



RE-EVALUATING THE PREVALENCE OF POLY-DRUG-POSITIVE DRIVING IN WASHINGTON

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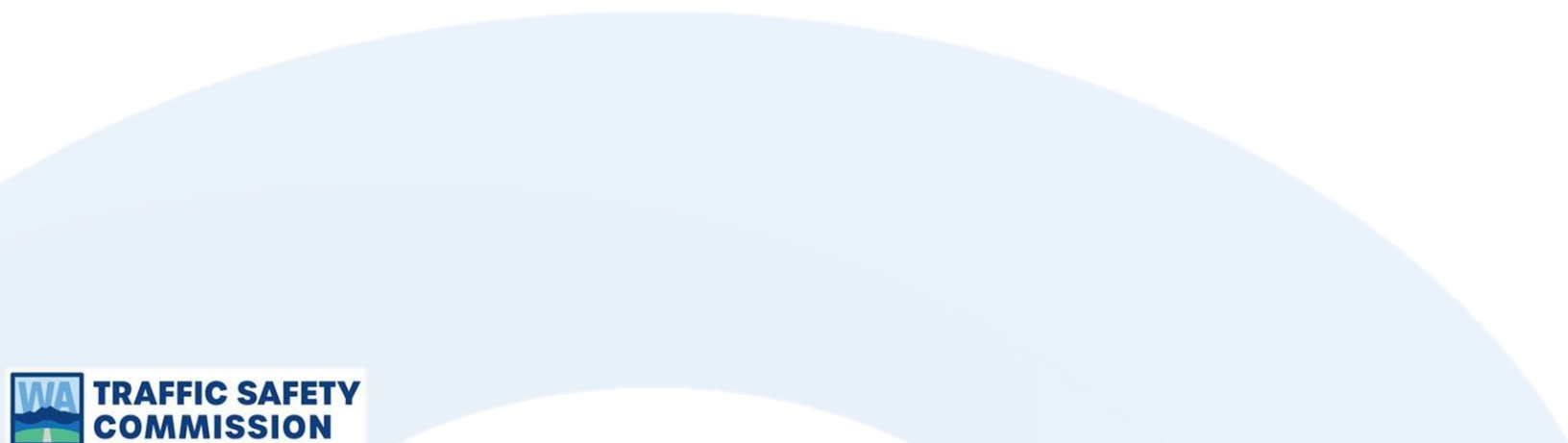
Research and Data Division, Washington Traffic Safety Commission

Washington State Injury Prevention Summit

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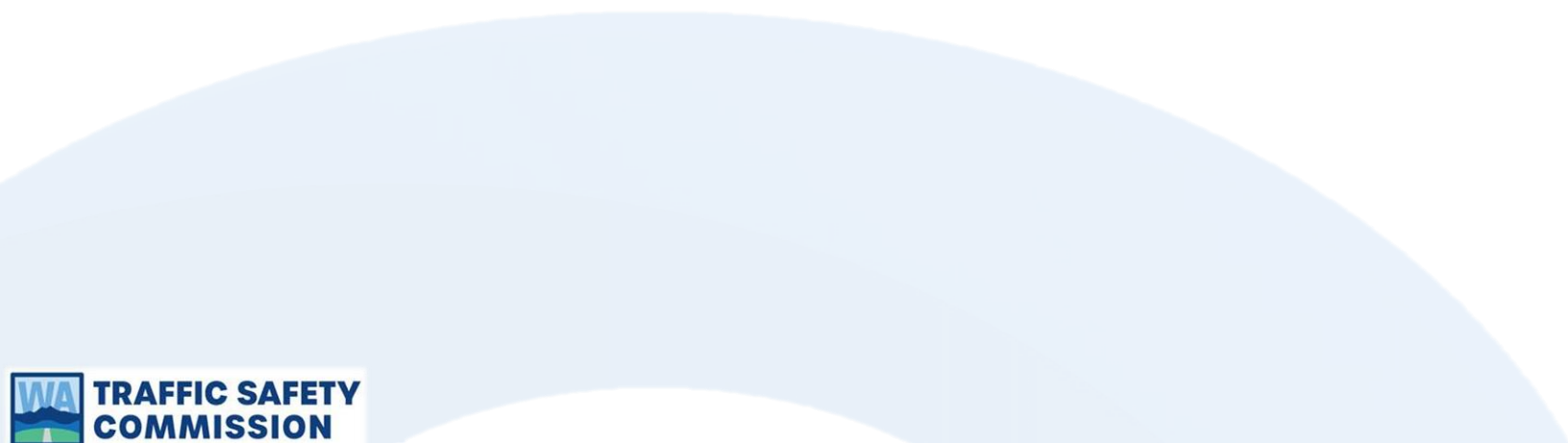
OVERVIEW

- Poly-drug background
- Current drug-positive driver data
- Methodology to re-evaluate poly-drug driving data
- Drug-positive driver data after applying method
- Future work
- Additional resources



