# 4-Year Evaluation of Drug Impaired Driving Drug Concentrations

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## INTRODUCTION

Impaired driving has been an ongoing problem in the United States (US) that has not only increased in volume, but also increased in the complexity of the cases. With the ever-increasing number of prescription drugs in addition to illicit drugs available as well as the rise in poly substance use, drugged driving has become an increasingly important public health and safety concern. In 2018, 12.6 million Americans reported driving under the influence of marijuana or another illicit drug. Moreover, the National Highway Traffic Safety Administration (NHTSA) reported that 56% of drivers in the fourth quarter of 2020 involved in a fatal crash or a serious injury crash tested positive for at least one category of drug. To this end, it has become imperative to get a better understanding of drug impaired driving. Through the efforts of the National Safety Council's Alcohol Drugs and Impairment Division (NSC-ADID) scope recommendations and cutoff levels, the overall quality of the impaired driving data has improved. However, one area that remains relatively unexplored is the evaluation of changing patterns in terms of both drug concentration and drug positivity for all Tier I drugs. The objective of this research was to review drug concentration data for NSC-ADID Tier I drugs over a four-year period (2017-2020), assessing changes in concentrations over time as well as positivity.

## METHODS

- Source
  - Data provided by NMS Labs – majority of cases from Pennsylvania

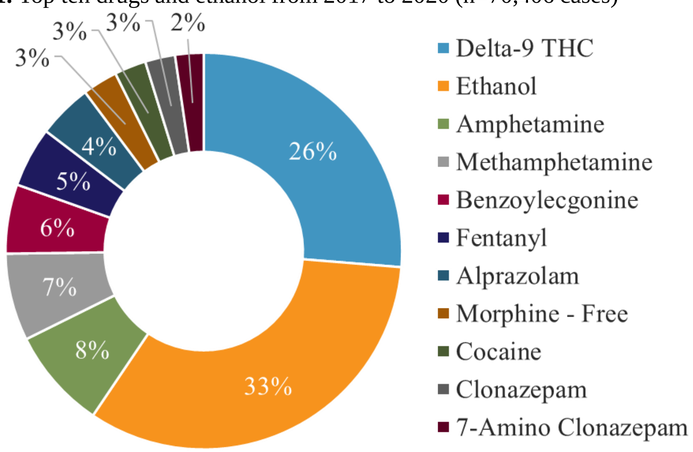
| | 2017 | 2018 | 2019 | 2020* |
|---|---|---|---|---|
| Number of Cases | 17,346 | 17,471 | 19,050 | 16,539 |

*There were 18,379 cases in 2020 but data only provided for 16,539

- Statistical Analysis
  - F-test, T-test, Z-test, and Mood's Median test were evaluated with an alpha level of 0.05
    - F-test was used to determine if the variance of the data was equal between the years being compared
    - T-test was performed with equal or unequal variance depending on the results of the F-test
    - Z-test was employed to determine whether the positivity rate of a drug differed year to year
    - Mood's Median test was used to determine if there was a difference in the median between two years
  - Data was not normalized to account for case volume from year to year

