



# Impaired Driving (DUI) Analyses

## Characteristic of Crashes

(Alabama 2012 Crash Data)

David B. Brown

[brown@cs.ua.edu](mailto:brown@cs.ua.edu)

February 20, 2014

# Purpose of this Presentation

- To Present Impaired Driving Crash (ID) Info
  - To create and improve ID countermeasures
  - To improve their implementations
- To Train on the Use of CARE/IMPACT
  - Critical Analysis Report Environment (CARE)
  - Information Mining Performance Analysis Control Technique (IMPACT)



## Definitions for the Comparison

- Impaired Driving (ID) – used to be DUI/DWI
  - Includes alcohol and all other drugs
  - Filter: **all** possible ID indicators in the crash record
- *Over-Represented* – Proportion Comparison (P)
  - If ID had no effect, proportions would be equal
  - Significance determined by odds ratio
  - Odds ratio =  $P(\text{ID})/P(\text{non-ID})$



Order: Natural Order    Descending     Suppress Zero-Valued Rows    Significance: Over Representation    Threshold: 2.0

**C008: Time of Day**

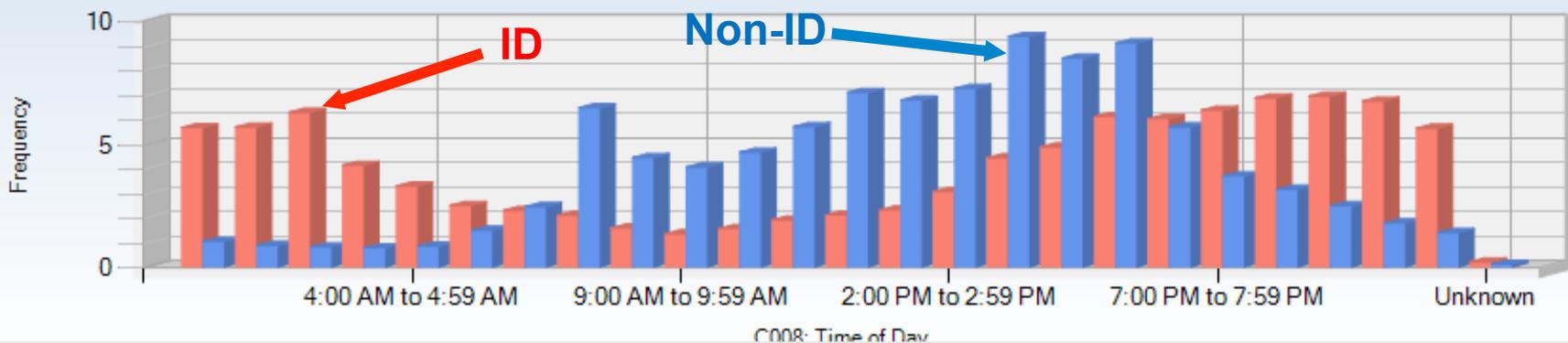
Value	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain
12:00 Midnight to 12:59 AM	395	5.67	1248	1.03	5.510*	323.318
1:00 AM to 1:59 AM	396	5.68	1062	0.88	6.492*	335.001
2:00 AM to 2:59 AM	438	6.28	983	0.81	7.758*	381.539
3:00 AM to 3:59 AM	288	4.13	938	0.77	5.346*	234.123
4:00 AM to 4:59 AM	229	3.29	1021	0.84	3.905*	170.356
5:00 AM to 5:59 AM	174	2.50	1799	1.48	1.684*	70.670
6:00 AM to 6:59 AM	160	2.30	2970	2.45	0.938	-10.590
7:00 AM to 7:59 AM	146	2.09	7854	6.47	0.324*	-305.115
8:00 AM to 8:59 AM	110	1.58	5386	4.44	0.356*	-199.359
9:00 AM to 9:59 AM	93	1.33	4926	4.06	0.329*	-189.938

- C124: CU Driver Alcohol Test Type Given
  - C225: CU Citation Issued
  - C227: CU Vehicle Towed
  - C126: CU Driver Alcohol Test Results
  - C204: E CU Sequence of Events #1
  - C123: CU Driver Officer Opinion Drugs
  - C205: E CU Sequence of Events #2
  - C017: First Harmful Event
  - C201: CU Vehicle Most Harmful Event
  - C008: Time of Day
  - C019: E Most Harmful Event
  - C031: Lighting Conditions
  - C023: E Manner of Crash
- Sort by Sum of Max Gain



Display Filter Name

2012 Alabama Integrated Crash Data  
C008: Time of Day



# Definitions for IMPACT

- **Max Gain – Maximum Expected Gain**
  - This is the reduction in crashes that would occur if some magical countermeasure could eliminate just the over-representation
  - IMPACT outputs are generally ordered by Max Gain
- **CARE Facilitates Any Ordering**
  - Max Gain, Natural, Odds Ratio, Frequency
  - Graphically rearranges cells accordingly



# Why Questions?

The questions posed are designed to enable you to understand what information is being conveyed by the displays. Please take a shot at answering the question prior to viewing the chart that contains the answer.

If you know the answers to over 80% of the posed questions correctly, we estimate that this puts you in the top 95% of experts on Impaired Driving (ID) crashes worldwide. As you will see, the questions are not trivial.

All answers come from Alabama 2012 crash data, which is fairly typical of most states as well as Alabama's current situation.



## Questions Related to Reporting

# Overall Impaired Driving Reported

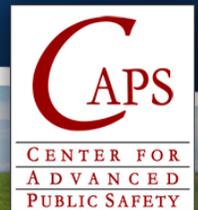
Multiple Choice

What proportion of crashes in Alabama are reported to involve **impaired driving (ID)**?

5%

10%

20%



**Answer:**

## Overall Impaired Driving Reported

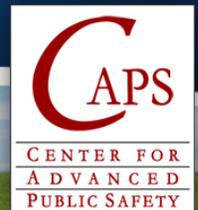
Multiple Choice

What proportion of crashes in Alabama are reported to involve **impaired driving (ID)**?

