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Evaluating Drug Positivity for Tier I and Tier II Drugs Relative to BAC Thresholds

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Disclaimer

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New Trends

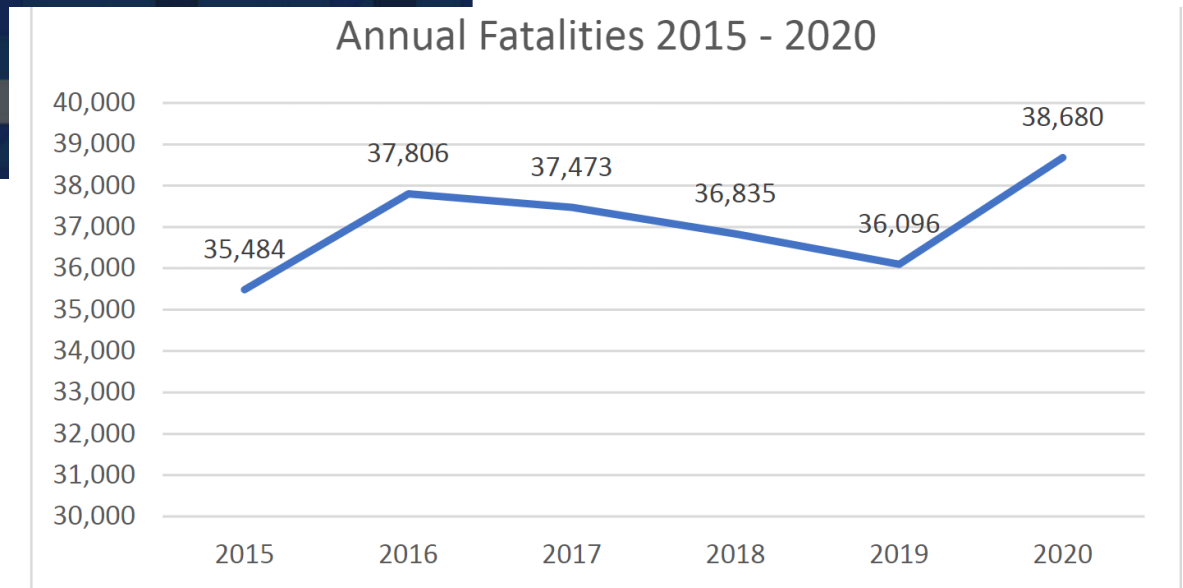United States Department of Transportation

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REPORT A SAFETY PROBLEM

NHTSA

Ratings Recalls Risky Driving Road Safety Equipment Technology & Innovation MORE INFO ▼

← NEWS

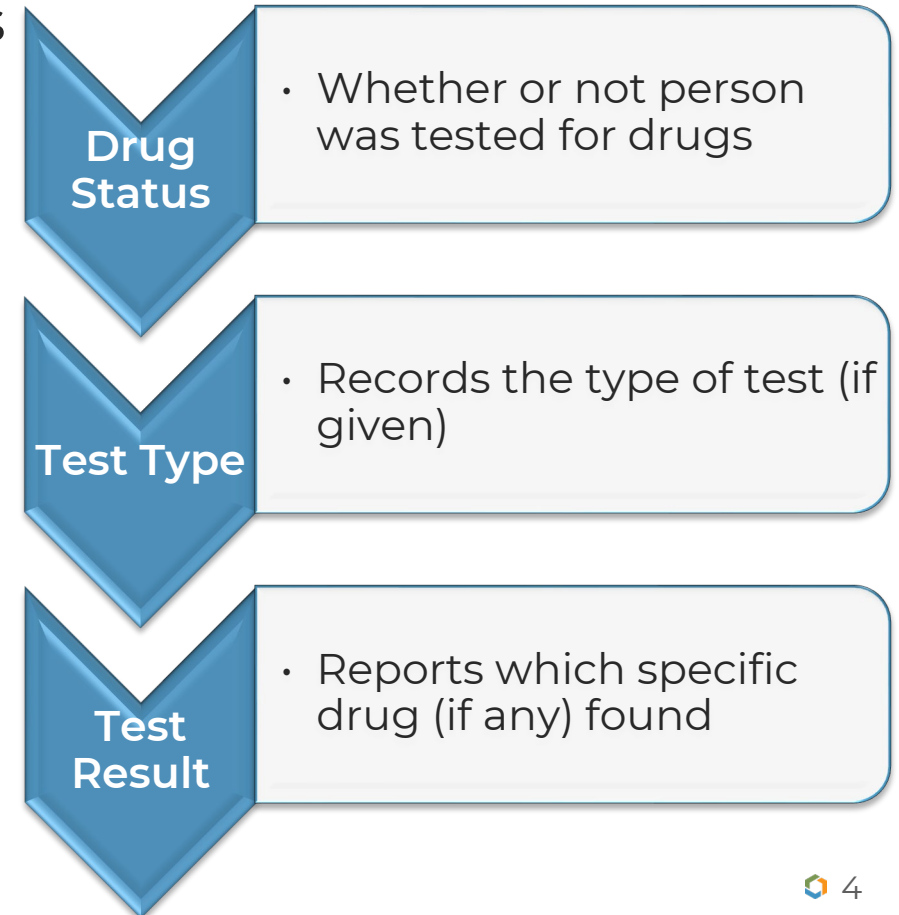## Newly Released Estimates Show Traffic Fatalities Reached a 16-Year High in 2021

Annual Fatalities 2015 - 2020

- 2015: 35,484
- 2016: 37,806
- 2017: 37,473
- 2018: 36,835
- 2019: 36,096
- 2020: 38,680

Adapted from NCSA, 2021[2]

Figure 1: FARS Motor Vehicle Fatalities in the United States 2015 to 2020

Source of National DUID Data

- NHTSA's Fatality Analysis Reporting System (FARS)

- Created in 1975 as a nationwide census on providing yearly data for fatal injuries suffered in motor vehicle traffic crashes