## RESULTS

**Figure 1.** Top ten drugs and ethanol from 2017 to 2020 (n=70,406 cases)




## RESULTS

**Table 1.** Positivity, count, average, median, min, and max for top ten drugs from 2017-2020

| Drug | Year | Positivity (%) | Count (n) | Reporting Limit (ng/mL) | Average (ng/mL) | Median (ng/mL) | Max. (ng/mL) |
|---|---|---|---|---|---|---|---|
| **Delta-9 THC** | 2017 | 44.4 | 7,710 | 0.5 | 6.4 | 4.0 | 140 |
| | 2018 | 45.9 $^{\alpha}$ | 8,023 | | 6.8 $^{\alpha}$ | 4.4 $^{\alpha}$ | 100 |
| | 2019 | 47.0 $^{\alpha,\beta}$ | 8,970 | | 7.1 $^{\alpha,\beta}$ | 4.5 $^{\alpha}$ | 230 |
| | 2020 | 49.0 $^{\alpha,\beta}$ | 8,110 | | 7.3 $^{\alpha,\beta}$ | 4.5 $^{\alpha}$ | 160 |
| **Amphetamine** | 2017 | 11.5 | 2,000 | 5.0 | 56 | 36 | 1,400 |
| | 2018 | 13.4 $^{\alpha}$ | 2,351 | | 59 | 39 | 4,100 |
| | 2019 | 14.5 $^{\alpha,\beta}$ | 2,754 | | 60 $^{\alpha}$ | 39 | 5,400 |
| | 2020 | 19.1 $^{\alpha,\beta}$ | 3,163 | | 56 | 37 | 2,700 |
| **Methamphetamine** | 2017 | 8.8 | 1,541 | 5.0 | 301 | 180 | 5,500 |
| | 2018 | 11.2 $^{\alpha}$ | 1,965 | | 345 $^{\alpha}$ | 230 | 8,800 |
| | 2019 | 12.5 $^{\alpha,\beta}$ | 2,378 | | 376 $^{\alpha,\beta}$ | 240 | 8,200 |
| | 2020 | 18.1 $^{\alpha,\beta}$ | 2,998 | | 381 $^{\alpha,\beta}$ | 240 | 13,000 |
| **Benzoylecgonine** | 2017 | 9.7 | 1,686 | 50 | 849 | 475 | 7,800 |
| | 2018 | 10.3 | 1,791 | | 874 | 500 | 11,000 |
| | 2019 | 9.9 | 1,900 | | 863 | 510 | 6,600 |
| | 2020 | 10.1 | 1,671 | | 736 $^{\alpha,\beta}$ | 400 $^{\alpha,\beta,\gamma}$ | 7,200 |
| **Fentanyl** | 2017 | 1.9 | 330 | 0.1 | 5.7 | 4.2 | 56 |
| | 2018 | 10.1 $^{\alpha}$ | 1,776 | | 5.6 | 3.4 $^{\alpha}$ | 83 |
| | 2019 | 9.9 $^{\alpha}$ | 1,886 | | 7.1 $^{\alpha,\beta}$ | 4.5 $^{\beta}$ | 140 |
| | 2020 | 12.8 $^{\alpha,\beta}$ | 2,122 | | 9.6 $^{\alpha,\beta}$ | 5.4 $^{\alpha,\beta,\gamma}$ | 310 |
| **Alprazolam** | 2017 | 11.2 | 1,951 | 5.0 | 67 | 44 | 1,300 |
| | 2018 | 8.6 $^{\alpha}$ | 1,504 | | 59 $^{\alpha}$ | 40 | 1,200 |
| | 2019 | 5.8 $^{\alpha,\beta}$ | 1,106 | | 49 $^{\alpha,\beta}$ | 34 $^{\alpha,\beta}$ | 390 |
| | 2020 | 5.9 $^{\alpha,\beta}$ | 981 | | 52 $^{\alpha,\beta}$ | 32 $^{\alpha,\beta}$ | 1,400 |
| **Morphine** | 2017 | 6.7 | 1,179 | 5.0 | 39 | 21 | 1,000 |
| | 2018 | 5.3 $^{\alpha}$ | 937 | | 34 | 17 $^{\alpha}$ | 1,600 |
| | 2019 | 4.6 $^{\alpha,\beta}$ | 881 | | 30 $^{\alpha}$ | 16 $^{\alpha}$ | 1,800 |
| | 2020 | 3.5 $^{\alpha,\beta}$ | 581 | | 29 $^{\alpha}$ | 15 $^{\alpha,\beta}$ | 870 |
| **Cocaine** | 2017 | 4.4 | 775 | 20 | 108 | 65 | 7,000 |
| | 2018 | 4.5 | 799 | | 99 | 66 | 2,300 |
| | 2019 | 5.0 $^{\alpha,\beta}$ | 961 | | 109 | 67 | 7,000 |
| | 2020 | 4.1 $^{\beta}$ | 679 | | 90 | 56 $^{\alpha,\beta,\gamma}$ | 1,400 |
| **Clonazepam** | 2017 | 5.6 | 985 | 2.0 | 24 | 16 | 350 |
| | 2018 | 4.6 $^{\alpha}$ | 813 | | 25 | 18 | 270 |
| | 2019 | 3.7 $^{\alpha,\beta}$ | 718 | | 23 | 15 $^{\beta}$ | 300 |
| | 2020 | 3.2 $^{\alpha,\beta}$ | 538 | | 20 $^{\alpha,\beta}$ | 13 $^{\alpha,\beta,\gamma}$ | 150 |
| **7-Amino Clonazepam** | 2017 | 5.4 | 936 | 5.0 | 35 | 24 | 340 |
| | 2018 | 4.5 $^{\alpha}$ | 786 | | 34 | 25 | 290 |
| | 2019 | 3.5 $^{\alpha,\beta}$ | 668 | | 35 | 23 | 380 |
| | 2020 | 3.1 $^{\alpha,\beta}$ | 513 | | 30 $^{\alpha,\beta}$ | 21 $^{\alpha,\beta}$ | 180 |

α – statistically different than 2017 at alpha level of 0.05; β – significantly different than 2018 at alpha level of 0.05; γ – significantly different than 2019 at alpha level of 0.05