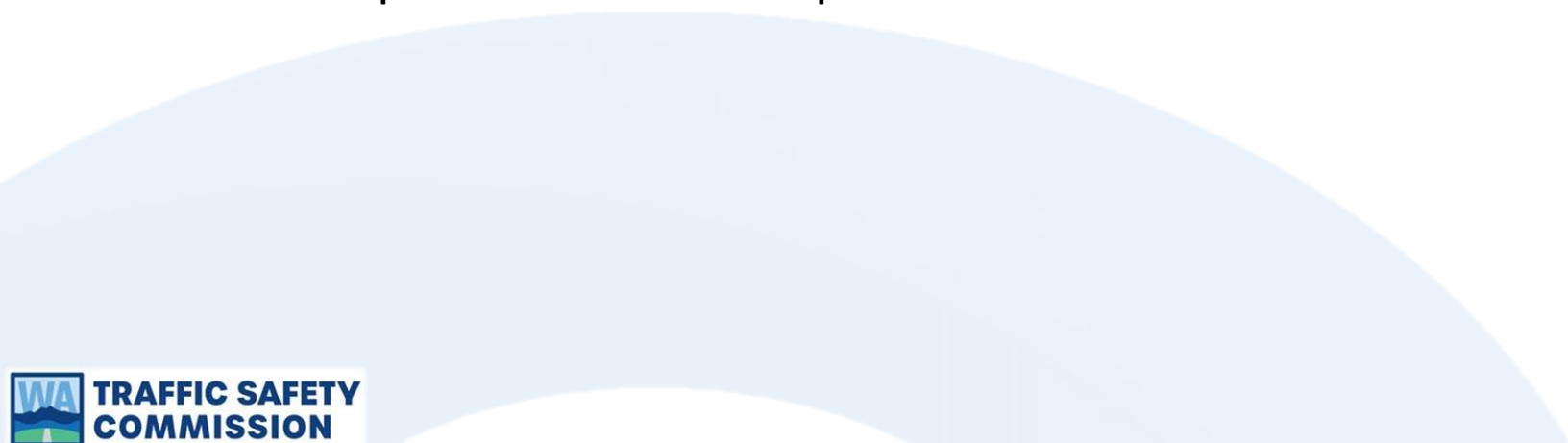
WASHINGTON TRAFFIC SAFETY COMMISSION

- The Washington Traffic Safety Commission (WTSC) is Washington's designated highway safety office
- Leads statewide efforts and builds partnerships to save lives and prevent injuries on Washington roadways
- Target Zero is the vision to reduce traffic fatalities and serious injuries to zero by 2030

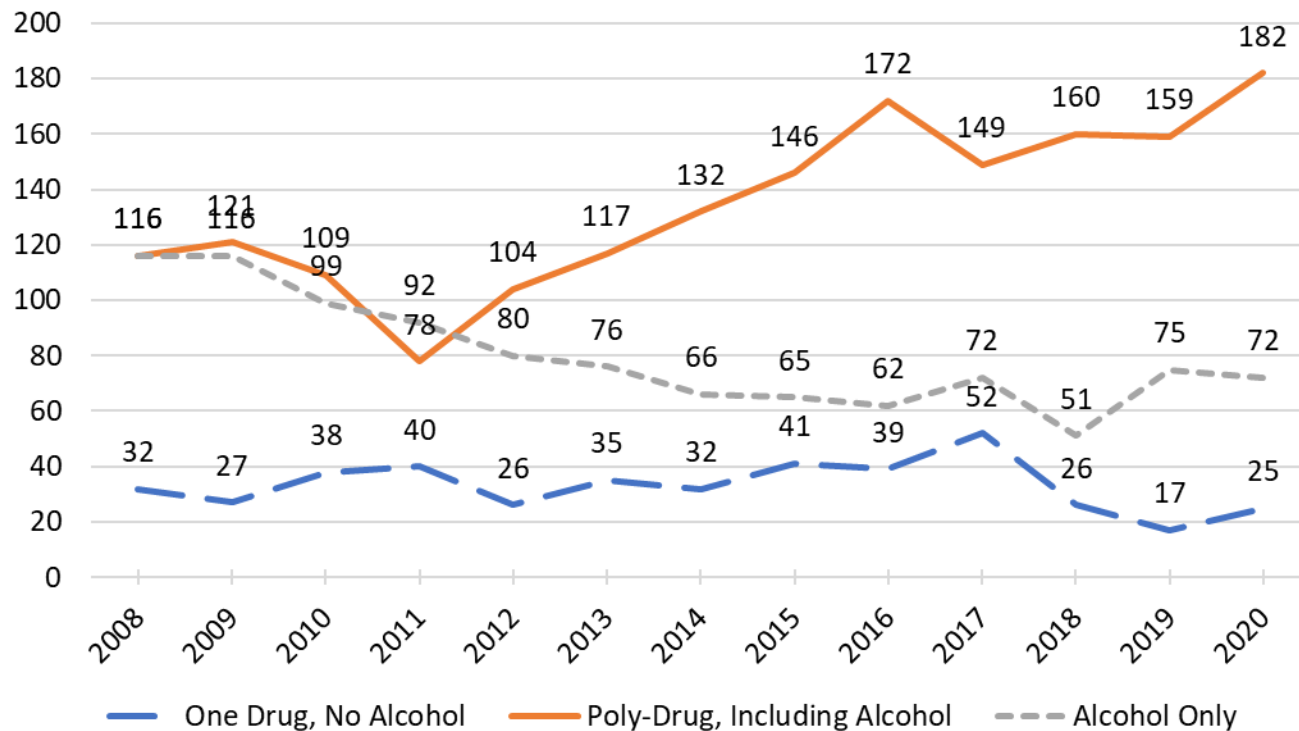


WHAT IS A POLY-DRUG POSITIVE DRIVER?

1. A driver that is positive for alcohol and one or more other drugs as confirmed by toxicology testing
 - Example: Alcohol + THC
2. A driver that is positive for two or more drugs that are not alcohol as confirmed by toxicology testing
 - Example: THC + methamphetamine



DRUG AND/OR ALCOHOL POSITIVE DRIVERS INVOLVED IN A FATAL CRASH



SCENARIO



Toxicology Results	
drug 1	acetaminophen
drug 2	caffeine
drug 3	carboxy-thc
drug 4	diltiazem
drug 5	nicotine/cotinine