**5%**       $6,970/128,319 = 0.0543$

10%

20%



# Questions Related to Reporting Overall Impaired Driving Reported

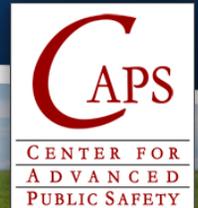
Multiple Choice

What proportion of fatal crashes in  
Alabama  
are reported to involve **impaired driving  
(ID)**?

10%

20%

30%



**Answer:**

## Overall Impaired Driving Reported

Multiple Choice

What proportion of fatal crashes in Alabama

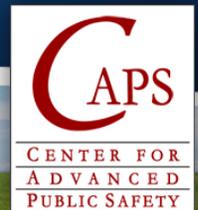
are *reported* to involve **impaired driving (ID)**?

10%

20%

30%

$$190/812 = .234 = 23.4\%$$



# Questions Related to Reporting Officer Opinion Entries

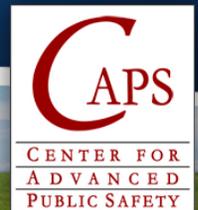
Multiple Choice

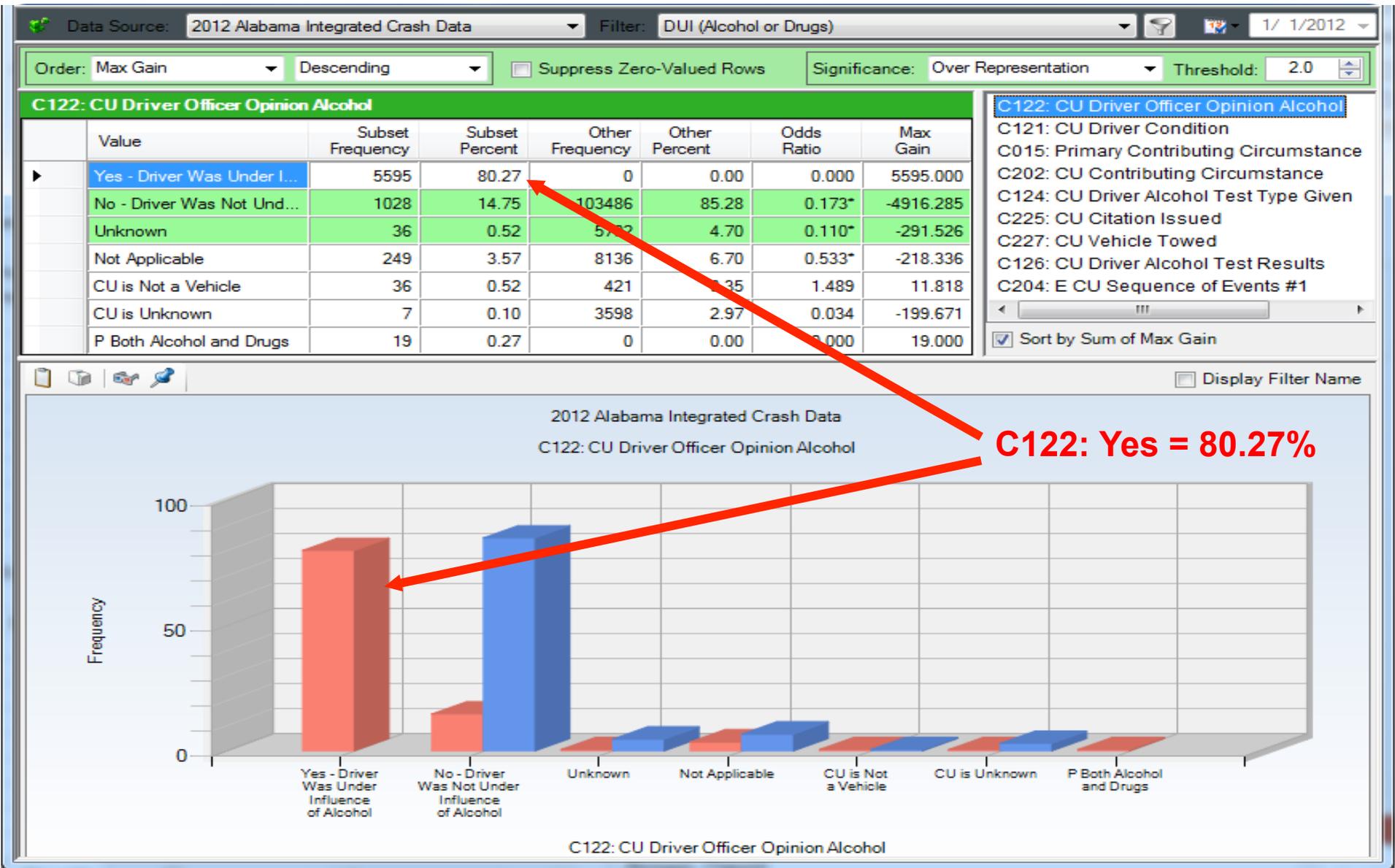
What proportion of all “ID crashes” in  
Alabama  
are reported as “YES” in the **Officer’s  
Opinion?**

60%

80%

95%





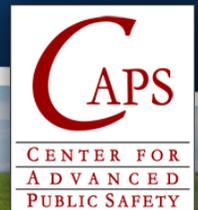
# Questions Related to Reporting BAC Levels (Legally Impaired at 0.08)

