



IMPROVING AND UNDERSTANDING POLY-DRUG INFORMATION

Max Roberts, PhD

Research Associate, Washington Traffic Safety Commission

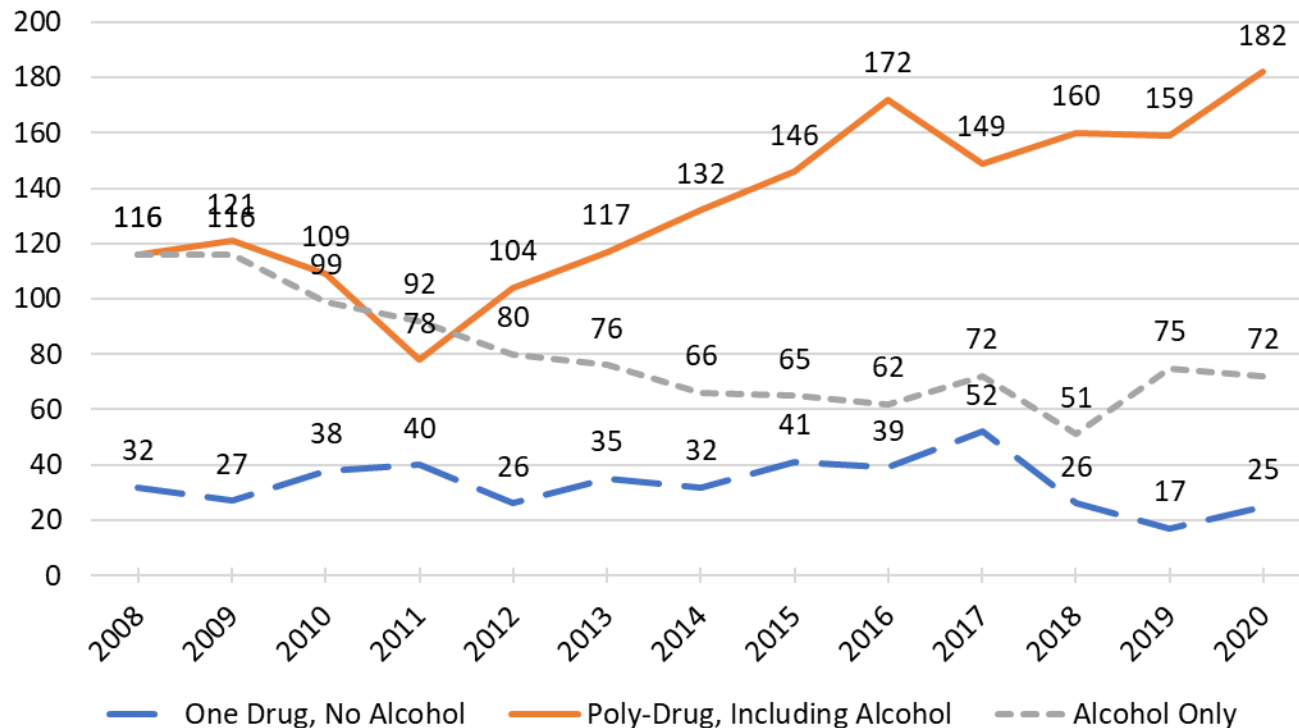
WTSC Quarterly Meeting

October 20, 2022

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



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

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	-

IDENTIFYING POTENTIAL FOR IMPAIRMENT

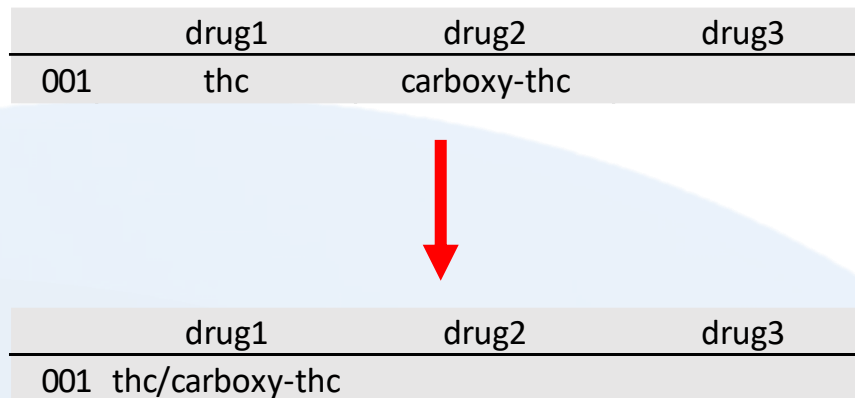
- Impairing
 - Clear evidence and understanding of drugs ability to impair driving abilities
 - Methamphetamine, benzodiazepines, THC, zolpidem (Ambien)
- Potentially impairing
 - Evidence may be mixed, but the potential for the drug to impair driving abilities exists
 - SSRI antidepressants, antihistamines, 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