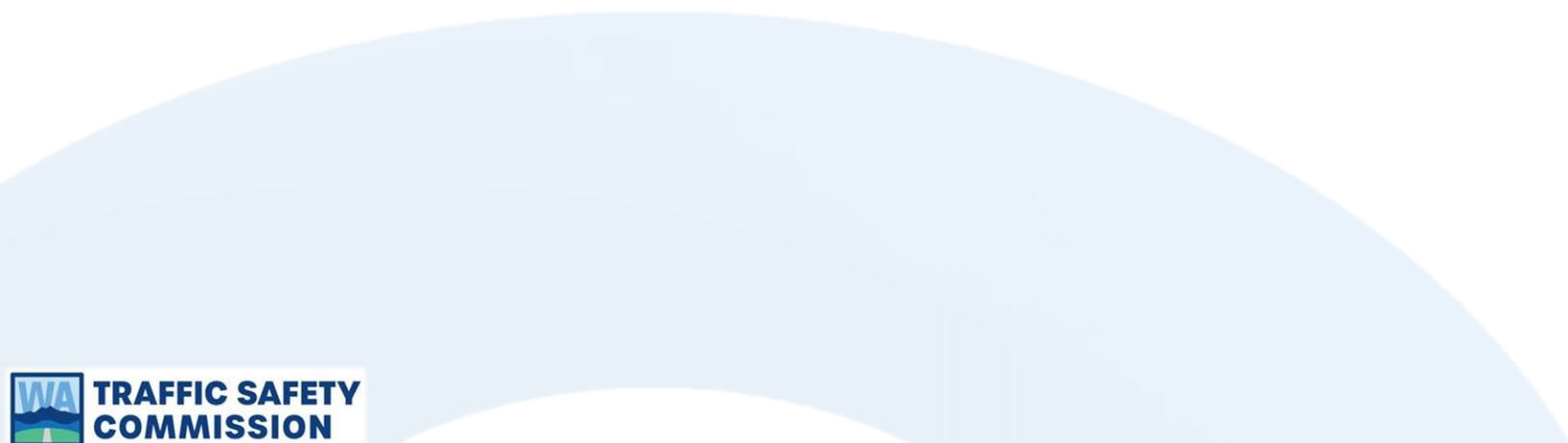
Drug data after cleaning	
drug 1	-
drug 2	-
drug 3	-
drug 4	-
drug 5	-

Before Cleaning

During Cleaning

After Cleaning

DRUG-POSITIVE DRIVER DATA BEFORE CLEANING



BEGINNING DRUG-POSITIVE DRIVER DATA*

Before Cleaning

During Cleaning

After Cleaning

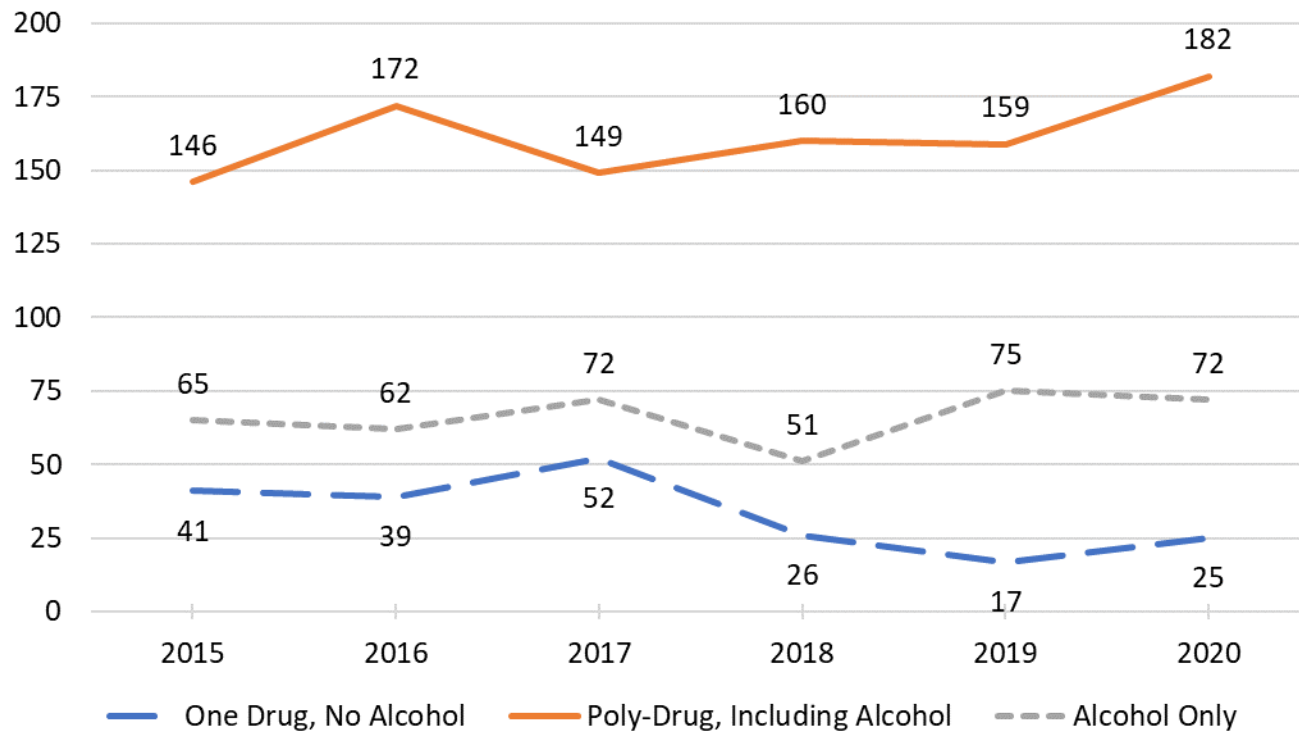
- Washington Coded Fatal Crash (CFC) files
- Toxicology data linked with traffic fatality data from 2015-2020 (6 years)
- All drivers involved in a fatal crash with a positive toxicology drug results (n=1,193)
 - Excludes officer-reported impairment
- 125 Total unique drugs (e.g., 'THC' 'fentanyl' 'midazolam')
- 373 Distinct drug combinations (e.g., 'THC' + 'carboxy- THC')

Before Cleaning

During Cleaning

After Cleaning

DRUG AND/OR ALCOHOL POSITIVE DRIVERS INVOLVED IN A FATAL CRASH



- 'Poly-Drug' and 'Alcohol Only' includes *any* alcohol greater than a BAC of zero

NUMBER OF DRUGS AMONG DRUG-POSITIVE DRIVERS INVOLVED IN A FATAL CRASH*

Before Cleaning

During Cleaning

After Cleaning

- Majority of drug-positive drivers tested positive for two drugs (~44%)
- ~23% tested positive for one drug
- ~77% tested positive for two or more drugs

Number of Drugs	Frequency	Percent
2	521	43.67
1	274	22.97
3	197	16.51
4	93	7.80
5	61	5.11
6	23	1.93
7	10	0.84
8	8	0.67
10	3	0.25
9	2	0.17
11	1	0.08