**For causal drivers for which a BAC test is given, which has the greatest BAC frequency?**

Less than 0.099

0.10 to 0.199

0.20 or greater



**C126: CU Driver Alcohol Test Results**

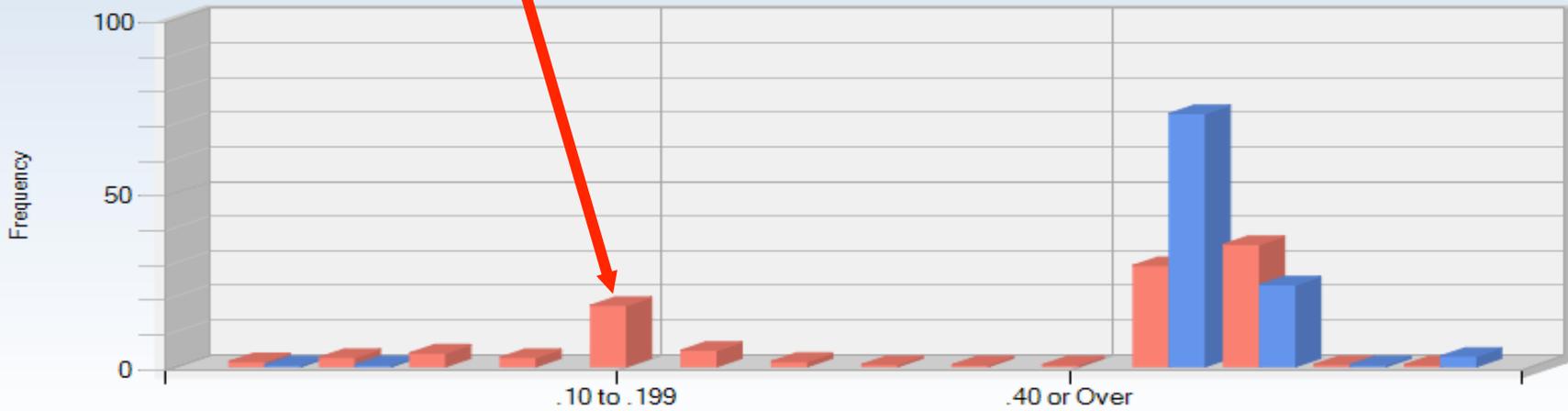
	Value	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain
▶	0.00	93	1.40	235	0.19	7.219*	80.118
	.01 to .039	173	2.61	2	0.00	1578.000	172.890
	.04 to .079	257	3.87	0	0.00	0.000	257.000
	.08 to .099	172	2.59	0	0.00	0.000	172.000
	.10 to .199	1169	17.61	0	0.00	0.000	1169.000
	.20 to .249	309	4.65	0	0.00	0.000	309.000
	.25 to .299	97	1.46	0	0.00	0.000	97.000
	.30 to .349	38	0.57	0	0.00	0.000	38.000
	.35 to .399	10	0.15	0	0.00	0.000	10.000
	.40 or Over	8	0.12	0	0.00	0.000	8.000
	No Test Given	1934	29.13	88337	72.93	0.399*	-2908.302

- C122: CU Driver Officer Opinion Alcohol
- C121: CU Driver Condition
- C015: Primary Contributing Circumstance
- C202: CU Contributing Circumstance
- C124: CU Driver Alcohol Test Type Given
- C225: CU Citation Issued
- C227: CU Vehicle Towed
- C126: CU Driver Alcohol Test Results
- C204: E CU Sequence of Events #1
- C123: CU Driver Officer Opinion Drugs
- C205: E CU Sequence of Events #2
- C017: First Harmful Event
- C201: CU Vehicle Most Harmful Event
- C008: Time of Day

Sort by Sum of Max Gain

Display Filter Name

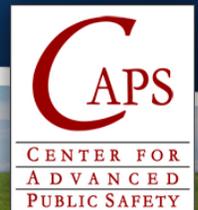
2012 Alabama Integrated Crash Data  
C126: CU Driver Alcohol Test Results



# Questions Related to Reporting Drug Proportion

True or False:

**Drugs were reportedly involved in over  
20% of impaired driving crashes**



Order: Subset Frequency    Descending     Suppress Zero-Valued Rows    Significance: Over Representation    Threshold: 2.0

**C123: CU Driver Officer Opinion Drugs**

	Value	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain
▶	No - Driver Was Not Und...	3305	47.42	102951	84.84	0.559*	-2608.555
	Not Applicable	1852	26.57	8671	7.15	3.718*	1353.934
	Yes - Driver Was Under I...	1611	23.11	0	0.00	0.000	1611.000
	Unknown	140	2.01	5702	4.70	0.427*	-187.526
	CU is Not a Vehicle	36	0.52	421	0.35	1.489	11.818
	P Both Alcohol and Drugs	19	0.27	0	0.00	0.000	19.000
	CU is Unknown	7	0.10	3598	2.97	0.034	-199.671

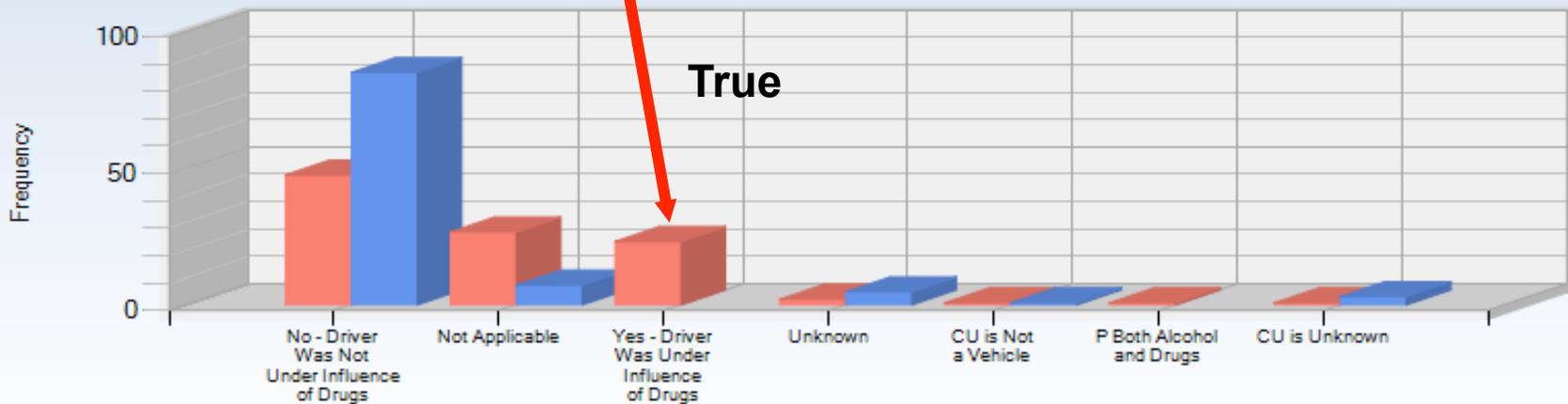
C122: CU Driver Officer Opinion Alcohol  
 C121: CU Driver Condition  
 C015: Primary Contributing Circumstance  
 C202: CU Contributing Circumstance  
 C124: CU Driver Alcohol Test Type Given  
 C225: CU Citation Issued  
 C227: CU Vehicle Towed  
 C126: CU Driver Alcohol Test Results  
 C204: E CU Sequence of Events #1