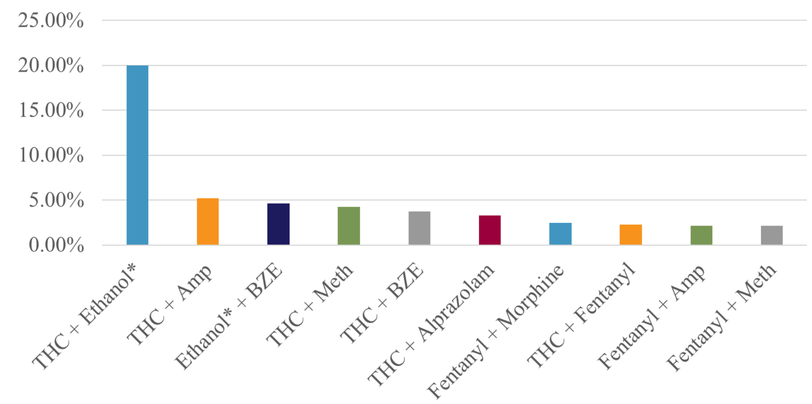
## RESULTS

**Table 2.** Positivity, count, average, median, min, and max for ethanol from 2017-2020

| Drug | Year | No. Cases Screened | Positivity (%) | Count (n) | Reporting Limit (mg/dL) | Average (mg/dL) | Median (mg/dL) | Max (mg/dL) |
|---|---|---|---|---|---|---|---|---|
| **Ethanol*** | 2017 | 9,835 | 59.4 | 5,812 | 10 | 156 | 156 | 450 |
| | 2018 | 10,127 | 59.9 | 6,069 | | 159 | 159 | 438 |
| | 2019 | 11,292 | 61.4 $^{\alpha,\beta}$ | 6,931 | | 157 | 155 $^{\beta}$ | 498 |
| | 2020 | 8,534 | 53.4 $^{\alpha,\beta}$ | 4,564 | | 155 $^{\beta}$ | 154 $^{\beta}$ | 457 |

α – statistically different than 2017 at alpha level of 0.05; β – significantly different than 2018 at alpha level of 0.05
*- Ethanol was not tested for in all cases submitted for suspected DUID

**Figure 2.** Top ten drug combinations from 2017 to 2020.




*- Ethanol was not tested for in all cases submitted for suspected DUID

## DISCUSSION/CONCLUSIONS

The percent of cases positive for at least one Tier I drug were 90.2% in 2017, 91.6% in 2018, 92.0% in 2019, and 90.5% in 2020. Cannabinoids, narcotic analgesics (NA), and CNS stimulants all increased in positivity over the four years. CNS depressants decreased in positivity and ethanol increased until 2019 and then decreased in positivity in 2020. The decrease in positivity is most likely due to the quarantine put in place in 2020, resulting in fewer drivers on the road. Not all cases submitted for suspected DUID to NMS Labs underwent ethanol testing. The increase in positivity for the cannabinoid class is most likely tied to the change in legal status of marijuana across the US in the past few years. With the move to legalize THC for medicinal and recreational purposes in some states, it is unsurprising that there was an increase in positivity. Fentanyl had the largest increase in positivity out of all the drugs going from 1.9% to 12.8% over the four years and is tied to the ongoing opioid epidemic in the US. In the CNS stimulant category, both methamphetamine and amphetamine increased in positivity over the four years, which is consistent with national trends noted by the National Institute of Health.

With respect to concentration data, fentanyl increased in average, median and maximum concentration over the four years with the maximum concentration increasing approximately six times by 2020. Delta-9-THC concentrations were relatively stable over the four years. Methamphetamine did see a statistically significant increase in average concentration, which is due in part to the drastic increase in maximum concentrations reported. The maximum reported concentration for methamphetamine nearly tripled over the four years.

THC and ethanol were the most common drug combination and were observed together in approximately 20% of the cases.

The landscape of DUID concentrations has significantly changed over four years, with significant focus on fentanyl. A concentration of 310 ng/mL of fentanyl in previous years would have been a lethal concentration, and here is the highest reported DUID concentration of 2020. Laboratories should consider the impact of changing drug concentrations in both interpretation and analytical methods.

## DISCLOSURE/ACKNOWLEDGEMENTS

This project was supported by Award No. 2020-DQ-BX-0009 awarded by the National Institute of Justice, Office of Justice Programs, U.S. Department of Justice. The opinions, findings, and conclusions expressed in this exhibition are those of the authors and do not necessarily reflect those of the Department of Justice.

## SUPPLEMENTARY INFORMATION