Before Cleaning

During Cleaning

After Cleaning

MOST FREQUENT DRUG COMBINATIONS AMONG DRUG-POSITIVE DRIVERS*

- 'thc' + 'carboxy-thc' was the most common drug combination (~23%)
- 'amphetamine' + 'methamphetamine' was the second most common drug combination (~9%)
- ~33% of drug-positive drivers had *only* forms of cannabis

Drug Combos	Frequency	Percent
1 carboxy-thc & thc	278	23.3
2 amphetamine & methamphetamine	103	8.63
3 thc	39	3.27
4 carboxy-thc	30	2.51
5 11-hydroxy delta 9 thc & carboxy-thc & thc	28	2.35
6 amphetamine & carboxy-thc & methamphetamine & thc	25	2.1
7 midazolam	25	2.1
8 carboxyhemoglobin	21	1.76
9 methamphetamine	20	1.68
10 cannabinoids & carboxy-thc & thc	13	1.09
11 citalopram	12	1.01
12 benzoylecgonine & carboxy-thc & thc	11	0.92
13 amphetamine & methamphetamine & morphine	10	0.84
14 benzoylecgonine	10	0.84
15 morphine	10	0.84
16 carboxy-thc & midazolam & thc	9	0.75
17 diphenhydramine	9	0.75
18 fluoxetine & norfluoxetine	9	0.75
19 carboxy-thc & methamphetamine & thc	8	0.67
20 ketamine & norketamine	8	0.67

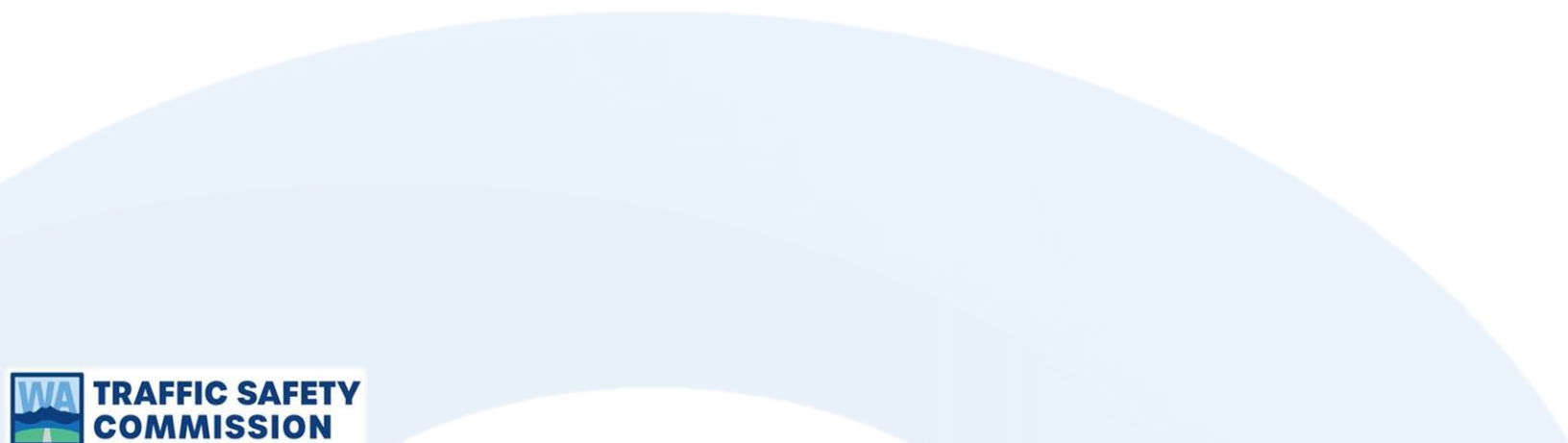
*Excluding alcohol

Before Cleaning

During Cleaning

After Cleaning

DRUG-POSITIVE DRIVER DATA CLEANING METHODOLOGY



IDENTIFYING POTENTIAL FOR IMPAIRMENT

- Impairing
 - Clear evidence and understanding of drugs ability to impair driving abilities
 - Methamphetamine, benzodiazepines, THC, zolpidem (Ambien)
- Potentially impairing
 - Evidence may be mixed, but the potential for the drug to impair driving abilities exists
 - SSRI antidepressants, antihistamines, pseudoephedrine
- Non-impairing
 - Drugs do not have serious impairing effects on driving ability
 - Caffeine, acetaminophen, non-active metabolites

SCREENING OUT DRUGS UNDER CERTAIN CONDITIONS

- Non-impairing drugs removed (n=14)
 - Acetaminophen, benzene, caffeine, carboxyhemoglobin, glucose, ibuprofen, ketones, naloxone, nicotine/cotinine, quinine, salicylate, theobromine, trimethoprim, yohimbine
- Non-impairing, non-active metabolites removed if they are alone with no parent drug present (n=4)
 - Benzoylcegonine, carboxy-THC, ecgonine methyl ester, norfentanyl
- Non-impairing pharmaceuticals removed if alcohol is not present (n=13)
 - Dextromorphan, diltiazem, glipizide, metformin, nifedipine, pseudoephedrine, norpseudoephedrine, risperidone, 9-hydroxyrisperidone, warfarin

MATCHING PARENT DRUGS WITH METABOLITES

Before Cleaning

During Cleaning

After Cleaning

- When a drug is taken, the body quickly begins to metabolize it
- If 'THC' and 'carboxy- THC' are present, this should not be treated as two separate impairing drugs, but rather a single drug that has been/is being metabolized, 'THC /carboxy- THC'

	drug1	drug2	drug3
001	thc	carboxy-thc	



	drug1	drug2	drug3
001	thc/carboxy-thc		

PARENT-METABOLITE COMPOUNDS

Before Cleaning

During Cleaning

After Cleaning

- 39 parent drugs matched with their metabolites

Parent-Metabolite
1 amitriptyline / nortriptyline
2 alprazolam / alprazolam metabolite
3 buprenorphine / norbuprenorphine
4 bupropion / bupropion metabolite
5 thc / 11-hydroxy delta 9 thc
6 thc / carboxy-thc
7 thc / carboxy-thc / 11-hydroxy delta 9 thc
8 chlordiazepoxide / nordiazepam
9 citalopram / desmethylcitalopram
10 citalopram / norcitalopram
11 clonazepam / 7-aminoclonazepam
12 cocaine / benzoylecgonine
13 cocaine / benzoylecgonine / cocaethylene
14 cocaine / benzoylecgonine / ecgonine methyl ester
15 cocaine / benzoylecgonine / ecgonine methyl ester / cocaethylene
16 codeine / morphine
17 diazepam / nordiazepam
18 doxepin / desmethyldoxepin
19 fentanyl / norfentanyl
20 fluoxetine / norfluoxetine