- Collects data on 3 drugs use fields
  - As of 2018 all drugs detected can be recorded

- Limitations:
  - Uniformity of data collected
  - Data submission is voluntary
  - Not all crashes involve police

Drug Status
- Whether or not person was tested for drugs

Test Type
- Records the type of test (if given)

Test Result
- Reports which specific drug (if any) found

Updated Impaired Driving

- 56% of drivers involved in serious injury and fatal crashes tested positive for at least 1 drug

- Data collected from select trauma centers and medical examiners (September 2019 – July 2020)
  - Charlotte, NC
  - Miami, FL
  - Baltimore, MD
  - Worcester, MA

- Results are for confirmed positives
  - Parent drug or active metabolite(s)
  - Multiple drugs within the same category only counted once

Drug and Alcohol Prevalence in Seriously and Fatally Injured Road Users Before and During the COVID-19 Public Health Emergency

U.S. Department of Transportation
National Highway Traffic Safety Administration

NHTSA

DOT HS 813 018   October 2020

Table 14. All Road Users: Positive for Alcohol Combined With Other Drugs

Drug Category	Before (N=1,880)		During (N=1,123)	
	n	%	n	%
Alcohol only	218	11.6	144	12.8
Alcohol + 1 Other Category	128	6.8	122	10.9*
Cannabinoids	80	4.2	75	6.7*
Stimulants	28	1.5	16	1.4
Sedatives	8	0.4	13	1.1*
Opioids	7	0.3	11	1.0*
Antidepressants	1	0.1	0	0.0
Over-the-Counter	1	0.1	4	0.4*
Other Drugs	3	0.2	3	0.3
Alcohol + 2 or More Other Categories	54	2.9	36	3.2

*Significantly different ($p < .05$) from Before period.

U.S. Department of Transportation
National Highway Traffic Safety Administration

TRAFFIC SAFETY FACTS
Research Note

NHTSA

DOT HS 813 135   Behavioral Safety Research   June 2021

Update to Special Reports on Traffic Safety During the COVID-19 Public Health Emergency: Fourth Quarter Data

Table 1
Drivers (Excluding Motorcyclists): Positive for Drug Category by Quarter

Drug Category	Q4 2019 (N=409)		Q1 2020 (N=536)		Q2 2020 (N=404)		Q3 2020 (N=603)		Q4 2020 (N=474)	
	n	%	n	%	n	%	n	%	n	%
Alcohol	90	22.0	137	25.6	102	25.2	166	27.5	127	26.8
Cannabinoids	78	19.1	118	22.0	133	32.9[A,B]	155	25.7	130	27.4[A]
Opioids	28	6.8	52	9.7	60	14.9[A]	88	14.6[A]	44	9.3
Stimulants	36	8.8	60	11.2	41	10.1	64	10.6	42	8.9
Sedatives	42	10.3	35	6.5	34	8.4	48	8.0	33	7.0
Antidepressants	11	2.7	12	2.2	1	0.2[A]	4	0.7	4	0.8
Over-the-Counter	4	1.0	22	4.1	6	1.5	10	1.7	8	1.7
Other Drugs	7	1.7	9	1.7	3	0.7	17	2.8	10	2.1
At Least 1 Category	211	51.6	292	54.5	260	64.4[A,B]	366	60.7[A]	266	56.1
Multiple Categories	69	16.9	120	22.4	92	22.8	150	24.9[A]	108	22.8

[A] Significantly different ($p < .05$) compared to Q4 2019 period.
[B] Significantly different ($p < .05$) compared to Q1 2020 period.

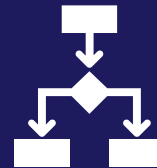# DUID Drug Testing Challenges

Scope

Complexity

Cutoffs

Policy

Resources

Procedures

National Safety Council's Alcohol, Drugs, and Impairment Division (NSC-ADID)

- Started an initiative to standardize testing practices in toxicology labs for DUID cases and improve the quality of data surrounding DUID

- Surveyed the testing scope and cutoffs for both blood and urine drug testing in laboratories

- Issued scope and cutoff recommendations beginning in 2007

nsc®
Alcohol, Drugs & Impairment Division

Tier I Drugs

Cannabinoids	CNS Depressants Cont.
Δ9-THC	Diazepam
Carboxy-THC	Nordiazepam
11-hydroxy-THC	Oxazepam
CNS Stimulants	Temazepam
Methamphetamine	Narcotic Analgesics
Amphetamine	Codeine
MDMA	6-MAM
MDA	Buprenorphine
Cocaine	Norbuprenorphine
Benzoylecgonine	Fentanyl
CNS Depressants	Hydrocodone
Carisoprodol	Hydromorphone
Meprobamate	Methadone
Alprazolam	Morphine
Alpha-hydroxyalprazolam	Oxycodone
Clonazepam	Oxymorphone
7-Aminoclonazepam	Tramadol
Lorazepam	O-Desmethyltramadol

Tier II Drugs

Cannabinoids	CNS Depressants Cont.
Synthetic cannabinoids	Pregabalin
CNS Stimulants	Secobarbital
Cathinones	Topiramate
Methylphenidate	Trazodone
Mitragynine	Tricyclic antidepressants
CNS Depressants	Valproic Acid
Atypical antipsychotics	Zopiclone
Barbiturates	**Narcotic Analgesics**
Carbamazepine	Fentanyl analogs
Chlordiazepoxide	Novel opioids
Chlorpheniramine	Tapentadol
Cyclobenzaprine	**Dissociative Drugs***
Diphenhydramine	Dextromethorphan
Doxylamine	Ketamine
Gabapentin	PCP
GHB	**Inhalants***
Hydroxyzine	Difluoroethane
Lamotrigine	Inhalant class
Mirtazapine	**Hallucinogens***
Novel benzodiazepines	Hallucinogens
Phenytoin	