Sort by Sum of Max Gain



Display Filter Name

2012 Alabama Integrated Crash Data  
 C123: CU Driver Officer Opinion Drugs



C123: CU Driver Officer Opinion Drugs

## Questions Related to Reporting Citations Issued

What proportion of drivers were issued DUI citations when impaired driving was in any way indicated on the crash report?

1/3

1/2

2/3

File Dashboard Filters Analysis Impact Locations Tools Window Help

Data Source: 2012 Alabama Integrated Crash Data Filter: DUI (Alcohol or Drugs) 1/ 1/2012

Order: Subset Frequency Descending  Suppress Zero-Valued Rows Significance: Over Representation Threshold: 2.0

### C225: CU Citation Issued

	Value	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain
▶	Driving Under the Influe...★	2995	43.95	0	0.00	0.000	2995.000
	E None	2370	34.78	94121	85.31	0.408*	-3442.877
	E No Proof of Insurance	332	4.87	9018	8.17	0.596*	-224.948
	Driving Under the Influe...★	295	4.33	0	0.00	0.000	295.000
	Leaving the Scene of a...	259	3.80	848	0.77	4.945*	206.628
	E Driving Under the Influe...★	252	3.70	0	0.00	0.000	252.000
	E Driving Under the Influe...★	151	2.22	0	0.00	0.000	151.000
	CU is Not a Vehicle	36	0.53	421	0.38	1.385	9.999
	No Driver License	32	0.47	1076	0.98	0.482*	-34.453
	Driving While Suspended	32	0.47	681	0.62	0.761	-10.058
	Eluding Police	21	0.31	65	0.06	5.231*	16.986

C122: CU Driver Officer Opinion Alcohol  
 C121: CU Driver Condition  
 C015: Primary Contributing Circumstance  
 C202: CU Contributing Circumstance  
 C124: CU Driver Alcohol Test Type Given  
 C225: CU Citation Issued  
 C227: CU Vehicle Towed  
 C126: CU Driver Alcohol Test Results  
 C204: E CU Sequence of Events #1  
 C123: CU Driver Officer Opinion Drugs  
 C205: E CU Sequence of Events #2  
 C017: First Harmful Event  
 C201: CU Vehicle Most Harmful Event  
 C008: Time of Day

Sort by Sum of Max Gain

★  $(2995+295+252+151)/5595 = 0.660 = 66.0\%$   Display Filter Name

## Questions Related to Cause

### Causal Unit Contributing Circumstances

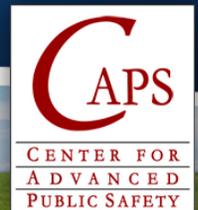
(Given: DUI is the most frequent CUCC for ID Crashes)

What is the second most cited CUCC in ID crashes?

Over the Speed Limit

Ran Off Road

Aggressive Operation



File Dashboard Filters Analysis Impact Locations Tools Window Help

Data Source: 2012 Alabama Integrated Crash Data Filter: DUI (Alcohol or Drugs) 1/ 1/2012

Order: Subset Frequency Descending  Suppress Zero-Valued Rows Significance: Over Representation Threshold: 2.0

### C202: CU Contributing Circumstance

	Value	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain
▶	DUI	3473	49.83	0	0.00	0.000	3473.000
	Over Speed Limit ←	595	8.54	2122	1.75	4.881*	473.093
	Not Applicable	419	6.01	20797	17.14	0.351*	-775.767
	E Ran off Road ←	321	4.61	2565	2.11	2.178*	173.643
	Unknown	242	3.47	8664	7.14	0.486*	-255.738
	E Aggressive Operation ←	210	3.01	1152	0.95	3.173*	143.819
	Driving too Fast for Con...	126	1.81	3387	2.79	0.648*	-68.580
	Followed too Close	121	1.74	12740	10.50	0.165*	-610.900
	E Fatigued/Asleep	99	1.42	1424	1.17	1.210	17.193
	Misjudge Stopping Dista...	93	1.33	9495	7.83	0.170*	-452.478
	Traveling Wrong Way/...	79	1.13	416	0.34	3.306*	55.101
	E Over Correcting/Over ...	79	1.13	1407	1.16	0.977	-1.831
	E Ran Stop Sign	77	1.10	821	0.68	1.633*	29.834

C122: CU Driver Officer Opinion Alcohol  
 C121: CU Driver Condition  
 C015: Primary Contributing Circumstance  
 C202: CU Contributing Circumstance  
 C124: CU Driver Alcohol Test Type Given  
 C225: CU Citation Issued  
 C227: CU Vehicle Towed  
 C126: CU Driver Alcohol Test Results  
 C204: E CU Sequence of Events #1  
 C123: CU Driver Officer Opinion Drugs  
 C205: E CU Sequence of Events #2  
 C017: First Harmful Event  
 C201: CU Vehicle Most Harmful Event  
 C008: Time of Day  
 C019: E Most Harmful Event  
 C031: Lighting Conditions  
 C003: E Manner of Crash

Sort by Sum of Max Gain  Display Filter Name

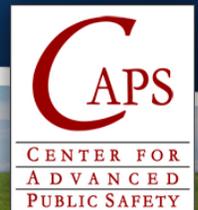
# Questions Related to Cause First Harmful Event

