

Abstract:**Introduction:**

Impaired driving is an on-going public health concern in the United States. Recently, there has been an increased focus on drug detection in impaired driving along with concomitant use of alcohol. Through the efforts of the National Safety Council's Alcohol Drugs and Impairment Division (NSC-ADID) scope recommendations and cutoff levels, 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.

Objectives:

The objective of this research was to review drug concentration data for NSC-ADID Tier I drugs over a four-year period (2017-2020) to assess fluctuations in drug concentrations over time as well as evaluate overall drug positivity rates using a large data set.

Methods:

Data used was compiled from reported results from suspected DUID cases received by NMS Labs between 2017 to 2020. Average, median, maximum, and minimum concentrations were calculated for each drug. A Z-test ($\alpha=0.05$) was performed to determine the difference in positivity for each Tier I drug year to year; an F-test ($\alpha=0.05$) was used to determine if the variance in drug concentrations were different year to year. Using the F-test results, a T-test with either equal or unequal variance was employed to determine if the average concentration for each drug changed year over year.

Results:

The total number of cases per year is provided in Table 1.

Table 1. Number of cases per year

Year	No. of Cases Submitted
2017	17,346
2018	17,471
2019	19,050
2020	16,539

*1,840 (10%) cases from 2020 in included.

The most identified drug class was cannabinoids, with approximately 50% of the cases each year having a cannabinoid positive finding. In terms of individual drugs identified in the cases over the four years, delta-9-THC and its metabolites, ethanol, amphetamine/methamphetamine, fentanyl, and alprazolam were the top five drugs. Positivity for delta-9-THC and ethanol can be found in Table 2 along with positivity rates for cases where delta-9-THC and ethanol were found in combination, which was the most frequently encountered drug combination. Positivity rates

for delta-9-THC, amphetamine, methamphetamine, and fentanyl showed all statistically significant increases over the four years.

Table 2. Positivity of delta-9-THC and ethanol.

Drug	2017	2018	2019	2020
Delta-9-THC	45%	46%	46%	49%
Ethanol	59%	59%	61%	53%
Delta-9-THC + Ethanol	18%	19%	20%	20%

Related to drug concentrations, the general trend was that the average concentrations were relatively stable over time for most drugs. Exceptions to this included a statistically significant increase in the average concentration of fentanyl (5.7 ng/mL in 2017 to 9.6 ng/mL in 2020), methamphetamine (301 ng/mL in 2017 to 381 ng/mL in 2020), and delta-9-THC (6.4 ng/mL in 2017 to 7.3 ng/mL in 2020). Other findings included increases in the maximum reported concentrations between 2017 to 2020 for amphetamine (1,400 to 2,700 ng/mL), methamphetamine (5,550 to 13,000 ng/mL) and fentanyl (56 to 310 ng/mL). Statistically significant concentration decreases were noted for several CNS depressants and many narcotic analgesics other than fentanyl.

Discussion:

There were observable differences in both drug positivity and average concentration for all classes of drugs evaluated. Increases in positivity were observed with the cannabinoid, CNS stimulant, and narcotic analgesic drug classes, while CNS depressants declined in positivity. The drugs with the largest increases in positivity over the four years were delta-9-THC, fentanyl, amphetamine, and methamphetamine. Notable changes in concentrations were observed for several drugs in Tier I. Laboratories should consider the impact of changing drug concentrations to ensure methods have adequate sensitivity and/or methods are appropriately validated for dilution to bring high concentrations within range.