Advantages of a Uniform Approach

Comparable data to accurately characterize the scope of the problem

Better data on the effects of drugs on driving

More successful/fair prosecution

Better public education on the risks of drugged driving

Early detection on emerging drug trends

Stop Limit Testing

- The practice of making a determination about whether or not to perform drug testing based on an administratively determined alcohol concentration

- The practice of confirming and quantifying the "most significant" drug identified during screening

- Justification

  – No enhancement penalties for combined drug and alcohol use

  – Impairment explained by the BAC

  – Limited resources/budget
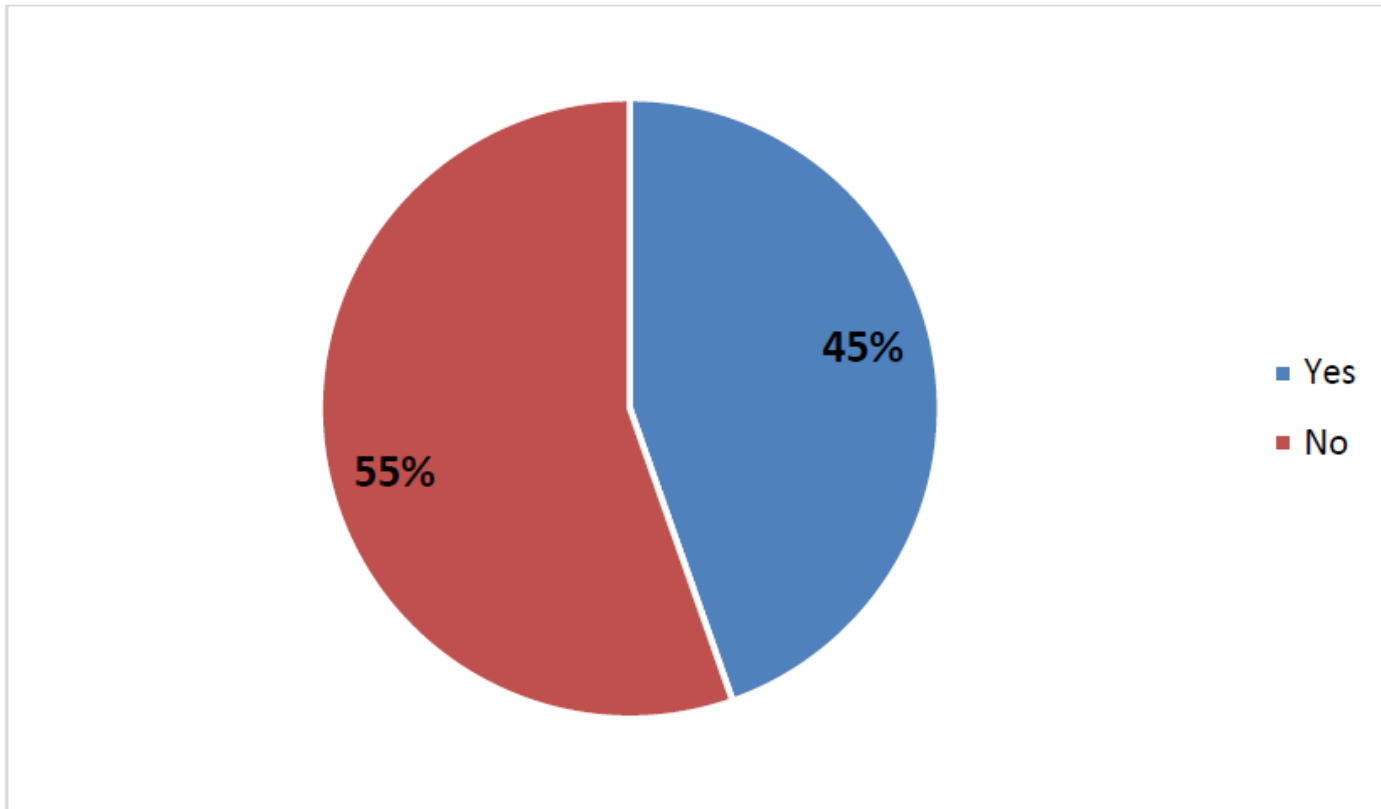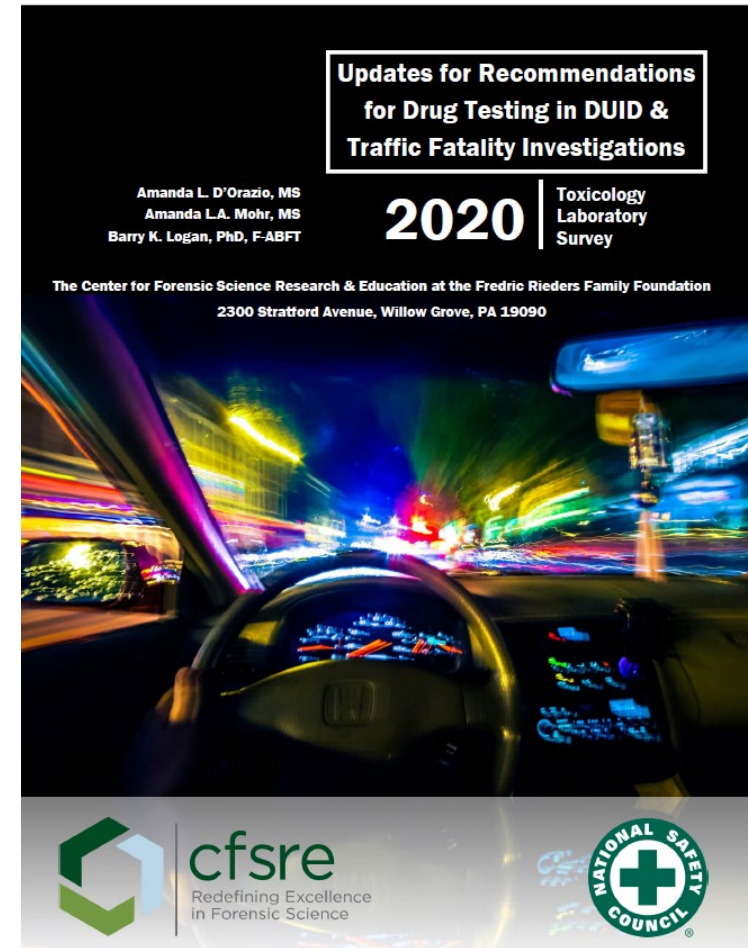
  – Agency request