True or False:

“Collisions with other Vehicle” is the highest frequency first harmful event in ID crashes,

but it only occurs with half of the proportion

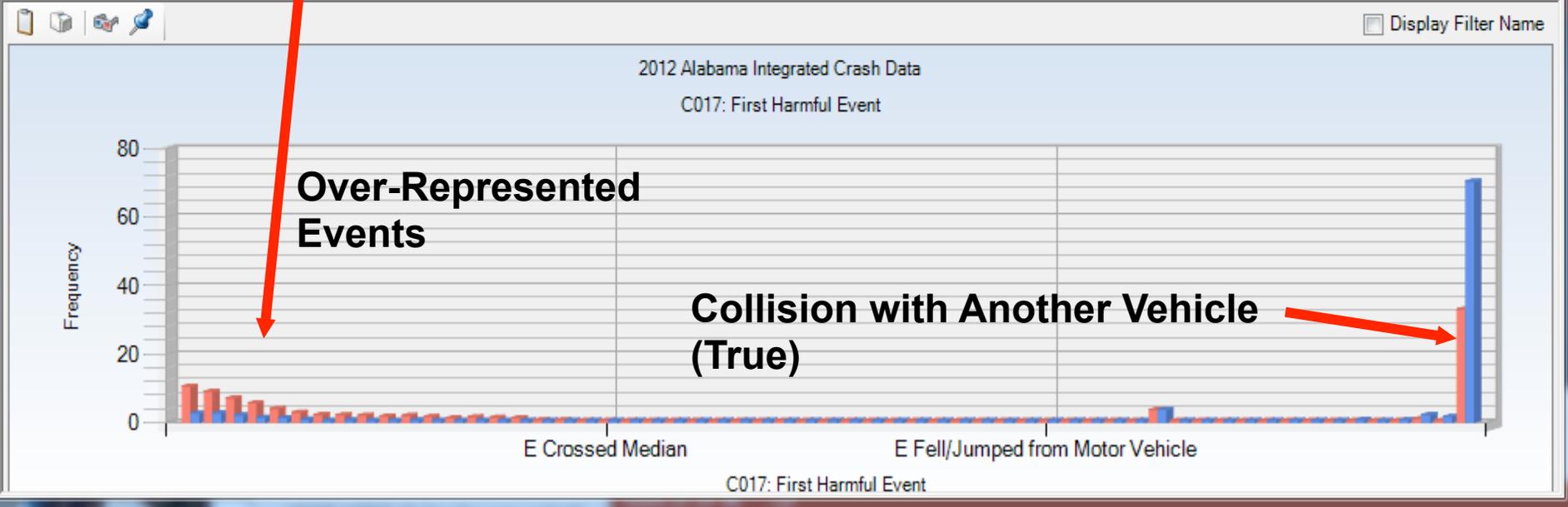
of non-ID crashes.



**C017: First Harmful Event**

Value	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain
Collision with Ditch	733	10.52	3209	2.65	3.976*	548.633
E Ran Off Road Right	625	8.97	3227	2.66	3.371*	439.599
Collision with Tree	490	7.03	2511	2.07	3.397*	345.736
E Ran Off Road Left	391	5.61	1686	1.39	4.037*	294.134
Overtum/Rollover	275	3.95	1551	1.28	3.086*	185.890
Collision with Utility Pole	199	2.86	1012	0.83	3.423*	140.858
Collision with Mailbox	152	2.18	630	0.52	4.199*	115.805
Collision with Sign Post	145	2.08	722	0.60	3.496*	103.519
E Collision with Embankment	137	1.97	627	0.52	3.803*	100.977
Collision with Culvert Headwall	124	1.78	451	0.37	4.786*	98.089

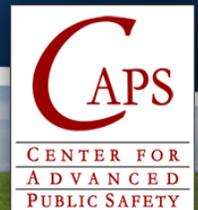
- C205: E CU Sequence of Events #2
  - C017: First Harmful Event
  - C201: CU Vehicle Most Harmful Event
  - C008: Time of Day
  - C019: E Most Harmful Event
  - C031: Lighting Conditions
  - C023: E Manner of Crash
  - C051: Number of Vehicles
  - C018: Location First Harmful Event Rel
  - C052: Number of Drivers Recorded
  - C203: CU First Harmful Event Location
  - C226: CU Vehicle Damage
  - C054: Number of Motorists Recorded
- Sort by Sum of Max Gain



# Questions Related to Cause Number of Vehicles

True or False:

**Less than 50% of ID crashes are single vehicle.**



Order: Max Gain    Descending     Suppress Zero-Valued Rows    Significance: Over Representation    Threshold: 2.0

