University of Glasgow

Forensic Toxicology – Findings in DRDs

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INSPIRING PEOPLE

Forensic Toxicology at the University of Glasgow

- Dept of Forensic Medicine and Science, est. 1839
- Pathologists and Toxicologists
- Toxicology
  - Provides postmortem toxicology service to COPFS to investigate any sudden, suspicious, unexplained or unexpected death in most of Scotland
  - Covers ~85% of population
  - Around 3200 cases per year

What drugs do we find in deaths?

- Alcohol (39%)
- Morphine* (20%)

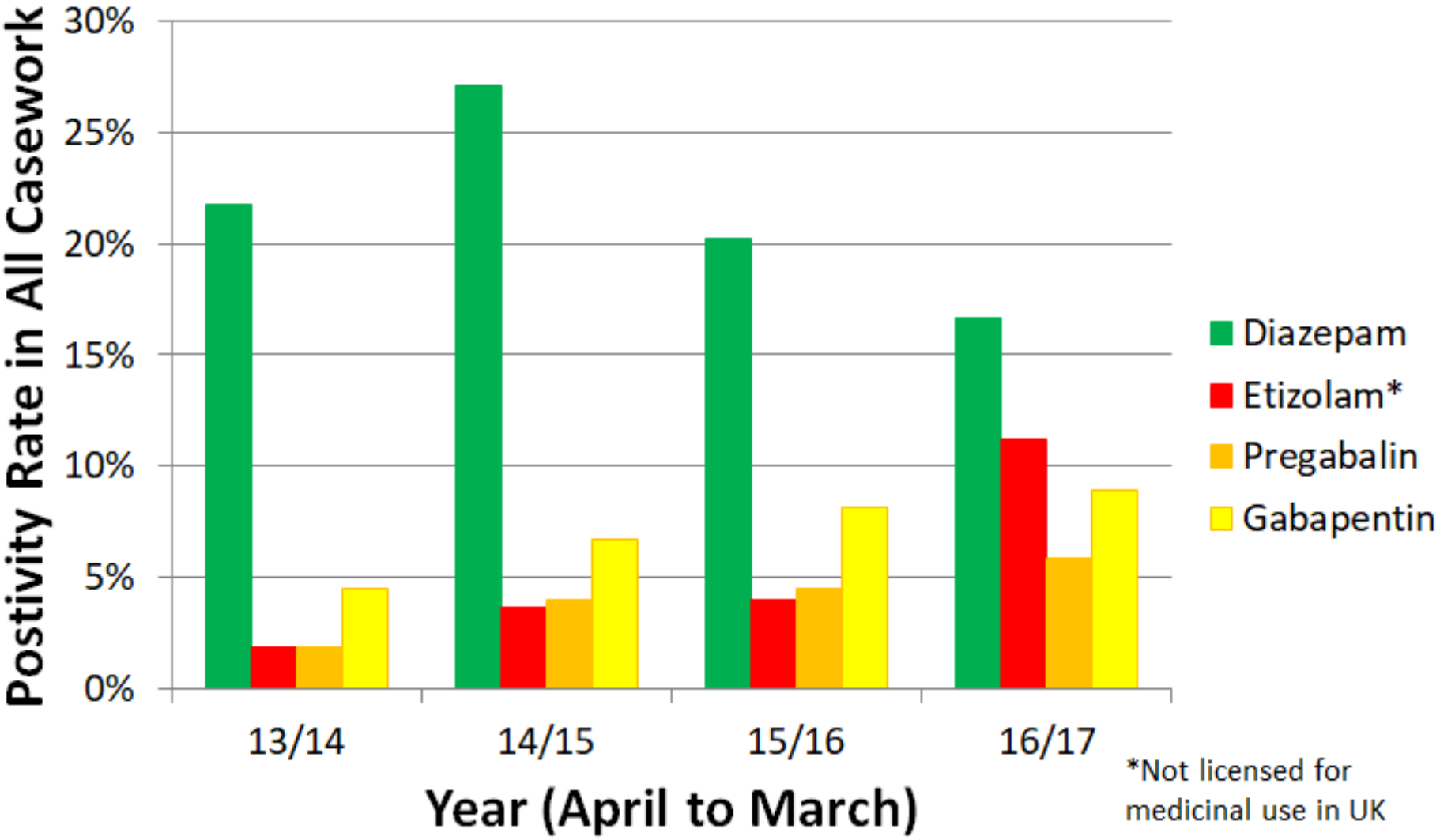
  * Mixture of prescribed morphine, heroin and metabolite of codeine

- Diazepam (17%)
- Methadone (14%)
- Codeine** (14%)