Stop Limit Testing in Practice

Figure 8. Is there an administrative decision to stop testing if a BAC result is at or above a certain concentration (n = 64)?
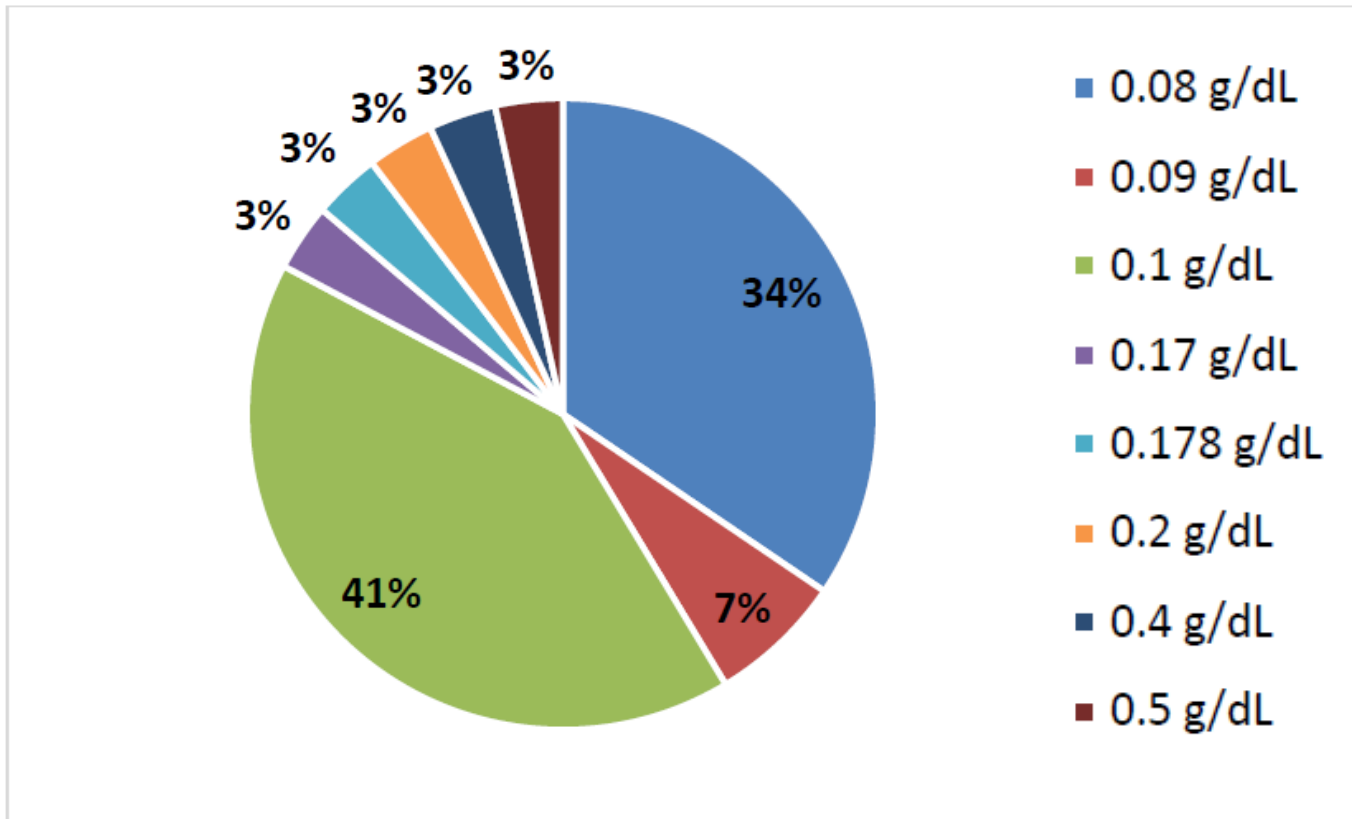
Stop Limit Testing in Practice

Figure 9. Is there a BAC concentration where there is an administrative decision to stop testing (n = 29)?

Projects Goals

- Test authentic DUID blood samples submitted to a reference laboratory using a comprehensive scope including NSC-ADID's Recommendations
  - Tier I
  - Tier II (includes NPS)
- Analyze drugs results relative to various BAC thresholds

Testing Methods

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Sample Acquisition

- Discarded and deidentified blood samples that were submitted for analysis in suspected DUID cases were re-analyzed for the study
  - January 2020 to December 2021
  - ~200 samples collected each month

- The data for ethanol and THC results were provided with the deidentified blood sample

Sample Analysis

- Three different extractions were performed
  - Basic Drugs
  - Synthetic Cannabinoids
  - Gabapentin

