC – present
  • Pupils
    • Room: 3.0 mm
    • Near Total Darkness: 4.0 mm
    • Direct: 2.0 mm
    • Reaction to light: Little to none
Buprenorphine Case DRE Eval

• Clinical Indicators cont.
  • Pulse
    • 104, 108, and 106 bpm
  • Body temperature - normal
Buprenorphine Case Tox Report

- Amphetamine = 460 ng/mL
- **Buprenorphine = 0.73 ng/mL**

- One week since she switched from tablets to sublingual sheets
Fentanyl

- 100x potency of morphine, 50x potency of heroin
- Short acting
- Powder shipped in bulk from China
- Machinery also supplied from China

Pill press seized in British Columbia, Canada
Fentanyl Ingestion

- IV
- Oral (pills)
- Transdermal
  - Gel patches
- Tea
  - Steep gel patches in hot water
- Snorting – mix gel with powder
- Smoking – drop of gel in one-hitter

WISCONSIN STATE LABORATORY OF HYGIENE - TOXICOLOGY SECTION
Fentanyl-laced Heroin

- Fentanyl sold as heroin
  - Users may be unaware and take their typical dose
  - Might tell you they took heroin

- Fentanyl cut into heroin

- Overdose risk higher
  - More naloxone may be needed
**Fentanyl Analogues**

- Analogue: compound with major chemical structures similar to original compound with a minor change
  - i.e. Changing fluorine to chlorine or replacing a functional group
Fentanyl & Analogues

Fentanyl

Acetyl fentanyl

Butyryl fentanyl
Fentanyl Analogues

- Acetylfentanyl, Butyrylfentanyl, Remifentanil, Furanylfentanyl, Carfentanil
  - Potentially stronger than original fentanyl
  - Butyrylfentanyl - $\frac{1}{4}$ potency of fentanyl
  - Remifentanil – Ultiva, given in surgery, 2x potency of fentanyl
Acetylfentanyl

- No medical use
- Sold illicitly via the internet
  - Typically in tablets, powder, or blotters
- Base form - light yellow oil
- Powder form - Pale purple, off-white

- Not routinely tested for in most laboratories
Carfentanil

- Elephant sedative
  - Veterinarians wear face shield, gloves, and other protective gear
- One drop can be fatal
  - ~10,000x potency of morphine
  - ~100x potency of Fentanyl
- Seen in Ohio and Kentucky toxicology
- Sold online from China
Fentanyl Overdose

- Vaccine – Scripps Research Institute
  - Triggers immune response against synthetic opioids
  - Trains the body to produce antibodies that prevent drug from reaching the brain
  - Not effective against opioids such as oxycodone
Fentanyl or Oxycodone?

- Counterfeit oxycodone pills sold in Boston, MA
- 100% Fentanyl

Fake

Real

Courtesy of Boston Globe

Courtesy of Drugs.com
Fentanyl Case DRE Evaluation

- Driver passed out in vehicle at gas station
  - Unresponsive
  - Barely breathing
  - Constricted pupils
- Paramedics administered Naloxone and transported to hospital
  - Driver became responsive
  - Droopy eyelids
  - Slow, slurred speech
  - Leg tremors
Fentanyl Case DRE Evaluation

- Fentanyl patches recovered from vehicle
  - Four, 100 mg patches cut open and minimal gel remained

- Driver’s statements
  - Driving to get Fentanyl prescription
  - Smoked crack cocaine 4 – 5 hours ago
  - Confused about driving timeline
Fentanyl Case DRE Evaluation

• Psychophysical Indicators
  • Unable to perform
    • Continued treatment by hospital personnel
    • Paralyzed left leg
Fentanyl Case DRE Evaluation

- Clinical Indicators
  - HGN – none
  - Pupils
    - Room: 2.0 mm
    - No dark room or direct light checks
  - Pulse – 122 bpm
  - Blood pressure – 188/100
  - Body temp – normal
Fentanyl Case DRE Evaluation

• Signs of Ingestion
  • Red nasal cavity with fresh and dried blood
  • Heat bumps on tongue

• Further statements by driver regarding timeline conflicted initial statements

• DRE called Narcotic Analgesic and CNS Stimulant
Fentanyl Case Tox Report

- Cocaine = 22 ng/mL
- Benzoylecgonine = >1000 ng/mL
- Citalopram = 58 ng/mL
- Lidocaine = present
- Levamisole = present
- Fentanyl = 22 ng/mL
Oxycodone

- Oxycontin
  - 2010 reformulated to be crush-resistant
  - Increase in heroin use
  - Pill can be crushed, but when mixed with liquid it turns into a gel
Oxycontin Old v. New

Old

New
Oxycodone/Oxymorphone

- Oxycodone metabolizes to oxymorphone
- Oxymorphone – medication in its own right
  - Opana
  - 2x strength of Oxycodone
Oxycontin – Purdue Pharma

• Many lawsuits
  • Typically related to misleading users about risk for addiction
  • Sales reps told to claim medication wasn’t addictive
Oxycontin – Purdue Pharma

- Lake Medical – Los Angeles, CA
  - Run by convicted felon and his business partner
  - Hired a physician to prescribe mass quantities of Oxycontin
  - September 2009 – prescribed 68,670, 80 mg pills