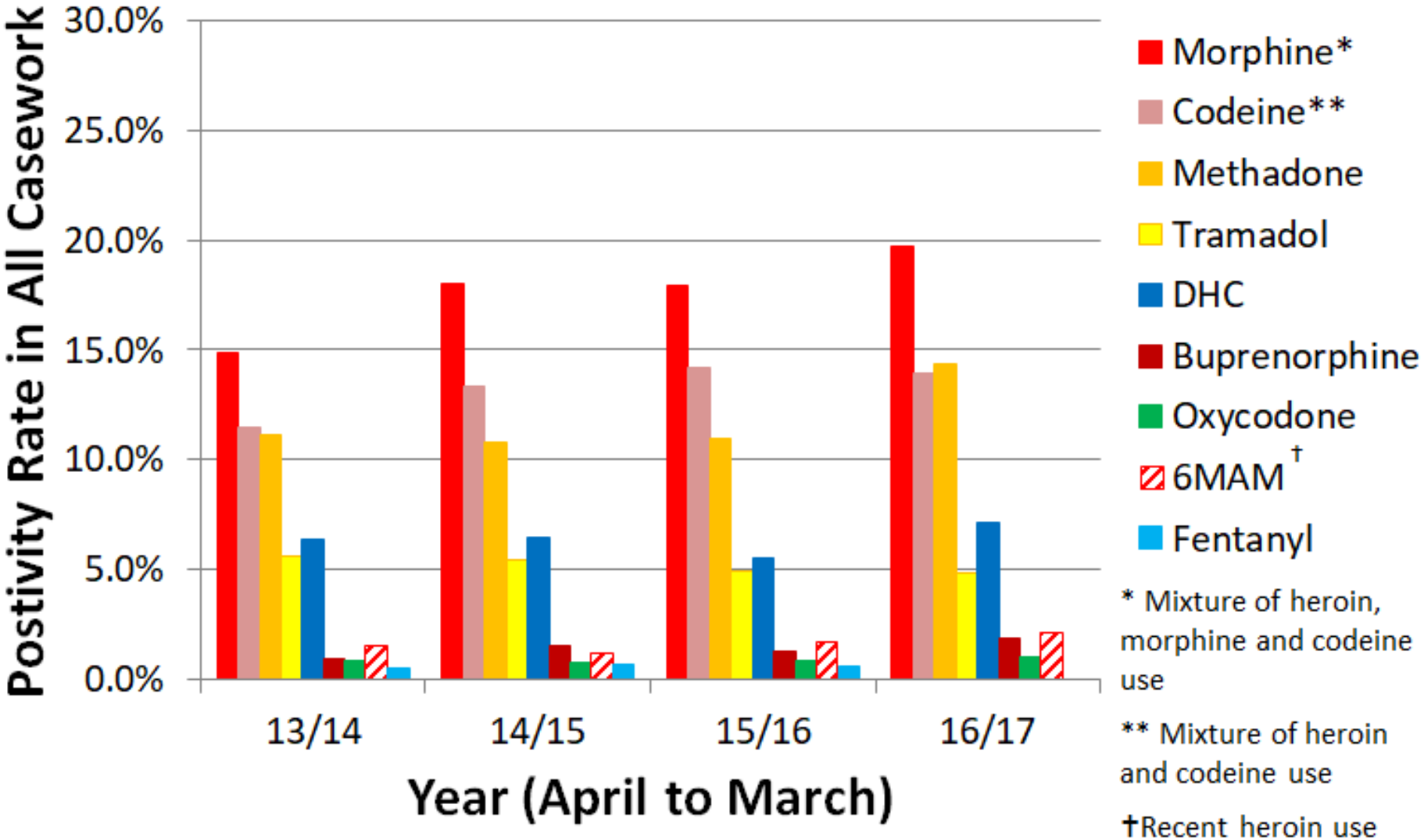
  ** Mixture of codeine and heroin use

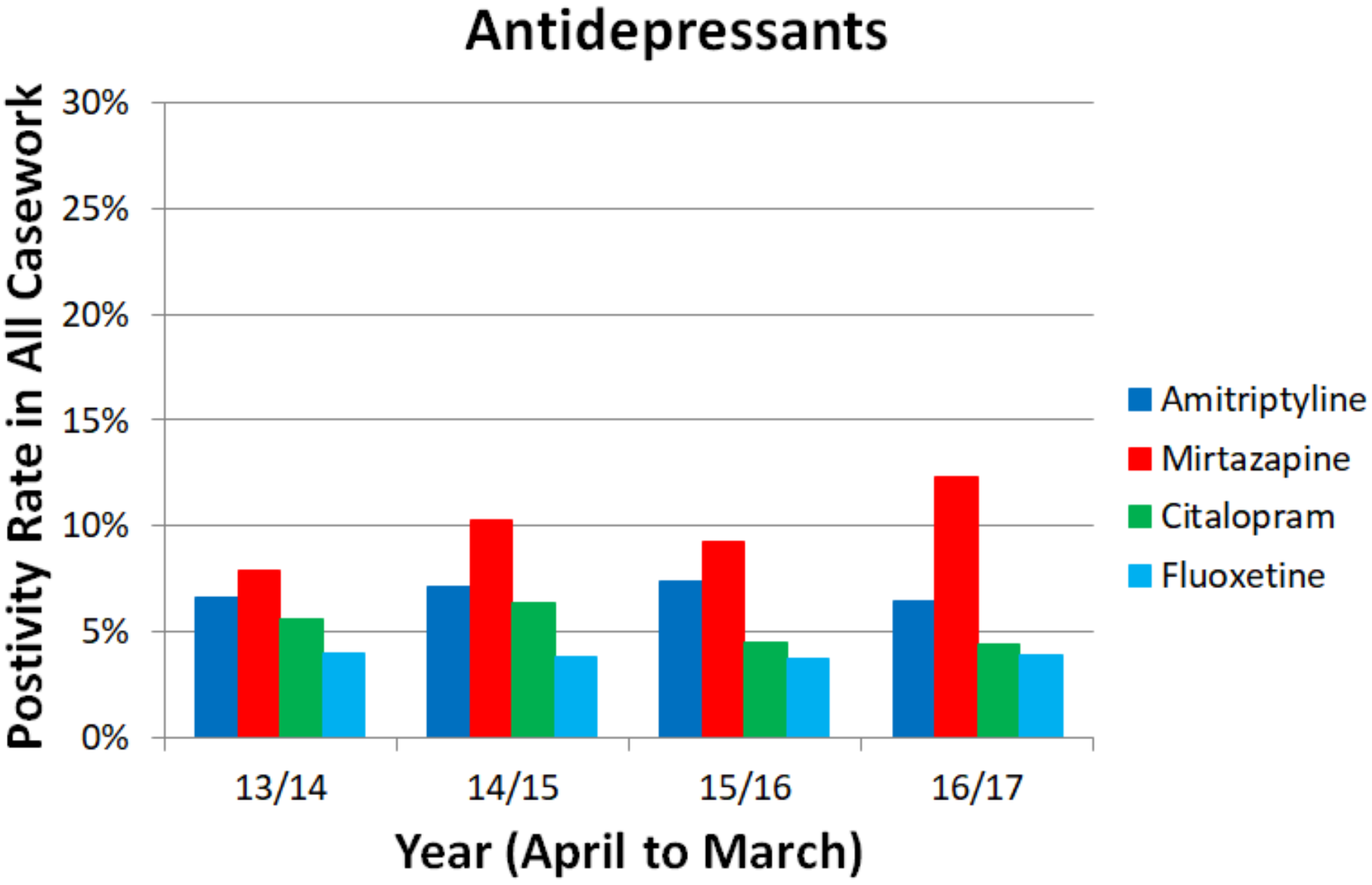
- Paracetamol (12%)
- Mirtazapine (12%)
- Etizolam (11%)
- Gabapentin (9%)