- The samples were analyzed using a Sciex TripleTOF® 5600+ LC-QTOF coupled with Shimadzu Nexera UHPLC
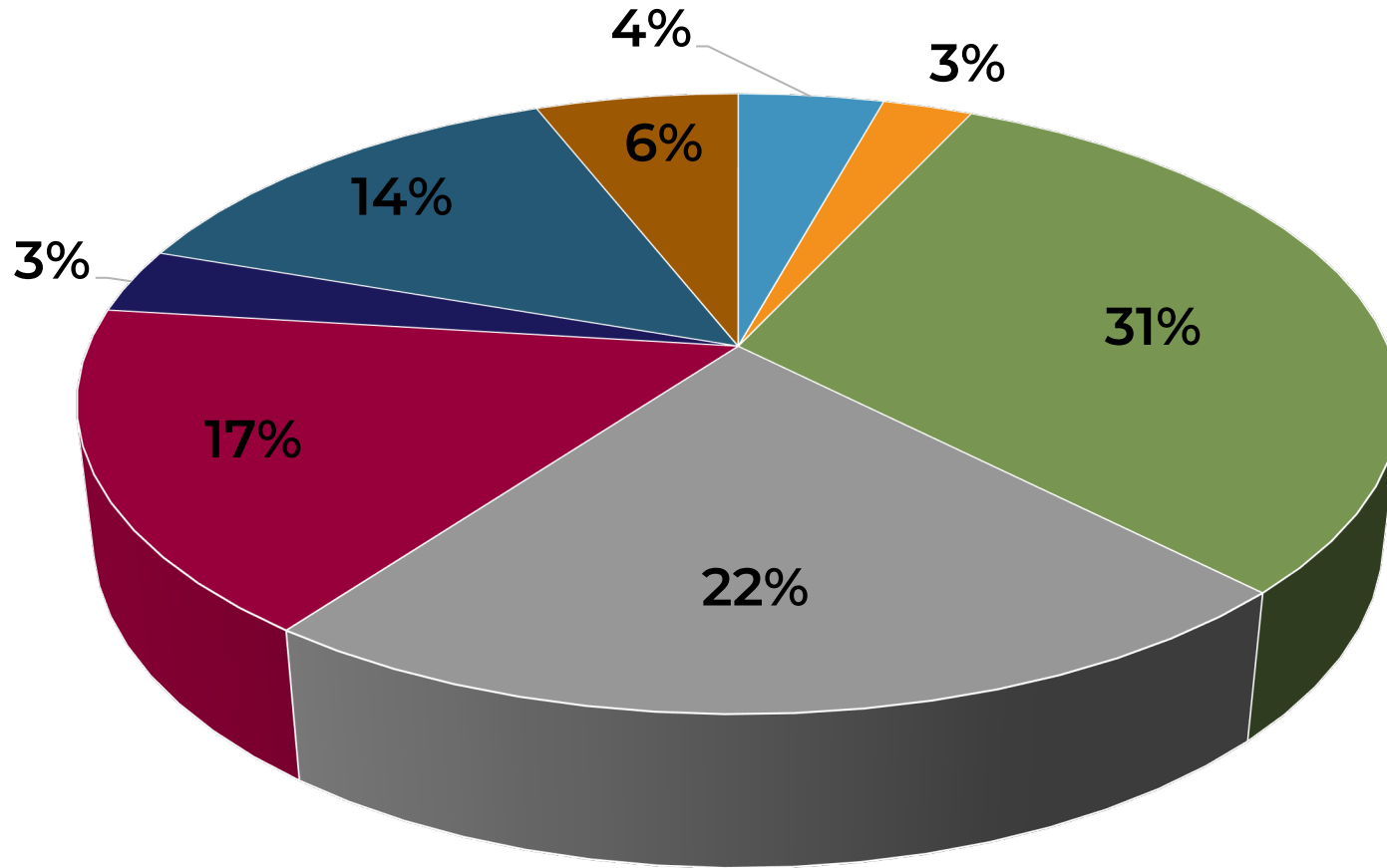 - Controls ran at NSC-ADID recommended cutoff concentrations

Results

Summary Data

- A total of 2,514 cases were analyzed
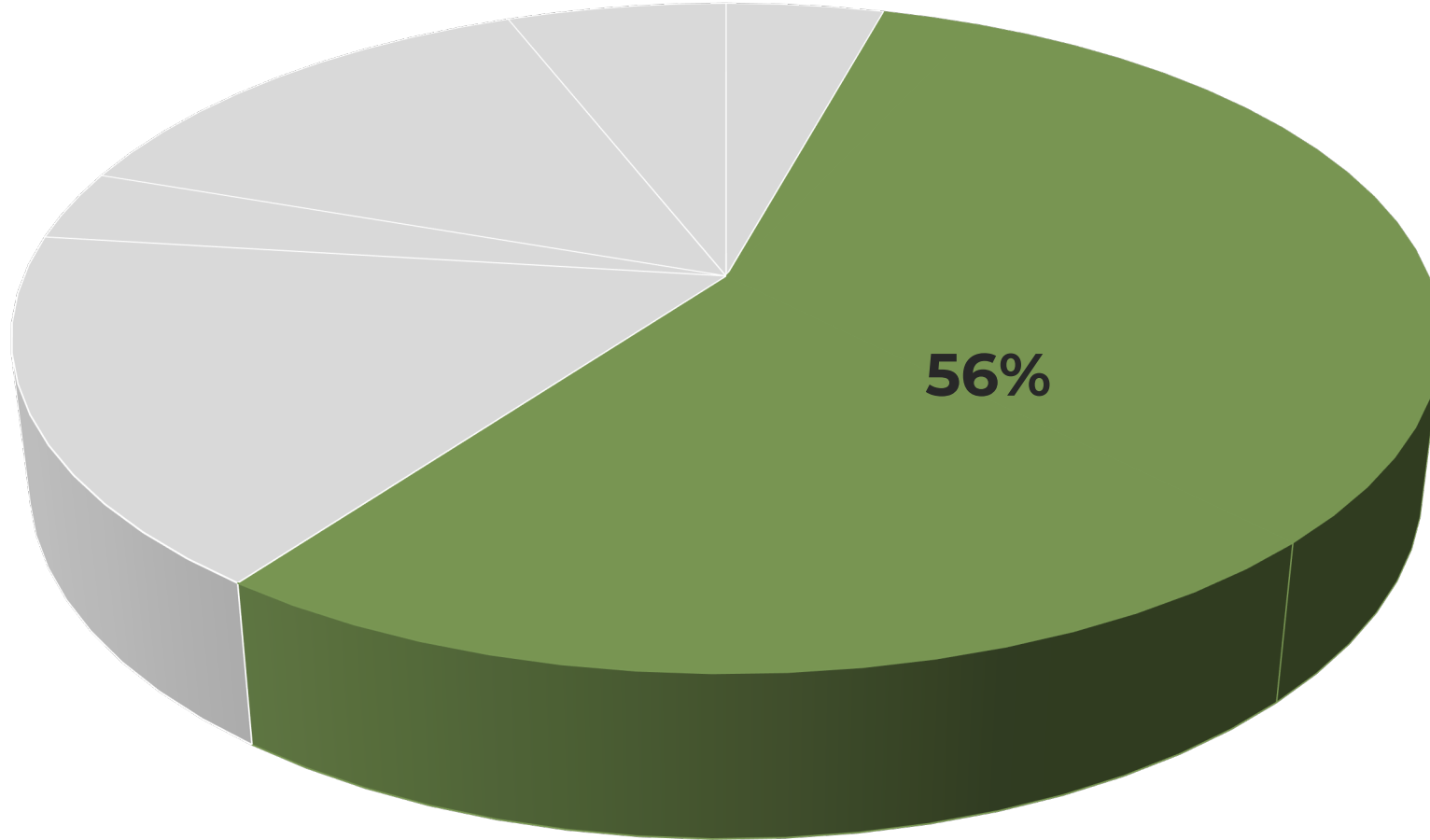
  – Data in chart is not mutually exclusive