Parent-Metabolite
21 hydrocodone / dihydrocodeine
22 hydrocodone / hydromorphone
23 hydrocodone / dihydrocodeine / hydromorphone
24 isopropanol / acetone
25 ketamine / norketamine
26 lidocaine / monoethylglycinexylidide
27 methadone / eddp
28 methamphetamine / amphetamine
29 oxycodone / oxymorphone
30 propoxyphene / norpropoxyphene
31 pseudoephedrine / norpseudoephedrine
32 risperidone / 9-hydroxyrisperidone
33 sertraline / desmethylsertraline
34 sertraline / norsertraline
35 topiramate / topiramate metabolite
36 tramadol / o-desmethyltramadol
37 venlafaxine / norvenlafaxine
38 venlafaxine / o-desmethylvenlafaxine
39 verapamil / norverapamil

SCREENING VS. CONFIRMATORY RESULTS

Before Cleaning

During Cleaning

After Cleaning

- Six different screening results periodically appeared in toxicology reports

Screening:	amphetamines	barbiturates	benzodiazepines	cannabinoids	opiates	tricyclic antidepressants
Confirmatory:	amphetamine	butalbital	7-aminoclonazepam	11-hydroxy delta 9 thc	6-acetylmorphine	amitriptyline
	mdma	phenobarbital	alprazolam	carboxy-thc	codeine	cyclobenzaprine
	methamphetamine		chlordiazepoxide	thc	fentanyl	doxepin
	phentermine		clonazepam		hydrocodone	nortriptyline
			desalkylflurazepam		hydromorphone	
			diazepam		morphine	
			flurazepam		norfentanyl	
			lorazepam		oxycodone	
			midazolam		oxymorphone	
			nordiazepam			
			oxazepam			
			temazepam			

SCREENING VS. CONFIRMATORY RESULTS

Before Cleaning

During Cleaning

After Cleaning

- Removing screening results when confirmatory results are present

	drug1	drug2	drug3
001	cannabinoids	thc/carboxy-thc	



	drug1	drug2	drug3
001	thc/carboxy-thc		

	drug1	drug2	drug3
001	codeine	opiates	oxycodone



	drug1	drug2	drug3
001	codeine	oxycodone	

SUMMARY OF METHODOLOGY

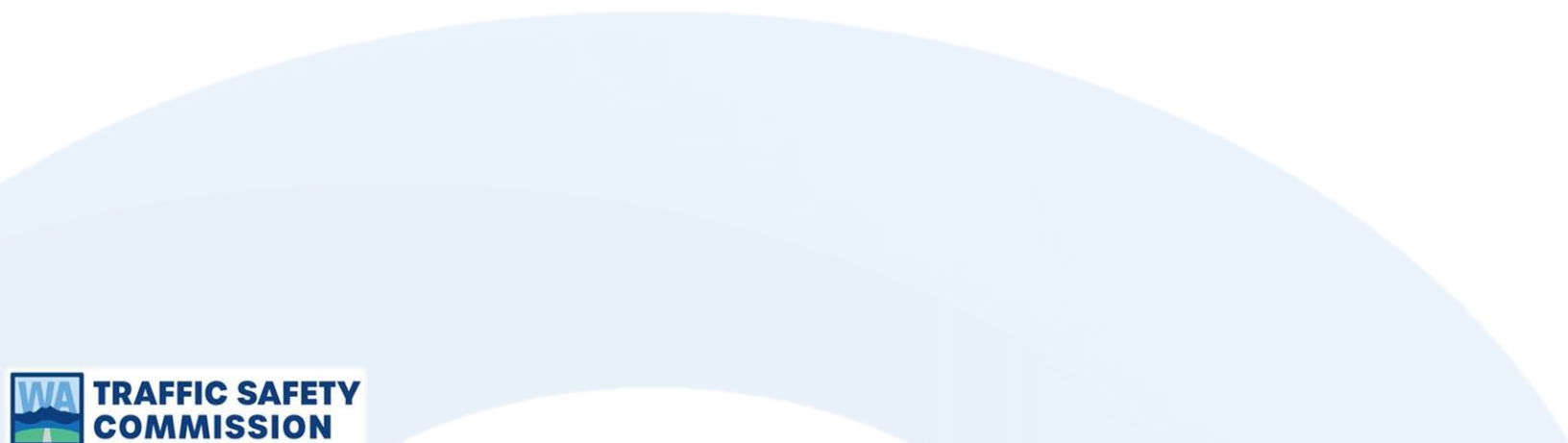
1. Identify drugs' potential for impairment
2. Remove apparent non-impairing drugs
3. Remove non-impairing, non-active metabolites if they are alone with no parent drug present
4. Remove non-impairing pharmaceutical drugs if alcohol is not present
5. Match parent drugs with their metabolites
6. Remove screening results if confirmatory results are present

Before Cleaning

During Cleaning

After Cleaning

DRUG-POSITIVE DRIVER DATA AFTER CLEANING



DRUG-POSITIVE DRIVER DATA*

- All drivers involved in a fatal crash with a positive toxicology drug result: n=1,101 (previously 1,193)
 - 92 (7.7%) drivers removed
- Total unique drugs after cleaning (e.g., 'thc' 'fentanyl' 'midazolam')
 - 106 (previously 125)
- Distinct drug combinations (e.g., 'thc/carboxy-thc' + 'methamphetamine' or 'opiates' + 'midazolam')
 - 363 (previously 373)
- Maximum number of drugs: 8 (previously 11)

Before Cleaning

During Cleaning

After Cleaning

CHANGE IN NUMBER OF DRUGS AMONG DRUG-POSITIVE DRIVERS*

- Majority of cases had one drug (~67%)
 - Previously majority had two drugs (~44%)
- ~67% of cases had one drug
 - Previously ~23%
- ~33% of cases had two or more drugs
 - Previously ~77%