Courtesy of Los Angeles Times
Oxycontin – Purdue Pharma

- Lake Medical – Los Angeles, CA
  - Purdue Pharma aware but did not contact DEA
  - Stopped sending sales reps
  - Hired homeless people to collect prescriptions
  - Sold Oxycontin 80 mg pills in bulk to drug dealers
  - Closed in 2010 by a team of local, state, and federal investigators
Hydrocodone

- Vicodin, Norco
- Prescribed for mild to moderate pain
- Metabolizes to hydromorphone
- Extended release available
  - Zohydro (Zogenix, Inc.)
Loperamide

- Anti-diarrheal – Imodium
- Large amounts – affects opioid receptors in brain
  - Euphoria
  - Respiratory depression
  - Reduces symptoms of opioid withdrawal
- Dosage
  - Normal – 8 mg/day
  - Abuse – 300+ mg/day
Loperamide

- Ft. Smith, Arkansas
  - Grinding down loperamide and re-forming as mimic oxycodone tablets

Courtesy of U.S. Department of Justice Microgram Bulletin LE
Loperamide

• Can cause heart problems
  • Irregular heartbeat
  • Heart attack

• Testing
  • Not routinely tested for by most labs
  • NMS discontinued testing May 2016, online again soon
Kratom

- Mitragynine
- Tree native to Southeast Asia
- Used as an herbal drug
  - Low doses – stimulant
  - High doses – sedative
- Commonly used to self-treat opioid addiction
Kratom

- Administration
  - Chewing leaves
  - Tea
  - Powder

- Side effects
  - Numb tongue
  - Nausea
  - Abdominal pain - “...I was forced to spend the rest of the day lying in severe pain” – Erowid user
Kratom
## Kratom

<table>
<thead>
<tr>
<th>Dosage (Kratom leaves, not extracts)</th>
<th>Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-6 grams</td>
<td>Mild - stimulant</td>
</tr>
<tr>
<td>7-15 grams</td>
<td>Stimulant, crossing over to sedative/euphoric/analgesic</td>
</tr>
<tr>
<td>16-25 grams</td>
<td>Sedation and euphoria (“too strong for highly sensitive people”)</td>
</tr>
<tr>
<td>26-50 grams</td>
<td>Strong sedation and euphoria (“TOO STRONG FOR MOST PEOPLE”)</td>
</tr>
</tbody>
</table>
Kratom Case

- Heroin and Kratom found in vehicle

- Initial observations:
  - Low, raspy speech
  - Constricted pupils

- Finger to Nose – “Lil bit of a challenge!”
- Romberg – 30 seconds in 50 seconds
Kratom DRE Eval Highlights

- Pupils
  - Room – 2.5 mm
  - Near Total Darkness – 3.0 mm
  - Direct Light – 2.0 mm
  - Little to no reaction to light
- Low and normal pulses (68, 87, 82)
- Low blood pressure (119/62)
- Body temperature – 97.2
Under the care of a psychiatrist in IL
- Prescribed Clonazepam and Gabapentin
- Suggesting using Kratom as maintenance therapy for heroin addiction

Smoked 1/10th of a gram of heroin

Took 6 grams of Kratom before work and 3 grams in the afternoon
Kratom Case

CAUTION: THIS PRODUCT IS NOT INTENDED TO DIAGNOSE, TREAT, CURE OR PREVENT ANY DISEASE OR AILMENT. DO NOT USE IF YOU ARE PREGNANT, LACTATING OR UNDER THE AGE OF 18. DO NOT TAKE WHEN OPERATING MACHINERY OR DRIVING. KEEP OUT OF REACH OF CHILDREN.
Kratom Case

- Codeine = 14 ng/mL
- Morphine = 160 ng/mL
- Mitragynine = present

- DRE included personal research into Mitragynine
U-47700

- Synthetic opioid developed in 70's

- Same effects as other opiates
  - Analgesia
  - Respiratory depression
  - Facial itching
  - Euphoria
  - Miosis

- Effects last ~60-90 minutes
U-47700

- Found in counterfeit “Norco” pills
  - Fentanyl and U-47700
  - Real Norco – hydrocodone
  - Seven patients treated in San Francisco Bay Area (mid-April 2016)

Counterfeit Norco - Courtesy of U.S. DEA

Real Norco – drugs.com
U-47700 Case Report

- Woman ingested 3 “Norco” tabs
  - Had “Watson” imprint
  - Were beige instead of white
  - Taken to hospital after overdosing
  - Toxicology reported Hydrocodone, Fentanyl, and U-47700
AH-7921

- No approved medical use
- 80% strength of morphine when taken orally
- “Doxylam”
  - Can lead to misbranding as Doxylamine (Unisom, CNS Depressant)
- Ingestion similar to heroin
- Physical dependence similar to other opioids
AH-7921

- Available online
- Active ingredient in some synthetic cannabinoids in Japan
- Federal Schedule I
W18

- Not a synthetic opioid as originally reported
  - Tested on animals – no detectable opioid receptor activity
  - Chemically similar to Fentanyl
- Sold as counterfeit Oxycontin in Canada
- Showing up in New York
Talk to your lab!

- Impairment is not based on toxicology results alone
- DRE face sheet – RCS cancellation
- Scope of testing
  - i.e. Fentanyl
Acknowledgements

- Wisconsin State Laboratory of Hygiene Toxicology Section
  - Amy Miles
  - Lori Edwards
  - Laura Sweeney
  - Kimberle Glowacki
  - Lorraine Edwards

- Wisconsin DREs!
Questions?