Category	Number of Cases	Percent of Total
None Detected	107	4%
Ethanol Positive	1004	40%
Drug Positive	1982	79%

Percent Positivity Data (n=2,514)

- None Detetected
- Tier II Only
- Tier I Only
- Tier I and Tier II
- Ethanol Only
- Tier II and Ethanol
- Tier I and Ethanol
- Tier I, Tier II and Ethanol

Percent Positivity Data (n=2,514)

56%

- None Detetected
- Tier II Only
- Tier I Only
- Tier I and Tier II
- Ethanol Only
- Tier II and Ethanol
- Tier I and Ethanol
- Tier I, Tier II and Ethanol

Tier I Findings

Drug	No. of Positive Cases	Positivity (%)
THC	1227	48.8
Methamphetamine	391	15.5
Fentanyl	348	13.8
Amphetamine	347	13.8
Benzoylecgonine	174	6.9
Alprazolam	87	3.5
Cocaine	86	3.4
Methadone	68	2.7
7-Amino Clonazepam	62	2.5
Buprenorphine	52	2.0
Clonazepam	45	1.7
Oxycodone	42	1.6
Tramadol	28	1.1
Morphine	24	0.9
Lorazepam	23	0.9

Tier II Findings

Drug	No. of Positive Cases	Positivity (%)
Diphenhydramine	187	7.4
Gabapentin*	**59**	**4.3**
Hydroxyzine	90	3.5
8-Aminoclonazolam	80	3.1
Fluorofentanyl	71	2.8
Trazodone	69	2.7
Cyclobenzaprine	54	2.1
Doxylamine	53	2.1
Lamotrigine	50	1.9
Etizolam	47	1.8
Eutylone	42	1.6
Mitragynine	34	1.4

* n=1,366 for gabapentin

- n=2,514

Alcohol and Drug Data

- Data for 2,407 cases; Excludes cases that were none detected
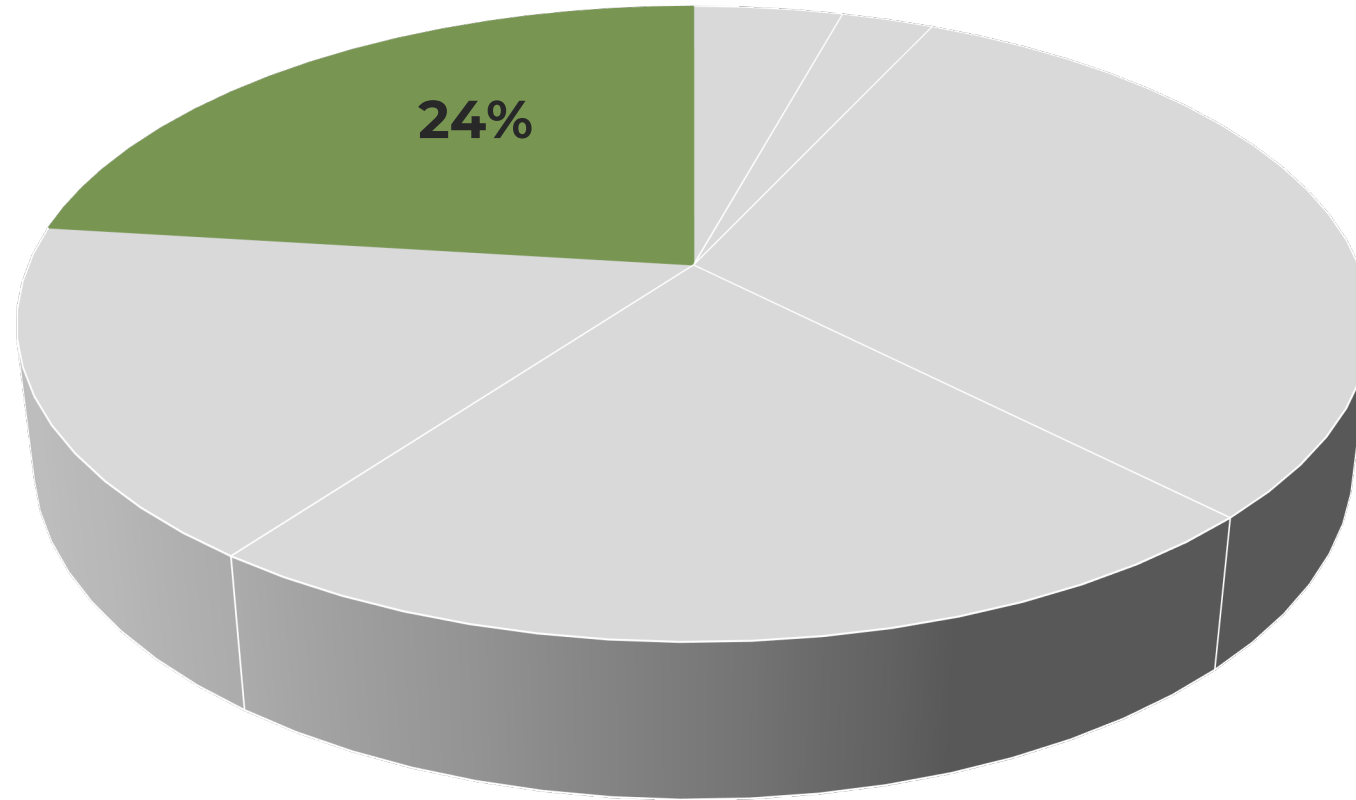