Number of Drugs	Frequency	Percent
1	736	66.85
2	237	21.53
3	82	7.45
4	28	2.54
5	10	0.91
6	4	0.36
7	2	0.18
8	2	0.18

Before Cleaning

During Cleaning

After Cleaning

CHANGE IN NUMBER OF DRUGS AMONG DRUG-POSITIVE DRIVERS*

BEFORE

Number of Drugs	Frequency	Percent
2	521	43.67
1	274	22.97
3	197	16.51
4	93	7.80
5	61	5.11
6	23	1.93
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AFTER

Number of Drugs	Frequency	Percent
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*Excluding alcohol

CHANGE IN MOST FREQUENT DRUG COMBINATIONS AMONG DRUG-POSITIVE DRIVERS*

Before Cleaning

During Cleaning

After Cleaning

- 'thc/carboxy-thc' was the most common drug combination (~28%)
 - Previously 'thc' + 'carboxy-thc' (~23%)
- 'methamphetamine/amphetamine' was the second most common drug combination (~10%)
 - Previously 'amphetamine' + 'methamphetamine' (~9%)
- ~34% had *only* forms of cannabis
 - Previously ~33%

Drug Combos	Frequency	Percent
thc/carboxy-thc	303	27.52
methamphetamine/amphetamine	110	9.99
thc	42	3.81
thc/carboxy-thc/11-hydroxy delta 9 thc	31	2.82
midazolam	30	2.72
methamphetamine	27	2.45
thc/carboxy-thc & methamphetamine/amphetamine	26	2.36
citalopram	13	1.18
fluoxetine/norfluoxetine	10	0.91
methamphetamine/amphetamine & morphine	10	0.91
morphine	10	0.91
diphenhydramine	9	0.82
thc/carboxy-thc & methamphetamine	9	0.82
thc/carboxy-thc & midazolam	9	0.82
hydrocodone	8	0.73
ketamine/norketamine	8	0.73
trazodone	8	0.73
amphetamine	6	0.54
diazepam/nordiazepam	6	0.54
methamphetamine/amphetamine & phenylpropanolamine	6	0.54

*Excluding alcohol

Before Cleaning

During Cleaning

After Cleaning

CHANGE IN MOST FREQUENT DRUG COMBINATIONS AMONG DRUG-POSITIVE DRIVERS*

BEFORE

AFTER

Drug Combos	Frequency	Percent	Drug Combos	Frequency	Percent
1 carboxy-thc & thc	278	23.3	thc/carboxy-thc	303	27.52
2 amphetamine & methamphetamine	103	8.63	methamphetamine/amphetamine	110	9.99
3 thc	39	3.27	thc	42	3.81
4 carboxy-thc	30	2.51	thc/carboxy-thc/11-hydroxy delta 9 thc	31	2.82
5 11-hydroxy delta 9 thc & carboxy-thc & thc	28	2.35	midazolam	30	2.72
6 amphetamine & carboxy-thc & methamphetamine & thc	25	2.1	methamphetamine	27	2.45
7 midazolam	25	2.1	thc/carboxy-thc & methamphetamine/amphetamine	26	2.36
8 carboxyhemoglobin	21	1.76	citalopram	13	1.18
9 methamphetamine	20	1.68	fluoxetine/norfluoxetine	10	0.91
10 cannabinoids & carboxy-thc & thc	13	1.09	methamphetamine/amphetamine & morphine	10	0.91
11 citalopram	12	1.01	morphine	10	0.91
12 benzoylecgonine & carboxy-thc & thc	11	0.92	diphenhydramine	9	0.82
13 amphetamine & methamphetamine & morphine	10	0.84	thc/carboxy-thc & methamphetamine	9	0.82
14 benzoylecgonine	10	0.84	thc/carboxy-thc & midazolam	9	0.82
15 morphine	10	0.84	hydrocodone	8	0.73
16 carboxy-thc & midazolam & thc	9	0.75	ketamine/norketamine	8	0.73
17 diphenhydramine	9	0.75	trazodone	8	0.73
18 fluoxetine & norfluoxetine	9	0.75	amphetamine	6	0.54
19 carboxy-thc & methamphetamine & thc	8	0.67	diazepam/nordiazepam	6	0.54
20 ketamine & norketamine	8	0.67	methamphetamine/amphetamine & phenylpropanolamine	6	0.54

Before Cleaning

During Cleaning

After Cleaning

COMBINING DRUGS AND ALCOHOL*

- Drivers positive for alcohol and/or drugs
 - n=1,534
 - 433 positive for alcohol only
- Majority, alcohol only (28%)
- Followed by alcohol and THC/carboxy-THC (11%)

Drug Combos	Frequency	Percent
alcohol	433	28.23
alcohol & thc/carboxy-thc	171	11.15
thc/carboxy-thc	132	8.6
methamphetamine/amphetamine	85	5.54
alcohol & thc	27	1.76
alcohol & methamphetamine/amphetamine	25	1.63
midazolam	24	1.56
alcohol & thc/carboxy-thc/11-hydroxy delta 9 thc	21	1.37
methamphetamine	21	1.37
thc/carboxy-thc & methamphetamine/amphetamine	17	1.11
thc	15	0.98
methamphetamine/amphetamine & morphine	10	0.65
thc/carboxy-thc/11-hydroxy delta 9 thc	10	0.65
alcohol & thc/carboxy-thc & methamphetamine/amphetamine	9	0.59
morphine	8	0.52
trazodone	8	0.52
alcohol & citalopram	7	0.46
fluoxetine/norfluoxetine	7	0.46
hydrocodone	7	0.46
ketamine/norketamine	7	0.46