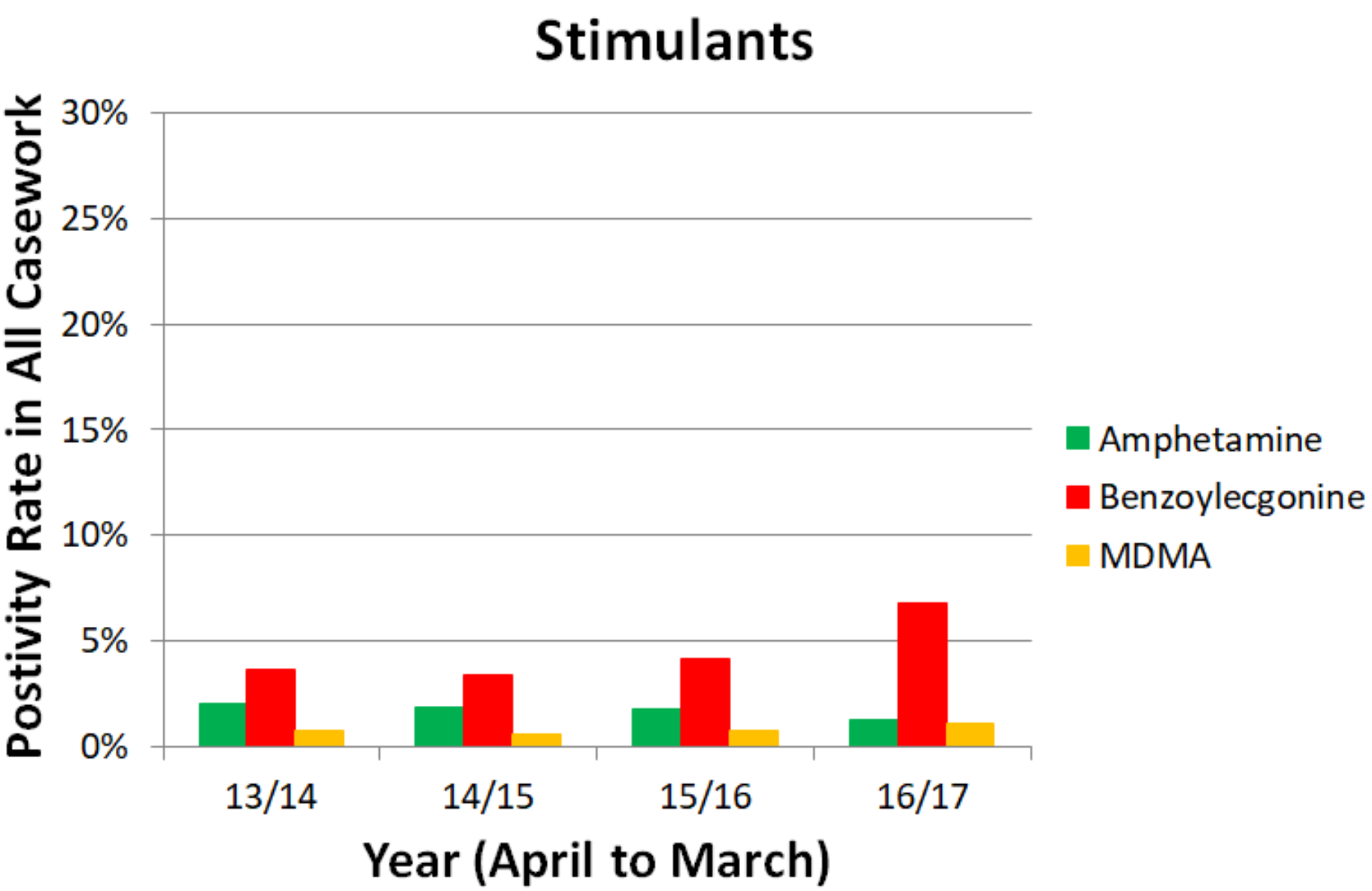
Benzos and Gabapentinoids



Opioids

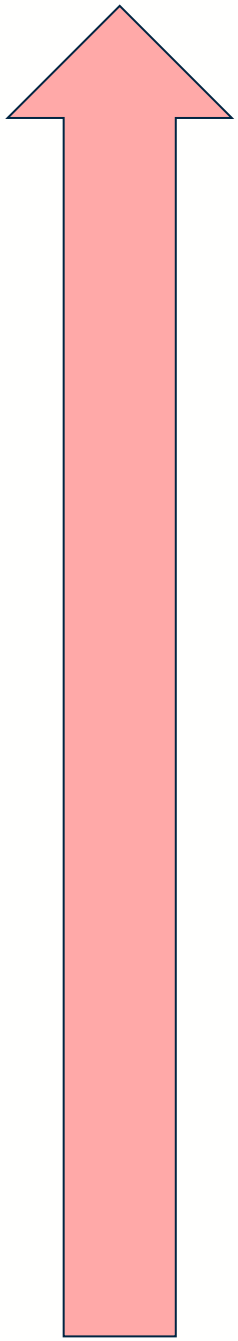

Postivity Rate in All Casework
30.0%
25.0%
20.0%
15.0%
10.0%
5.0%
0.0%
13/14
14/15
15/16
16/17
Year (April to March)
Morphine*
Codeine**
Methadone
Tramadol
DHC
Buprenorphine
Oxycodone
6MAM †
Fentanyl
* Mixture of heroin, morphine and codeine use
** Mixture of heroin and codeine use
†Recent heroin use


Antidepressants
Postivity Rate in All Casework
30%
25%
20%
15%
10%
5%
0%
13/14
14/15
15/16
16/17
Year (April to March)
Amitriptyline
Mirtazapine
Citalopram
Fluoxetine


Stimulants
Postivity Rate in All Casework
30%
25%
20%
15%
10%
5%
0%
13/14
14/15
15/16
16/17
Year (April to March)
Amphetamine
Benzoylecgonine
MDMA