24% **18%** **58%**
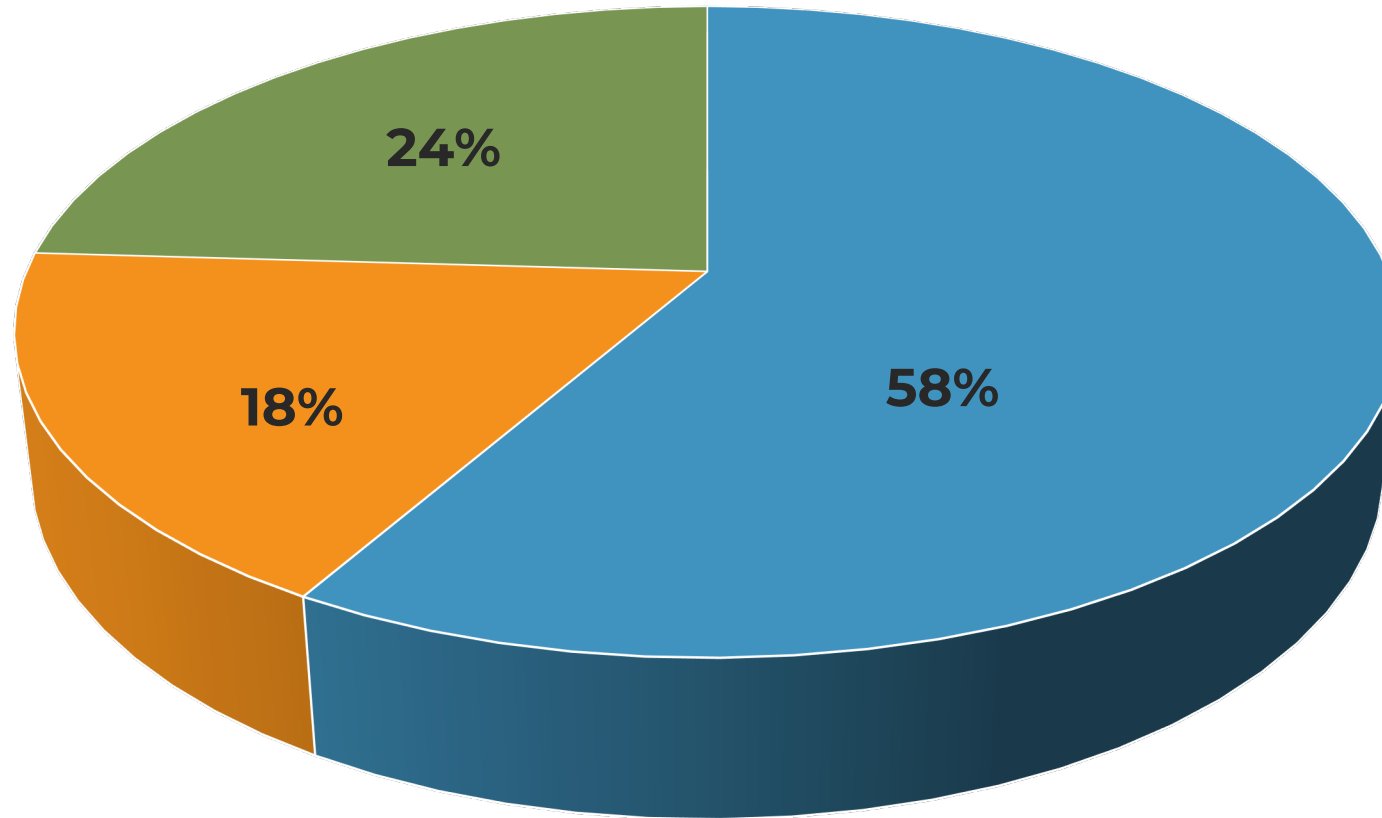
■ Drugs only   ■ Alcohol only   ■ Drugs and Alcohol

Alcohol Concentration Data

Drug	Reporting Limit (g/100 mL)	Max (g/100 mL)	Average (g/100 mL)	Median (g/100 mL)
Ethanol (n=1,004)	0.01	0.61	0.16(±0.07)	0.16

Distribution of BACs

Percent Positivity Data (n=2,514)

24%

■ None Detetected   ■ Tier II Only   ■ Tier I Only

■ Tier I and Tier II   ■ Ethanol Only   ■ Tier II and Ethanol

■ Tier I and Ethanol   ■ Tier I, Tier II and Ethanol

Drug Positivity at Various BAC Thresholds

- Evaluated for 2,514 cases

Stop Limit Thresholds	
	<0.08 g/100 mL
Tier I Only Positivity	33.0% (n=829)
Tier II Only Positivity	2.9% (n=72)
Tier I and Tier II Positivity	23.9% (n=602)
Positivity for any Tier I, Tier II or Combo	**60% (n=1,503)**