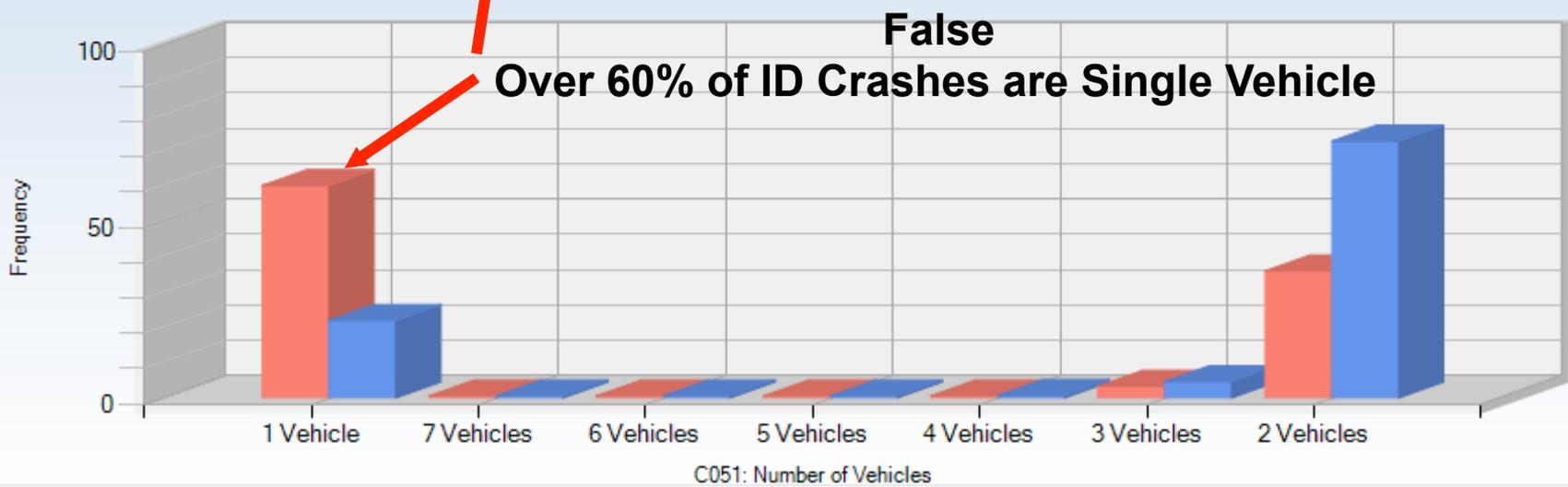
**C051: Number of Vehicles**

Value	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain
1 Vehicle	4192	60.14	26596	21.92	2.744*	2664.389
7 Vehicles	3	0.04	3	0.00	17.410	2.828
6 Vehicles	4	0.06	26	0.02	2.678	2.507
5 Vehicles	3	0.04	100	0.08	0.522	-2.744
4 Vehicles	36	0.52	763	0.63	0.821	-7.825
3 Vehicles	228	3.27	5581	4.60	0.711*	-92.559
2 Vehicles	2504	35.93	88272	72.74	0.494*	-2566.135

- C205: E CU Sequence of Events #2
  - C017: First Harmful Event
  - C201: CU Vehicle Most Harmful Event
  - C008: Time of Day
  - C019: E Most Harmful Event
  - C031: Lighting Conditions
  - C023: E Manner of Crash
  - C051: Number of Vehicles
  - C018: Location First Harmful Event Rel
- Sort by Sum of Max Gain

Display Filter Name

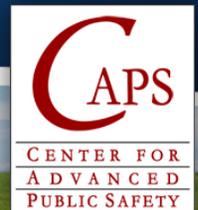
2012 Alabama Integrated Crash Data  
C051: Number of Vehicles



# Questions Related to Cause Weather

True or False?

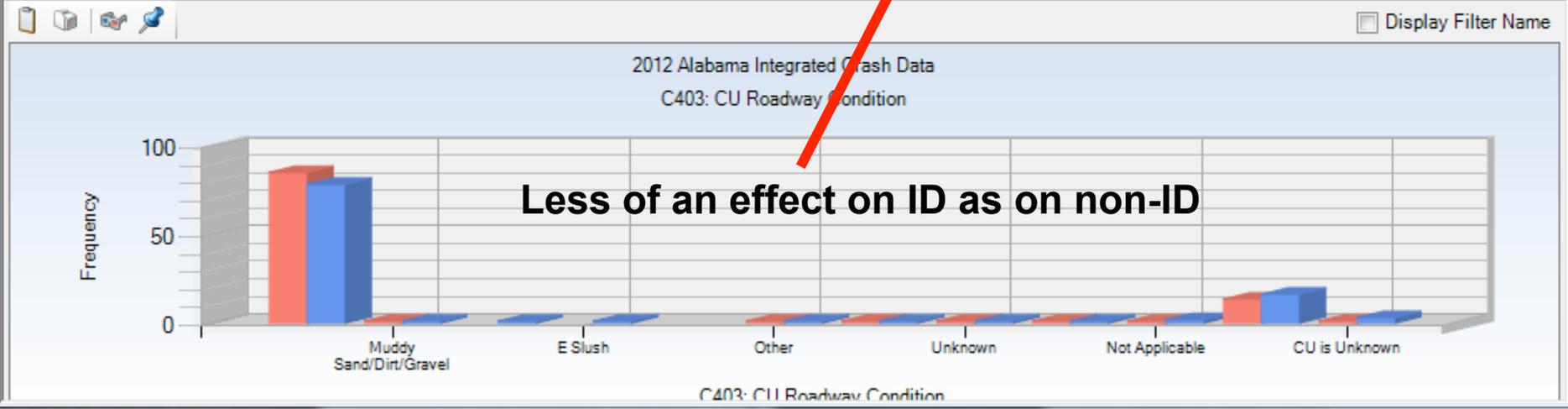
**Weather does not play much if any part in causing ID crashes.**



**C403: CU Roadway Condition**

Value	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain
Dry	5946	85.33	95402	78.65	1.085*	465.965
Muddy Sand/Dirt/Gravel	9	0.13	71	0.06	2.207	4.922
E Snow	0	0.00	8	0.01	0.000	0.000
E Slush	0	0.00	3	0.00	0.000	0.000
P Snow or Slush*	0	0.00	0	0.00	0.000	0.000
Other	1	0.01	25	0.02	0.696	-0.436
Ice	2	0.03	65	0.05	0.536	-1.734
Unknown	6	0.09	136	0.11	0.768	-1.812
E Water Buildup	2	0.03	137	0.11	0.254	-5.869
Not Applicable	58	0.83	2197	1.81	0.460*	-68.199
Wet	937	13.45	19664	16.21	0.830*	-192.530
CU is Unknown	7	0.10	3598	2.97	0.034	-199.675

- C110: CU Driver Residence Distance
  - C403: CU Roadway Condition
  - C026: Intersection Related
  - C222: CU Contributing Vehicle Defect
  - C111: CU Driver License State
  - C103: CU Commercial Motor Vehicle Indicator
  - C450: CU CMV Indicator
  - C452: CU CMV Hazard Materials Involvement
  - C220: CU Oversized Load Requiring Permit
  - C034: E Police Present at Time of Crash
  - C009: Data Source
  - C016: Primary Contributing Unit Number
  - C217: CU Hazardous Cargo
  - C012: Controlled Access
  - C327: CU Driver Ejection Status
- Sort by Sum of Max Gain