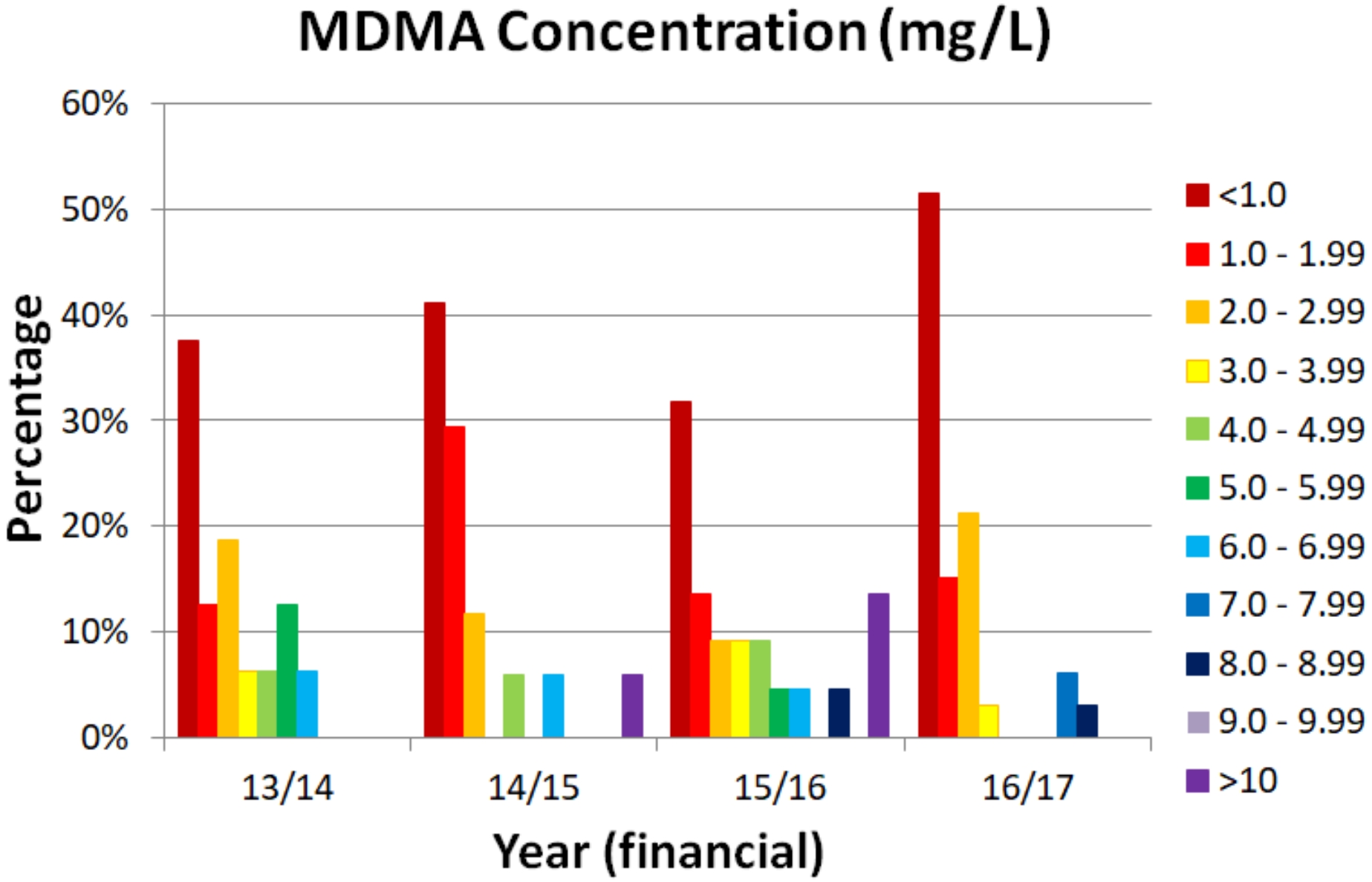
Increasing

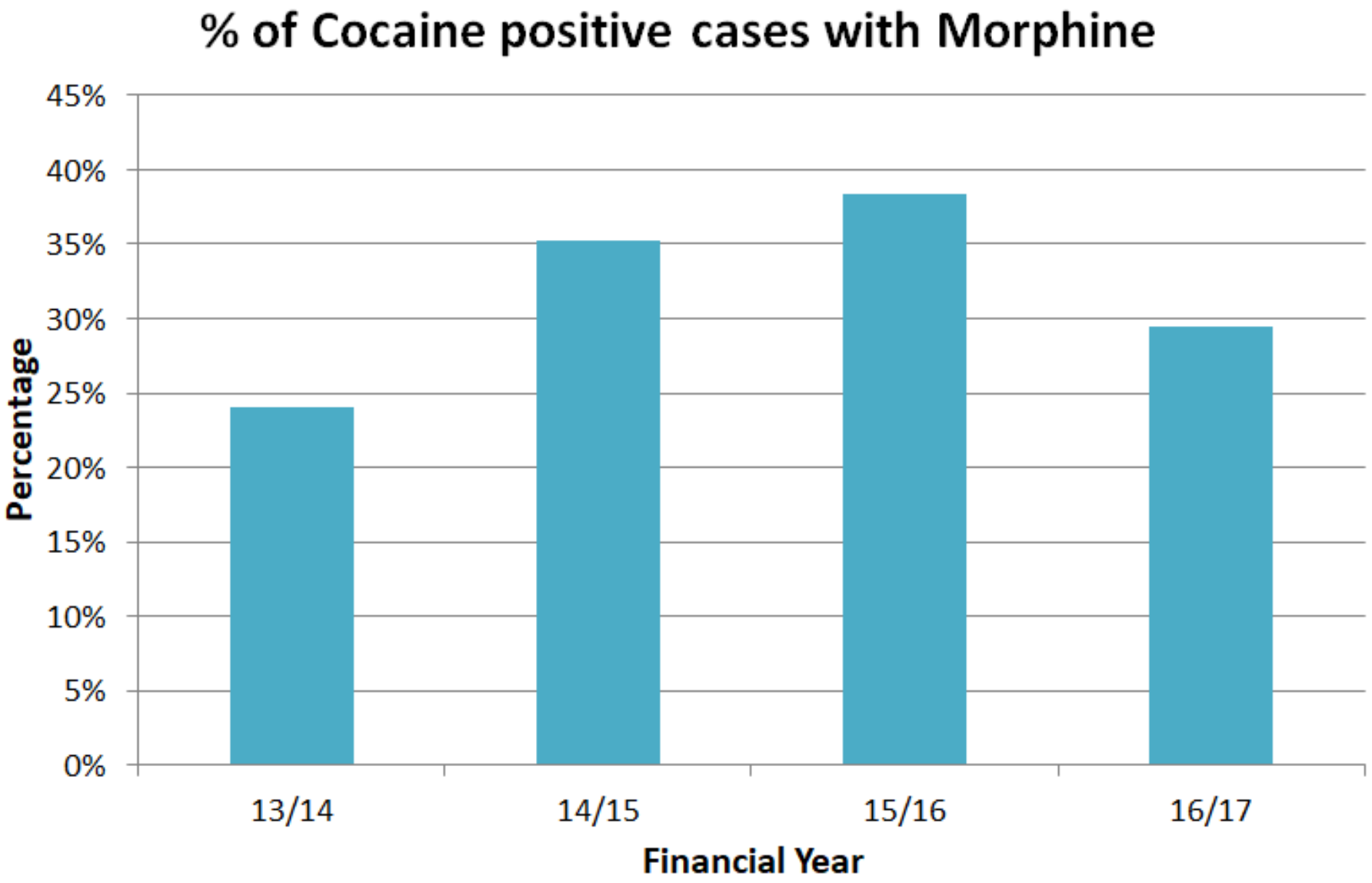
- Benzos and Gabapentinoids
  - Etizolam
  - Pregabalin
  - Gabapentin
- Opioids
  - Morphine
  - Codeine
  - Methadone
  - Buprenorphine
  - Oxycodone
- Antidepressants
  - Mirtazapine
- Stimulants
  - MDMA
  - Cocaine