Drug Positivity at Various BAC Thresholds

- Evaluated for 2,514 cases

Stop Limit Thresholds		
	<0.08 g/100 mL	**≥0.08 g/100mL**
Tier I Only Positivity	33.0% (n=829)	11.5% (n=288)
Tier II Only Positivity	2.9% (n=72)	3.1% (n=79)
Tier I and Tier II Positivity	23.9% (n=602)	4.4% (n=111)
Positivity for any Tier I, Tier II or Combo	**60% (n=1,503)**	**19% (n=478)**

Drug Positivity at Various BAC Thresholds

- Evaluated for 2,514 cases

Stop Limit Thresholds			
	<0.08 g/100 mL	**≥0.08 g/100mL**	**≥0.10 g/100 mL**
Tier I Only Positivity	33.0% (n=829)	11.5% (n=288)	10.6% (n=266)
Tier II Only Positivity	2.9% (n=72)	3.1% (n=79)	2.8% (n=71)
Tier I and Tier II Positivity	23.9% (n=602)	4.4% (n=111)	3.9% (n=97)
Positivity for any Tier I, Tier II or Combo	**60% (n=1,503)**	**19% (n=478)**	**17.3% (n=434)**

Drug Positivity at Various BAC Thresholds

- Evaluated for 2,514 cases

Stop Limit Thresholds

	<0.08 g/100 mL	≥0.08 g/100mL	≥0.10 g/100 mL	≥0.15 g/100 mL
Tier I Only Positivity	33.0% (n=829)	11.5% (n=288)	10.6% (n=266)	6.4% (n=152)
Tier II Only Positivity	2.9% (n=72)	3.1% (n=79)	2.8% (n=71)	2.1% (n=32)
Tier I and Tier II Positivity	23.9% (n=602)	4.4% (n=111)	3.9% (n=97)	2.7% (n=41)
Positivity for any Tier I, Tier II or Combo	**60% (n=1,503)**	**19% (n=478)**	**17.3% (n=434)**	**11.1% (n=280)**

Drug Positivity at Various BAC Thresholds

- Evaluated for 2,514 cases
  - 379 cases positive for ethanol >0.10 g/100 mL that were not positive for drugs

Stop Limit Thresholds	<0.08 g/100 mL	≥0.08 g/100mL	≥0.10 g/100 mL	≥0.15 g/100 mL
Tier I Only Positivity	33.0% (n=829)	11.5% (n=288)	10.6% (n=266)	6.4% (n=152)
Tier II Only Positivity	2.9% (n=72)	3.1% (n=79)	2.8% (n=71)	2.1% (n=32)
Tier I and Tier II Positivity	23.9% (n=602)	4.4% (n=111)	3.9% (n=97)	2.7% (n=41)
Positivity for any Tier I, Tier II or Combo	**60% (n=1,503)**	**19% (n=478)**	**17.3% (n=434)**	**11.1% (n=280)**

Tier I Drug Positive Results at BAC ≥0.10 g/100 mL

- 813 cases with a BAC at or greater than 0.10 g/100 mL

- Data in chart represents cases **only** positive for a Tier I drug

Drug	Number of Positive Cases	Percent of Cases with Drug
THC	209	25.7%
Amphetamine	20	2.4%
BZE	20	2.4%
Methamphetamine	11	1.3%
Cocaine	11	1.3%
Fentanyl	10	1.2%
Alprazolam	6	0.7%
7-Aminoclonazepam	4	0.5%

Tier II Drug Positive Results at BAC ≥0.10 g/100 mL

- 813 cases with a BAC at or greater than 0.10 g/100 mL

- Data in chart represents cases **only** positive for a Tier II drug

Drug	Number of Positive Cases	Percent of Cases with Drug
Diphenhydramine	21	2.5%
Doxylamine	8	1.0%
Hydroxyzine	7	0.8%
Cyclobenzaprine	4	0.5%
Mitragynine	3	0.4%

- Other NPS detected etizolam (n=1) and flubromazolam (n=1)

Comparing Cutoff Thresholds

- 75% of labs reported using cutoff thresholds at 0.08 g/100 mL or 0.10 g/100mL in the 2021 DUID survey

Drug	≥0.08 g/100 mL (n=889)		≥0.10 g/100 mL (n=813)	
	Number of Positive Cases	Percent of Cases with Drug	Number of Positive Cases	Percent of Cases with Drug
THC	226	25.4%	209	25.7%
BZE	24	2.6%	20	2.4%
Amphetamine	22	2.4%	20	2.4%
Cocaine	15	1.6%	11	1.3%
Methamphetamine	11	1.2%	11	1.3%
Fentanyl	11	1.2%	10	1.2%
Alprazolam	6	0.6%	6	0.7%
7-Aminoclonazepam	4	0.4%	4	0.5%

Discussions and Conclusions

Discussion

- Drug positivity for all cases was nearly 79%, almost double of alcohol positivity

  - Excluding negative cases, 24% are positive for both drugs and alcohol

- NSC-ADID recommendations for Tier I and Tier II drugs are supported by the findings of this research

  - Most frequently detected drugs are captured in Tier I

  - Only two Tier I drugs not detected in this data set

    - Alpha-hydroxyalprazolam and oxymorphone

Discussion

- Stop limit testing is often justified for a number reasons but..
  - 82% of cases have drugs

- At the most commonly used threshold, 0.10 g/100mL, 17.3% of cases are positive for a Tier I and/or Tier II drug

- Comparable Tier I positivity rates for the two most commonly used BAC cutoff thresholds

- Movement toward establishing enhanced penalties for combined alcohol and drug use
  - Utah → BAC of 0.05 or higher in addition to any measurable controlled substance
  - New York → Impaired by combined influence or drugs or of alcohol

Conclusions

- Limiting testing based on alcohol results precludes information of drug involvement in several cases leading to underreporting of drug contributions to impaired driving

- Estimates are likely even higher as some samples never even make it to the lab for testing

- Extrapolating "low" positivity's from study population to the nearly 1 million people arrested each year for suspected impaired driving has big impacts on the data collected

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Questions?

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