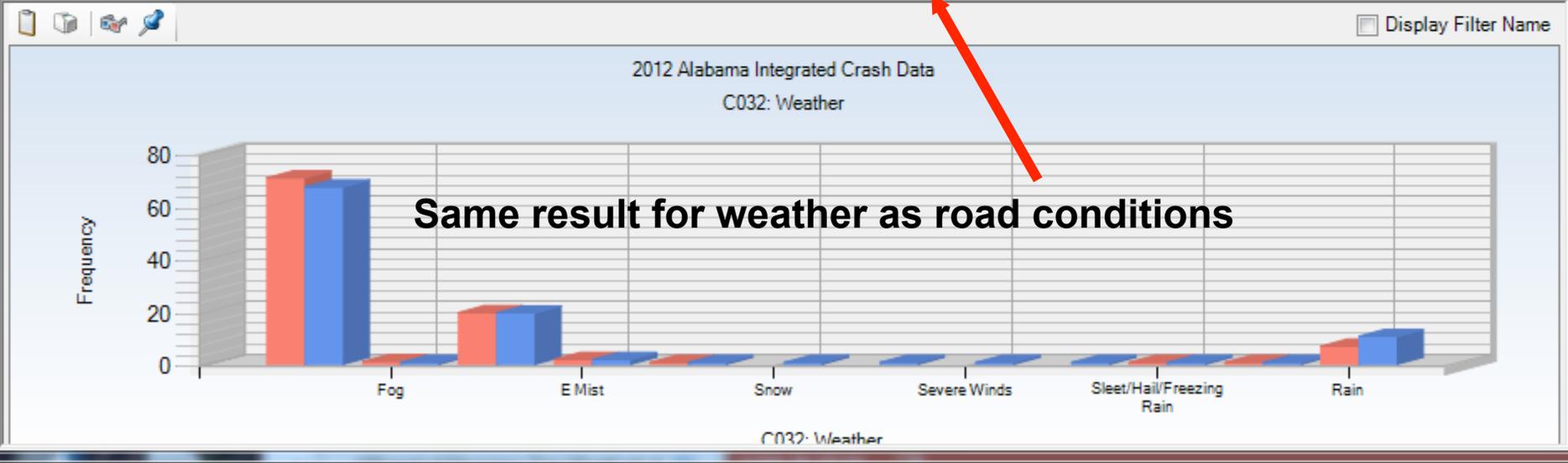


**C032: Weather**

Value	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain
Clear	4925	70.68	81555	67.25	1.051*	238.928
Fog	66	0.95	779	0.64	1.475*	21.239
Cloudy	1363	19.56	23617	19.47	1.004	5.990
E Mist	126	1.81	2121	1.75	1.034	4.129
Other	2	0.03	22	0.02	1.582	0.736
Snow	0	0.00	34	0.03	0.000	0.000
E Blowing Snow	0	0.00	6	0.00	0.000	0.000
Severe Winds	0	0.00	43	0.04	0.000	0.000
E Blowing Sand/Soil/Dirt	0	0.00	2	0.00	0.000	0.000
Sleet/Hail/Freezing Rain	3	0.04	54	0.04	0.967	-0.103
Unknown	9	0.13	200	0.16	0.783	-2.492
Rain	474	6.80	12836	10.58	0.643*	-263.544

- C221: CU Had Oversized Load Permit
- C007: Week of the Year
- C405: CU Contributing Material in Roadway
- C005: Day of Month
- C128: CU Vehicle Initial Travel Direction
- C415: CU Workzone Related
- C032: Weather
- C414: CU One-Way Street
- C406: CU Contributing Material Source
- C321: CU Driver/Non-Motorist Seating Position
- C322: CU Driver/Non-Motorist Victim/Occ Type
- C080: CMV Involved
- C046: HasRTMP
- C309: CU Non-Motorist Officer Opinion Alcohol
- C308: CU Non-Motorist Condition