*Any BAC greater than zero

MOST COMMON DRUGS PAIRED WITH ALCOHOL*

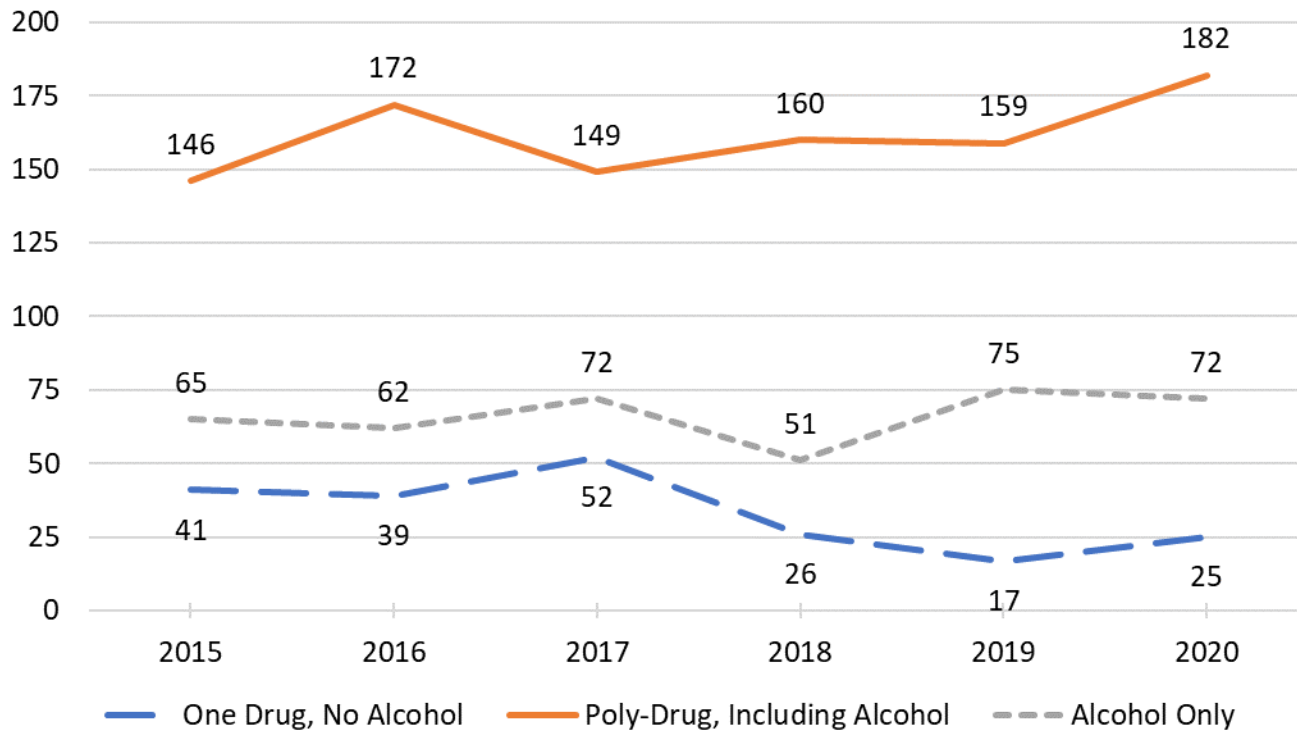
- THC/carboxy-THC most common drug paired with alcohol (~20%)
- Just THC was second most common (3%)
- Methamphetamine/amphetamine was third most common (2.9%)

	Frequency	Percent
alcohol	433	49.71
alcohol & thc/carboxy-thc	171	19.63
alcohol & thc	27	3.1
alcohol & methamphetamine/amphetamine	25	2.87
alcohol & thc/carboxy-thc/11-hydroxy delta 9 thc	21	2.41
alcohol & thc/carboxy-thc & methamphetamine/amphetamine	9	1.03
alcohol & citalopram	7	0.8
alcohol & methamphetamine	6	0.69
alcohol & midazolam	6	0.69
alcohol & thc/carboxy-thc & midazolam	6	0.69
alcohol & cocaine/benzoyllecgonine/cocaethylene	4	0.46
alcohol & diphenhydramine	4	0.46
alcohol & thc/carboxy-thc & methamphetamine	4	0.46
alcohol & cocaethylene	3	0.34
alcohol & diazepam/nordiazepam	3	0.34
alcohol & fluoxetine/norfluoxetine	3	0.34
alcohol & methamphetamine/amphetamine & thc	3	0.34
alcohol & midazolam & morphine	3	0.34
alcohol & thc/carboxy-thc & cocaine/benzoyllecgonine/cocae	3	0.34