Decreasing or Stable

- Diazepam
- Paracetamol
- Amitriptyline
- Tramadol
- Dihydrocodeine
- Citalopram
- Fluoxetine


MDMA Concentration (mg/L)
60%
50%
40%
30%
20%
10%
0%
Percentage
13/14
14/15
15/16
16/17
Year (financial)
<1.0
1.0 - 1.99
2.0 - 2.99
3.0 - 3.99
4.0 - 4.99
5.0 - 5.99
6.0 - 6.99
7.0 - 7.99
8.0 - 8.99
9.0 - 9.99
>10


% of Cocaine positive cases with Morphine
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
Percentage
13/14
14/15
15/16
16/17
Financial Year

Gabapentin

Interpretation of post-mortem concentrations

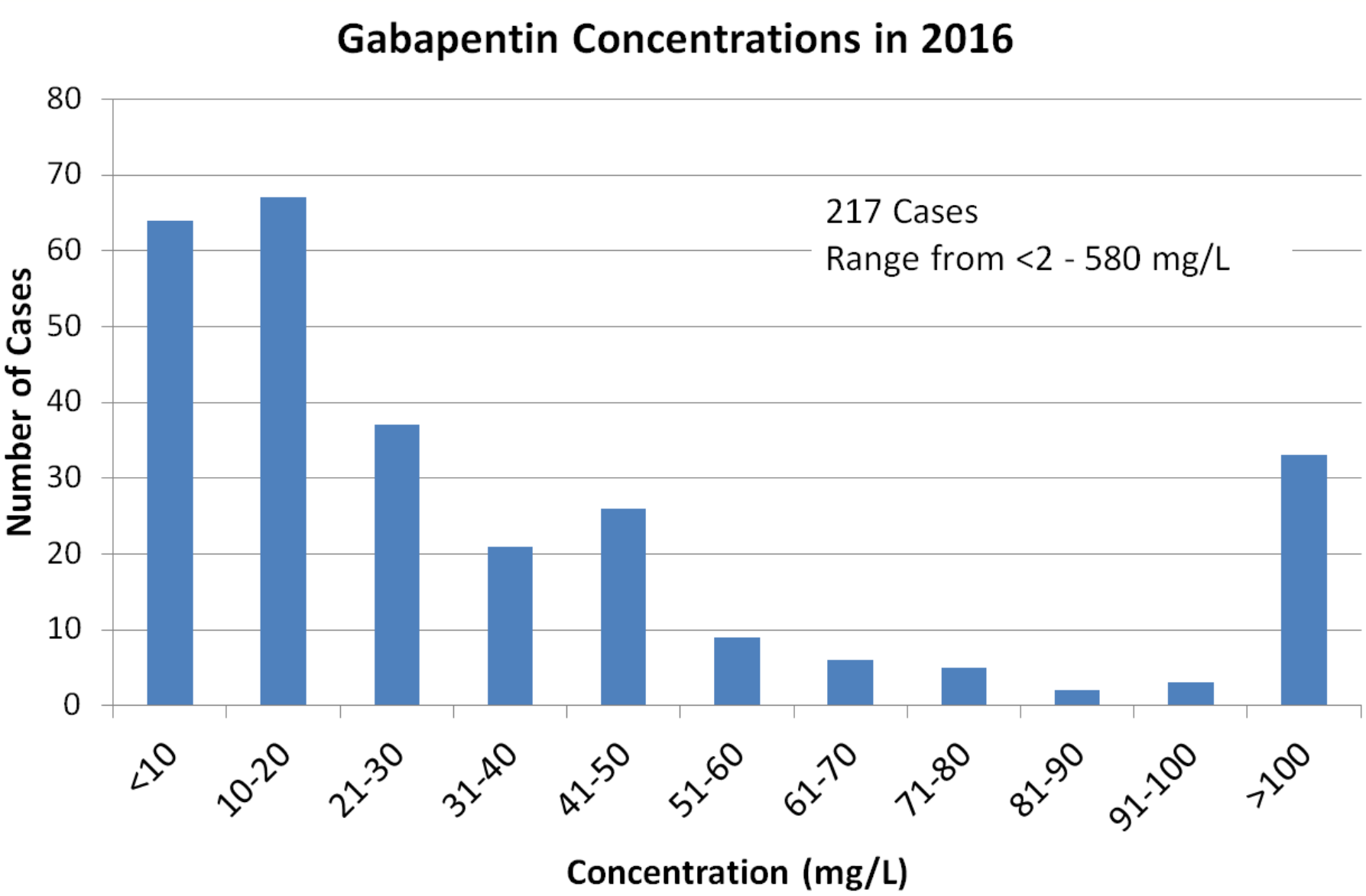
- A single oral dose of 400 mg of gabapentin to healthy individuals gave an average concentration of 3.4 mg/L (range, 2.2 - 6.1 mg/L).
- Healthy male volunteers administered between 300 and 4800 mg single doses gave peak plasma concentrations ranging from 2 – 12 mg/L.
- In three separate cases, individuals survived concentrations of 45 mg/L, 85 mg/L and 105 mg/L after supportive care.
- One study, of 13 fatalities, reported post-mortem gabapentin concentrations between 30 and 82 mg/L, and these were considered elevated. All of these cases listed mixed drug toxicity as the cause of death, potentially including gabapentin.