Sort by Sum of Max Gain



## Questions Related to Severity Towing

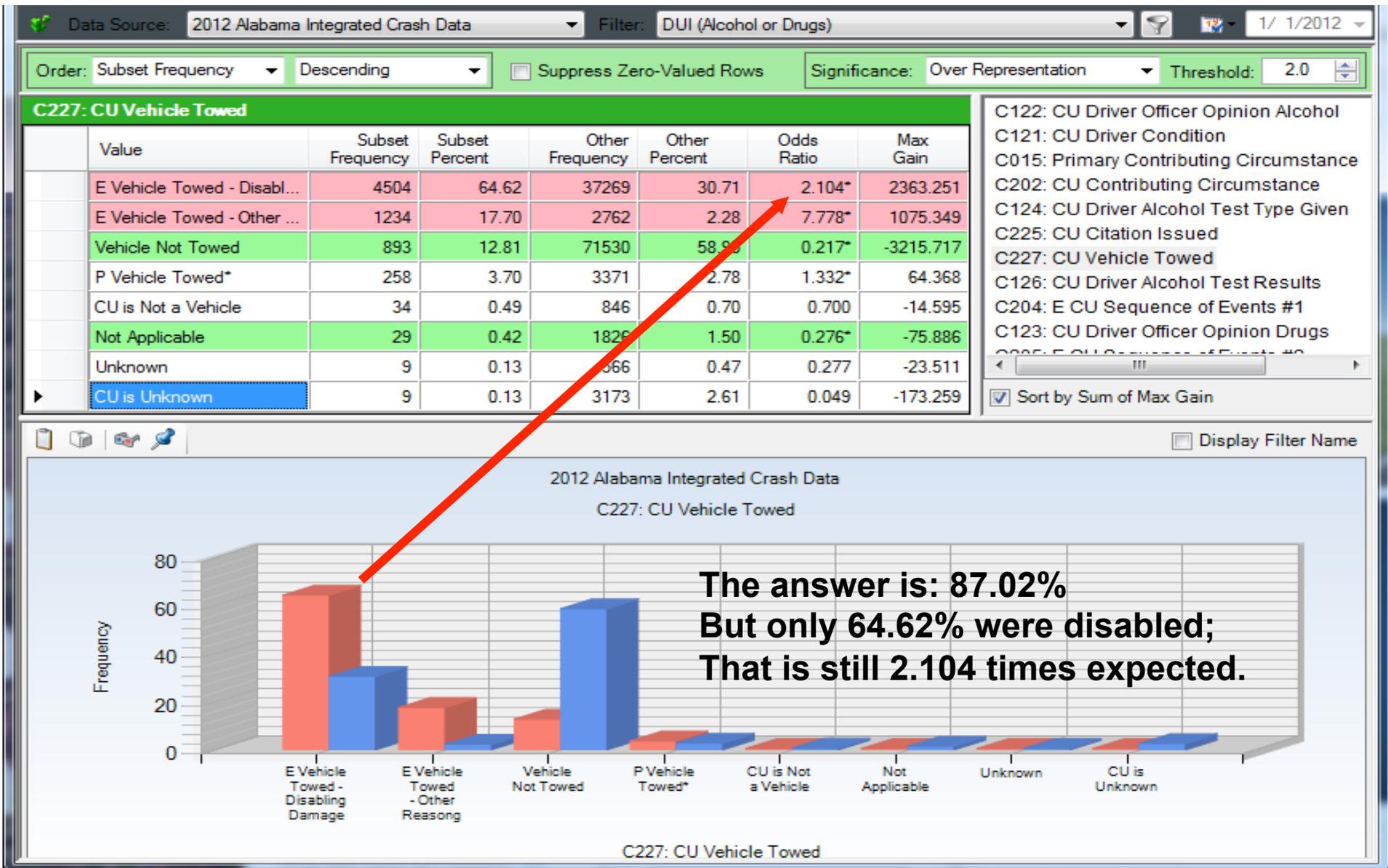
Multiple Choice:

What proportion of ID-involved  
causal units are towed?

50%

70%

90%

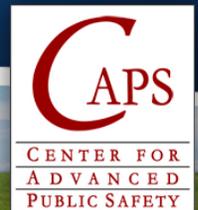


# Questions Related to Severity

## Severity

True or False:

**ID crashes produce over five times the fatalities as non-ID crashes.**



Order: Natural Order    Descending     Suppress Zero-Valued Rows    Significance: Over Representation    Threshold: 2.0

**C025: Crash Severity**

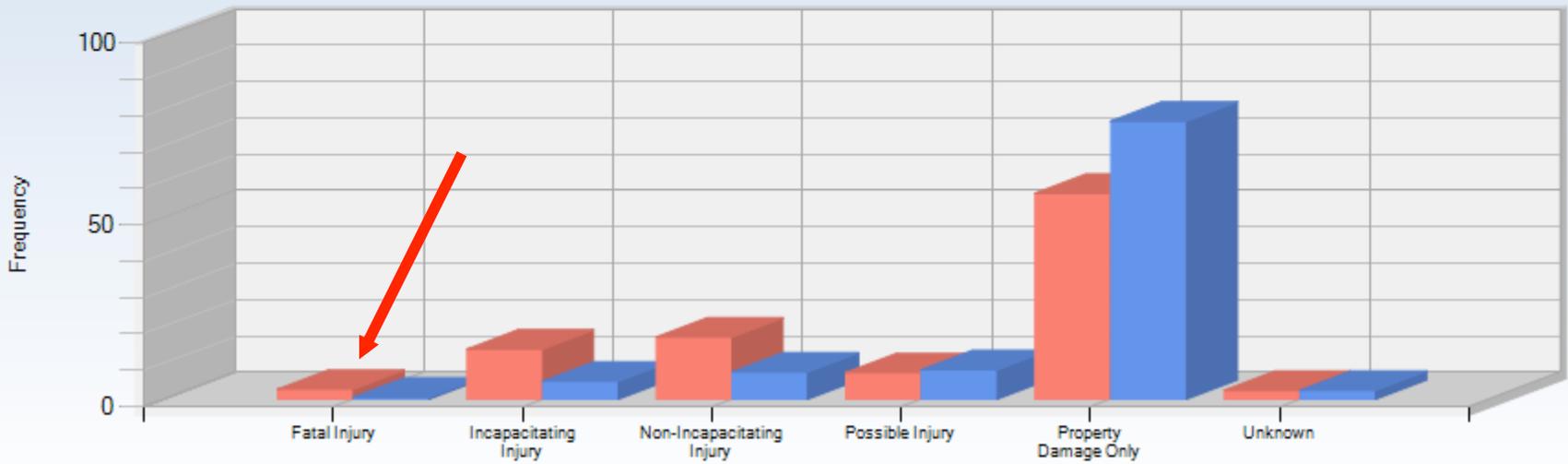
Value	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain
Fatal Injury	190	2.73	622	0.51	5.318*	154.274
Incapacitating Injury	959	13.76	5969	4.92	2.797*	616.155
Non-Incapacitating Injury	1192	17.10	9078	7.48	2.286*	670.581
Possible Injury	508	7.29	9824	8.10	0.900*	-56.267
Property Damage Only	3951	56.69	92899	76.56	0.740*	-1384.899
Unknown	170	2.44	2957	2.44	1.001	0.157

C025: Crash Severity  
 C328: CU Driver/Non-Motorist Injury Type  
 C331: E CU Driver/Non-Motorist Transport T  
 C120: E CU Driver Employment Status  
 C059: Number Injured (Includes Fatalities)  
 C045: HasGPS  
 C038: Non-Vehicular Property Damage  
 C329: CU Driver/Non-Motorist First Aid By

Sort by Sum of Max Gain

Display Filter Name

2012 Alabama Integrated Crash Data  
 C025: Crash Severity



C025: Crash Severity