- 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'
- 39 parent-metabolite combinations formed



PARENT-METABOLITE COMPOUNDS

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 / norsesertaline
- 35 topiramate / topiramate metabolite
- 36 tramadol / o-desmethyltramadol
- 37 venlafaxine / norvenlafaxine
- 38 venlafaxine / o-desmethylvenlafaxine
- 39 verapamil / norverapamil

SCREENING VS. CONFIRMATORY RESULTS

- 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

- 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	

DRUG-POSITIVE DRIVER DATA*

- Toxicology drug abstracts linked with traffic fatality data for drivers in fatal crashes from 2015 – 2020 (6 years)

BEFORE

- All drivers involved in a fatal crash with a positive toxicology drug results (n=1,193)
- 125 Total unique drugs
- 373 Distinct drug combinations

AFTER

- All drivers involved in a fatal crash with a positive toxicology drug results (n=1,101)
 - 92 drivers removed
- 106 Total unique drugs
- 363 Distinct drug combinations

*Excluding alcohol

CHANGE IN NUMBER OF DRUGS AMONG 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
7	10	0.84
8	8	0.67
10	3	0.25
9	2	0.17
11	1	0.08

AFTER

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

*Excluding alcohol

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 FREQUENT DRUGS WITH ALCOHOL*

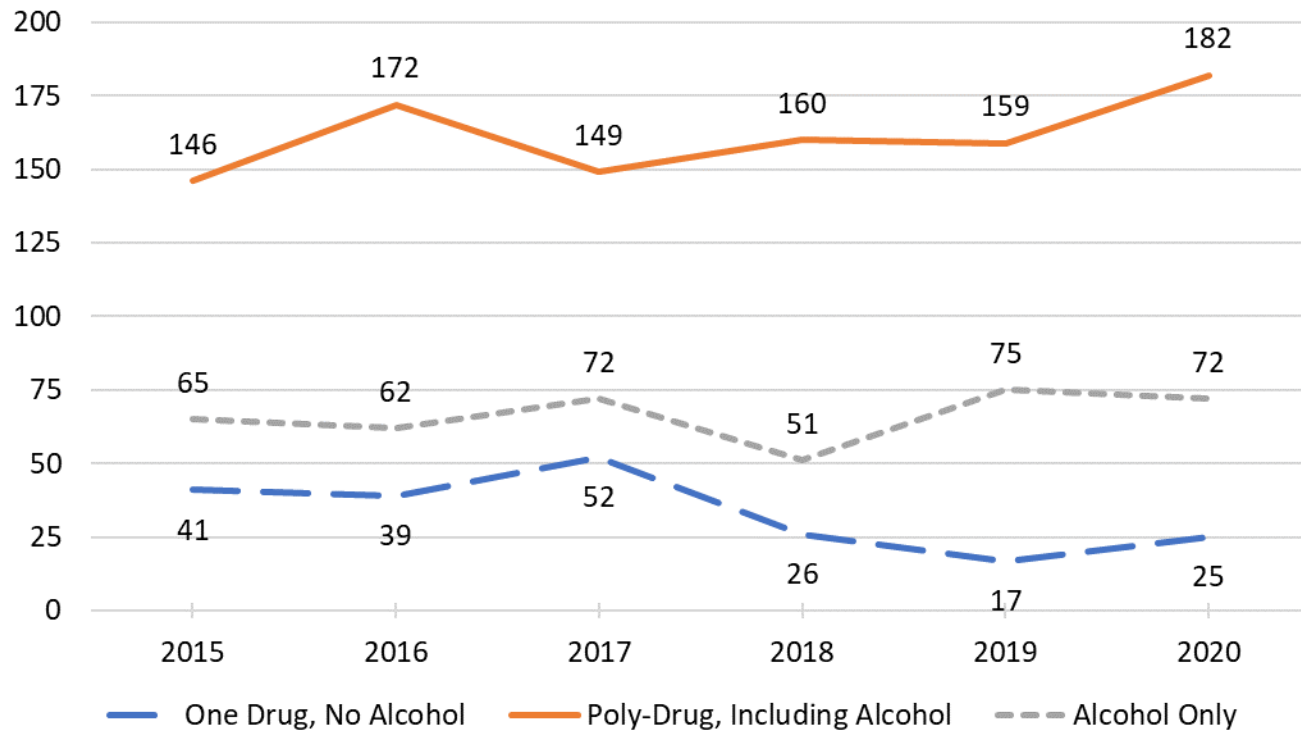
- THC or THC/carboxy-THC is the most common drug paired with alcohol (23%)
- Followed by methamphetamine and amphetamine (3%)