Vd = 0.8-1.3 L/Kg → less likely for post-mortem redistribution

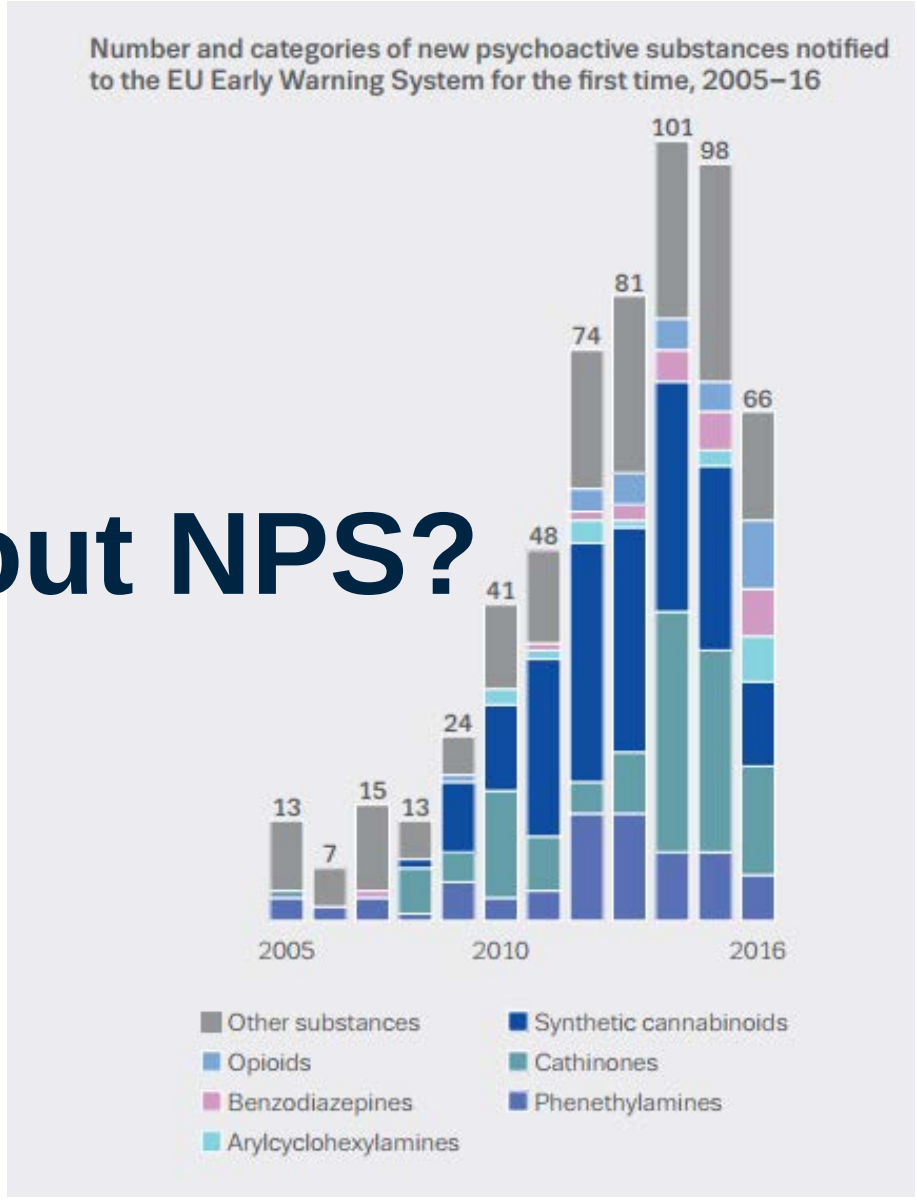
R. C. Baselt, Disposition of Toxic Drugs and Chemicals in Man, Biomedical Publications, Seal Beach, California, 11th edn (2017).

A.C. Moffat, Clarke's Analysis of Drugs and Poisons, Pharmaceutical Press, London, United Kingdom, (2011).

C. E. Hamm, R. D. Gary and I. M. McIntyre, Gabapentin concentrations and postmortem distribution. Forensic Science International **262** (2016) 201–203.


Gabapentin Concentrations in 2016
Number of Cases
80
70
60
50
40
30
20
10
0
217 Cases
Range from <2 - 580 mg/L
<10
10-20
21-30
31-40
41-50
51-60
61-70
71-80
81-90
91-100
>100
Concentration (mg/L)