*Any BAC greater than zero

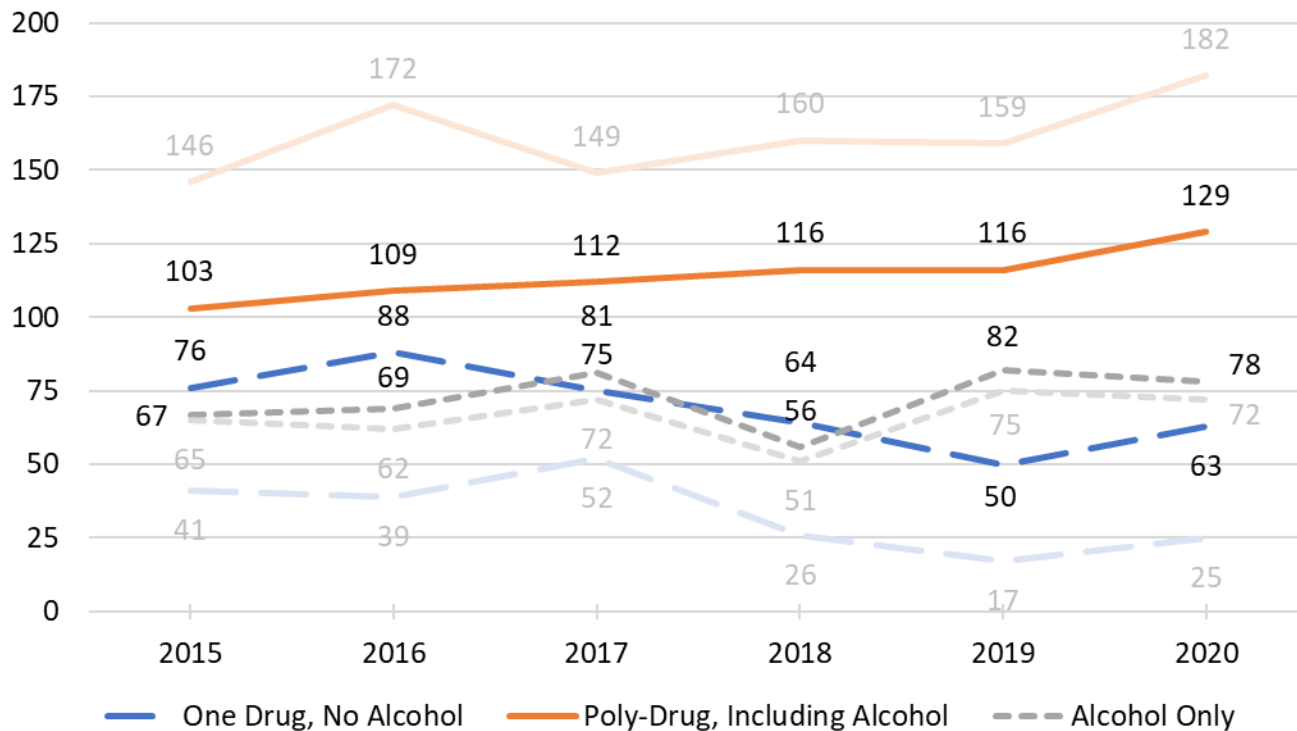
DRUG AND/OR ALCOHOL POSITIVE DRIVERS INVOLVED IN A FATAL CRASH

BEFORE



DRUG AND/OR ALCOHOL POSITIVE DRIVERS INVOLVED IN A FATAL CRASH

AFTER



DRUG OR ALCOHOL STATUS FOR DRIVERS INVOLVED IN A FATAL CRASH

- Poly-drug (including alcohol)-positive drivers involved in a fatal crash decreased by 29% in 2020
 - From 182 to 129
- One drug (no alcohol)-positive drivers involved in a fatal crash increased by 152% in 2020
 - From 25 to 63
- Alcohol only-positive drivers involved in a fatal crash increased by ~8%
 - From 72 to 78

NEEDS WORK...

Before Cleaning

During Cleaning

After Cleaning

Future Work

- Identifying drugs administered by EMS post-crash
 - Linkage with Toxicology and EMS data
- Analyzing poly-drug data among non-motorists
- Updating historical data files to reflect change
- Updating data dashboards

NEEDS WORK...

Before Cleaning

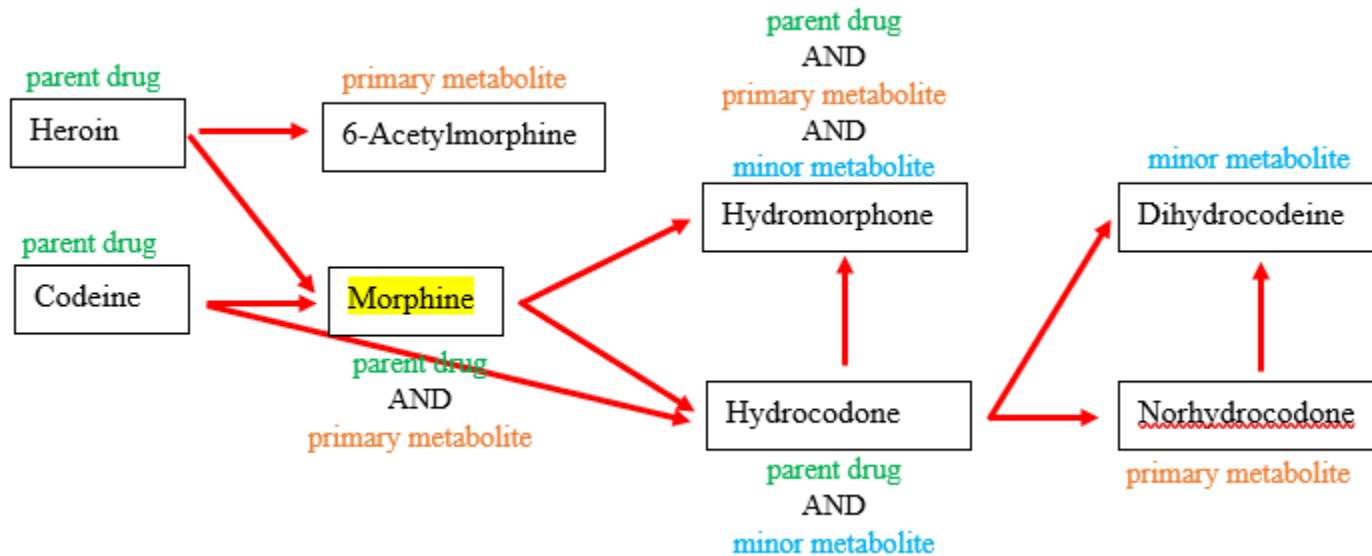
During Cleaning

After Cleaning

Future Work

- Morphine. It's complicated...

	drug1	drug2	drug3
001	codeine	hydrocodone	morphine
002	hydrocodone	hydromorphone	morphine
003	codeine	hydrocodone	?
004	hydrocodone	morphine	



WTSC RESEARCH AND DATA DIVISION PRODUCTS

- WTSC.wa.gov
- Traffic Safety Reports
 - <https://wtsc.wa.gov/research-data/traffic-safety-reports/>
 - Emerging Issues with Poly-Drug Use on Washington Roadways
 - http://wtsc.wa.gov/wp-content/uploads/dlm_uploads/2018/05/Marijuana-and-Alcohol-Involvement-in-Fatal-Crashes-in-WA_FINAL.pdf
 - Driver Toxicology and the Involvement of Marijuana in Fatal Crashes, 2010-2014: A Descriptive Report
 - http://wtsc.wa.gov/wp-content/uploads/dlm_uploads/2018/05/Driver-Toxicology-Testing-and-the-Involvement-of-Marijuana-in-Fatal-Crashes_REVFeb2016.pdf
- Data Dashboards
 - <https://wtsc.wa.gov/research-data/dashboards/>
 - Alcohol or Drug Positive Drivers, Pedestrians and Cyclists
 - <https://wtsc.wa.gov/research-data/impairment/>

Thank You

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