Drug Combos	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/benzoylecgonine/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/benzoylecgonine/cocae	3	0.34

*Any BAC greater than zero

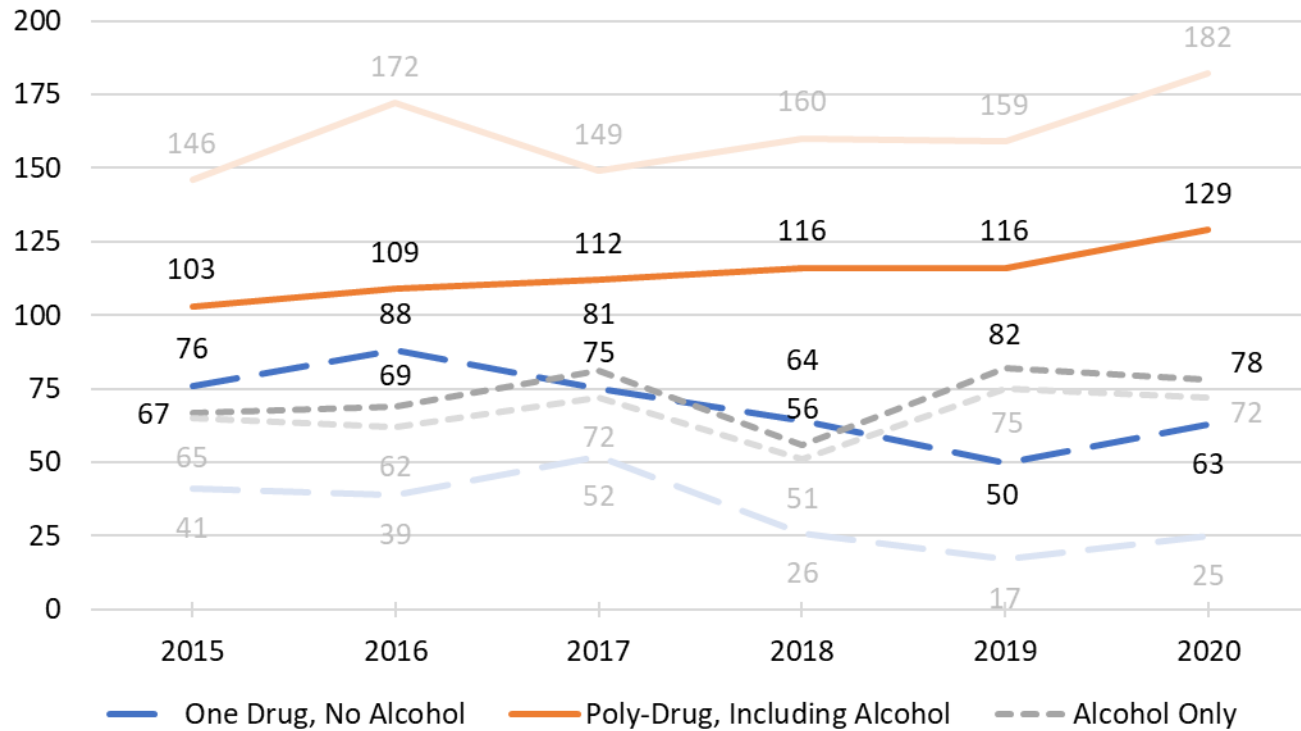
DRUG AND/ OR ALCOHOL POSITIVE DRIVERS INVOLVED IN A FATAL CRASH

BEFORE



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

AFTER



Thank You

Max Robert, PhD, Research Associate

mroberts@wtsc.wa.gov

Washington Traffic Safety Commission