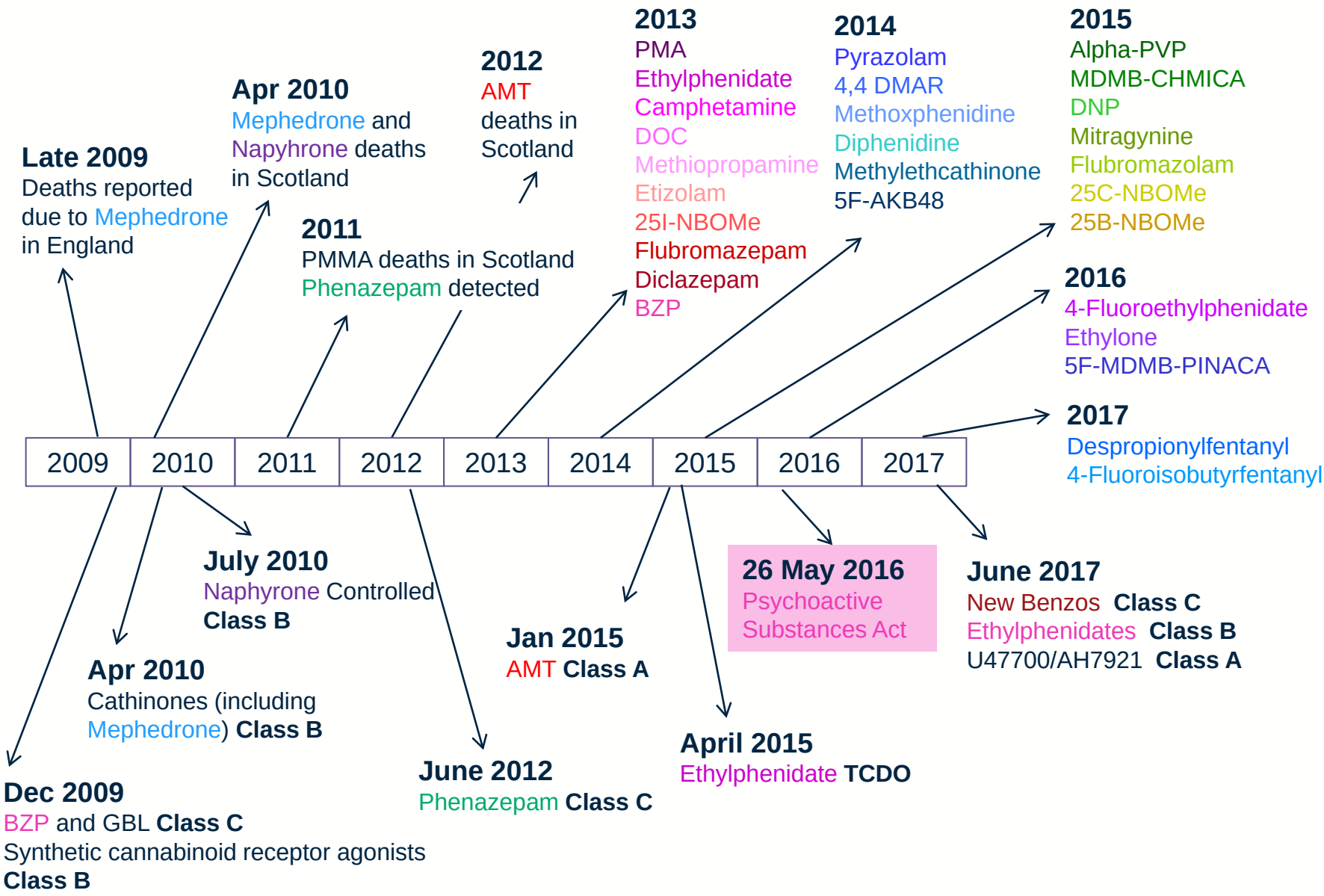
What about NPS?




FEATURE

Legal highs replace drugs

History of NPS at FMS



Ethylphenidate Deaths

Initially found something which looked like methylphenidate

Since July 2013 – 26 positive cases (only 4 named in COD)

Mostly confined to East of country

Usually injecting heroin users

Poly drug use (mainly diazepam, heroin, methadone etc.)

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A review of ethylphenidate in deaths in east and west Scotland

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ABSTRACT

Ethylphenidate is a psychostimulant and analogue of methylphenidate. Interestingly it is also produced as a metabolite from the co-ingestion of methylphenidate and alcohol (ethanol). In the UK, between April and June 2015, ethylphenidate and 6 other methylphenidate based novel psychoactive substances (NPS) were subjected to a temporary class drug order under the Misuse of Drugs Act 1971. Ethylphenidate is being abused by both novel and habitual drug users, more prominently in the East of Scotland. What is unknown in the literature is the contribution of ethylphenidate in deaths. A search was conducted for an 18 month period (July 2013 to December 2014) to identify cases where ethylphenidate was detected during post-mortem toxicological analysis. Nineteen cases were identified and these cases were examined with regards to case circumstances, pathology findings, toxicology results and adverse effects. The individuals ranged in age from 20 to 54 (median 37) and the majority were male ($n = 14$) and from the East of Scotland ($n = 16$), more specifically Edinburgh and surrounding area. Current or previous heroin abuse was a common theme in these cases ($n = 16$) and injection was a common route of administration of "legal highs" or "burst". The concentration of ethylphenidate in the cases ranged from

New Benzodiazepines in Fatalities

Diclazepam

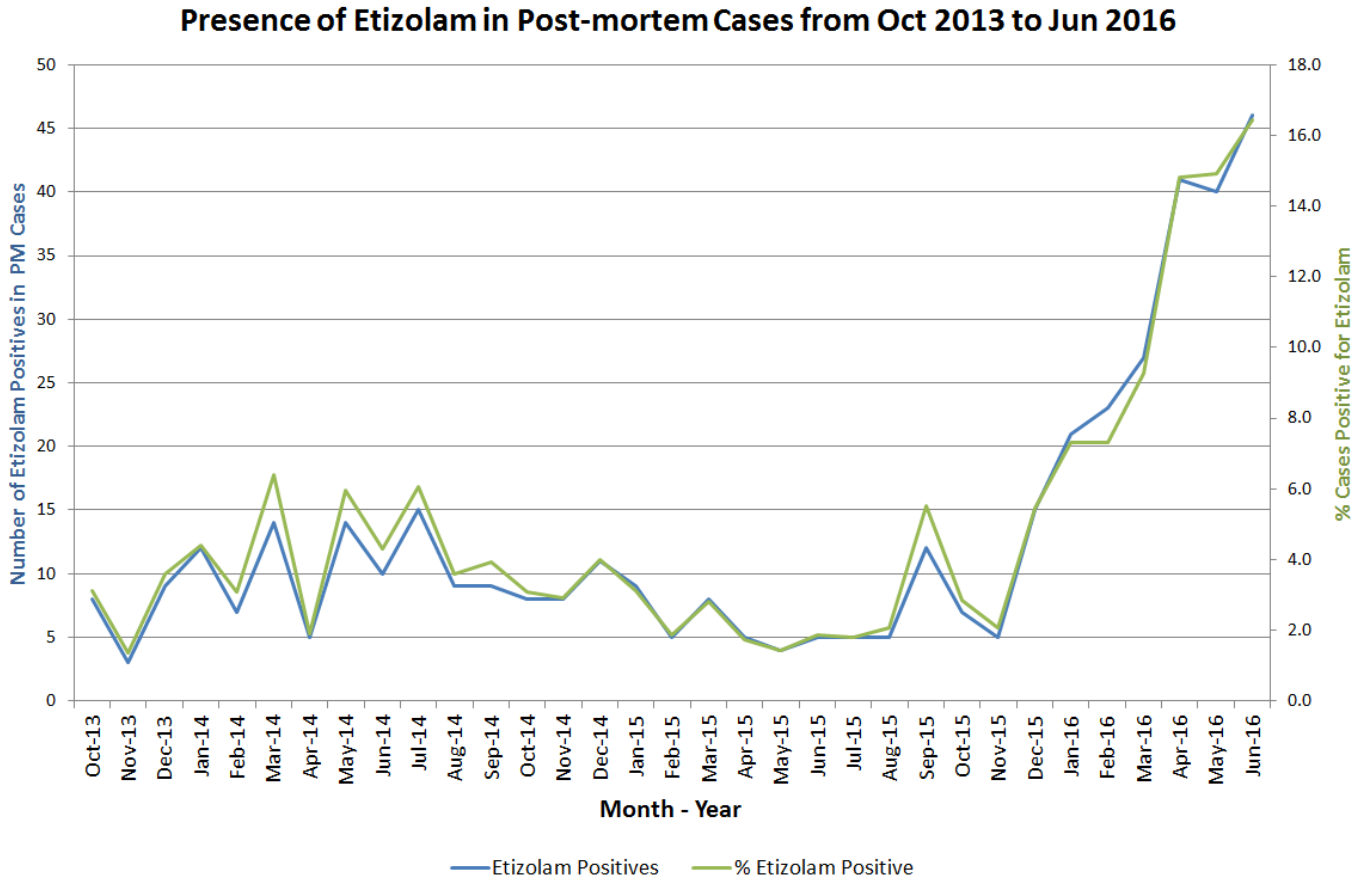
	Date First Case Received	No. Post-Mortem +ve Cases
Phenazepam	Dec-10	~260
Etizolam	Apr-13	~450
Diclazepam	Dec-13	~80
Pyrazolam	Jan-14	3
Flubromazepam	Jul-14	3
Flubromazolam	Feb-16	1

Etizolam

Detected regularly in PM cases since October 2013

Seemed to be tailing off mid 2015

Recent increase in incidence since late 2015

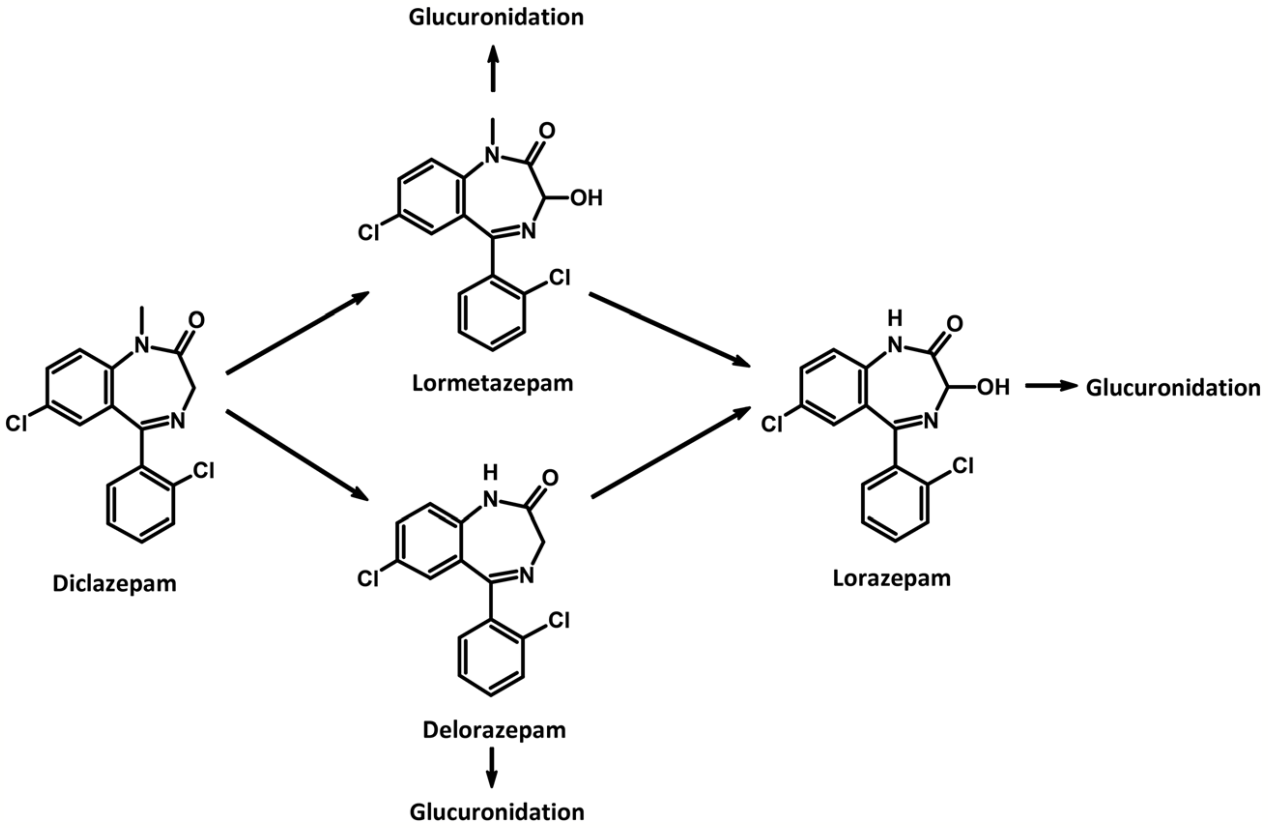


Diclazepam

Noticed several Lorazepam positives (no hospital stay)

Delorazepam (Italy) detected in unknown screen

Usually positive with diazepam



Moosmann B *et al.* Drug Test Anal. 2014;6(7-8):757-63

Trends we see

Cocaine

- Increase in Cocaine and Heroin use
- More injecting

Ecstasy

- Increase in MDMA positives in PM data
- High purity tablets
- Smoking/injecting ecstasy crystals

Heroin

- DRDs increasing
- Poly-drug use increasing

Thank you

"You're fired, Jack. The lab results just came back, and you tested positive for Coke."

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