A Review of Youth Impaired Driving Traffic Crashes in Alabama during 2008-2012

David B. Brown and Claire Davis
Center for Advanced Public Safety (CAPS)
The University of Alabama
for
The Alabama Department of Economic and Community Affairs
Traffic Safety Section
(Preliminary Draft: September 12, 2013)

Introduction

As part of their youth countermeasures programs, the Alabama Department of Economic and Community Affairs requested a special study to focus on the development of youth Impaired Driving (ID) countermeasures. By way of definition, the acronym ID will be used in a generic way to include driving under the influence (DUI) of either alcohol, other drugs, or both. Alcohol is the drug of choice throughout the population, but over the past five years other drugs have grown in importance. Further, *youth* or *young drivers* will be used refer to drivers of age 16-20.

This report will be in three sections. The first is a summary of recommended countermeasures in prioritized order based upon estimated cost-benefit. The recommendations are based upon the detailed analysis performed for Alabama and reviews of potential countermeasures given in the literature. The second and third sections of this report provide the detailed data analysis that was originally performed for the State of Alabama for CY (calendar year) 2008. These have been updated using 2008-2012 data. The appendix contains the CARE IMPACT outputs that were used to generate the summary information presented.

Recommended Countermeasures

The following is a list of recommended countermeasures in priority order based upon a qualitative assessment of the detailed data analysis and information obtained from the literature:

- **Graduated Drivers Licensing (GDL).** The bill to strengthen the state's GDL law has been introduced in the legislature for the past three years and shows continuing prospect of acceptance. The data within Alabama demonstrate that youth causal-driver ID crashes are over-represented in multiple injuries, multiple passengers in the vehicle, and specific times of day. All of these factors are addressed by GDL. For more details, see:
  http://www.safehomealabama.gov/InfoTraining/YoungDriverIssues.aspx

- **Administrative License Revocation (ALR).** This is stated as the top-priority countermeasure for youth because of the perceived value of the driver's license to

the young person and the proven overall effectiveness of this relatively inexpensive countermeasure: "License suspension has been shown in many well-designed studies to produce specified deterrence, that is, it deters suspended drivers from subsequent crashes and recidivism. Although many suspended drivers continue to drive, they report driving less and/or more carefully, and the reductions in violations and crashes associated with license suspension continue well beyond the suspension period." The increase in the penalty for driving while suspended/revoked could greatly multiply the deterrent capability of this countermeasure. Further: "there is overwhelming evidence that ALR contributes to both specific and general deterrence impaired driving. From 1980 through 1987, the proportion of motor vehicle crash fatalities with BACs at or above 0.10% fell sharply, but the decline slowed after that. The extent to which the United States can continue to reduce the contribution of ID to motor vehicle crash fatalities almost certainly depends on whether the remaining states adopt ALR ..." (1). Finally, this law will work best with youth only if it is coupled with a reduced BAC limit, which is also of the highest priority.

- **Reduced BAC for Youthful Drivers.** "These laws are justified by the fact that any drinking is illegal for drivers under 21 and by the fact that young drivers are impaired at much lower blood alcohol levels ... This law was found to be effective in reducing nighttime fatal crashes among teenagers in Maine even though only 40 to 50% of teenagers knew about the law." Effectiveness could be multiplied by coupling this with PI&E efforts, as demonstrated by the very well-designed project in Maryland (1, 25-26). They summarized:

  > "Given the extent of benefits documented for the Maryland sanction and the PI&E enhancement, it is reasonable to conclude that a lower BAC restriction for youth is a countermeasure which should be widely implemented."

  As to the particular level, since drinking is illegal for minors, the ideal level would be anything over a 0.0% BAC which would confirm any drinking at all (Maryland used 0.02%).

- **Reduced Youth Access to Alcohol.** While the initial effect of raising the drinking age had a very positive effect, that effect now seems to be eroding, especially for ages 19 and 20. Increased “sting” operations are necessary to assure that these laws are being observed, especially in the late-night week-end hours. Increased alcohol pricing (through taxation) has also been shown to be effective in this regard.

- **Community System-Wide Response.** This countermeasure links the agricultural county agent, who are highly trained in community organizing skills, with a key judge in each county. It involves a five-step organizational process, and an intensive educational effort. This is quite resource intensive, which places it lower on the priority list. Further, while some of these have been proven effective, their long-term impact upon those who are inclined to engage in risk-taking behavior is not confirmed.

Detailed Analysis of Crash Data

In this study we wish to concentrate on the young driver, specifically those who are of age 20 or younger. ID-related crashes are grossly under-reported as such (FARS has recently used an adjustment factor of 1.6 for Alabama), and we suspect that this might be low for youthful-offender cases, especially those of lower severity. The reason for this is that many officers are reluctant to place alcohol/drugs as a causal factor on the crash form unless they can prove it is a cause in court. However, it is well established that, especially in inexperienced drinkers, driving can be impaired at well below the 0.08% BAC level.

This does not defeat the purposes of our analysis, however, as will be explained below. In one year (CY 2008) of data, the following is the severity of the youth causal-driver ID subset of crashes:

Reported Youth Causal-driver ID Crashes by Severity (CY 2008-2012)

Severity	2008	2009	2010	2011	2012	Total	Percentage
Fatal	20	16	17	22	14	89	3.01%
Non-Fatal Injury	241	234	270	243	214	1202	40.66%
Property Damage Only	343	308	304	323	340	1618	54.74%
TOTAL	604	558	605	602	587	2956	100.00%

This is out of a total of 109,527 youth (causal driver age 16-20) crashes that occurred in the state during this (2008-2012) time period. In the overall population of youth causal-driver crashes, there were 489 fatal crashes (549 killed), 25,150 injury crashes (35,327 injured persons), and 82,223 property damage crashes. Of the total youth causal-driver crashes, 152 were pedestrian crashes, involving a total of 167 pedestrians.

While are aware that this subset of 2956 crashes does not include all of the youth causal-driver ID crashes that have occurred in the state, the conclusions of the comparisons given below will not be significantly affected by this under-reporting. It is true that some of the cases that are ID-related will be found in the "non-ID" subset. However, this can only have the effect of reducing the extent of any over- or under-representations. So the figures given below should be regarded as a conservative *minimum* estimate, i.e., the actual over- or under-representations will be *at least* the size of those shown.

Before leaving the severity figures above, note that the injury proportion given is almost twice what would be expected in the general population of all crashes (21.16%), and the fatality proportion is over four times that expected (0.74% for all crashes). So this is clearly one of the major killers of our young people on the roadway today. In addition, if we can prevent youth causal-driver ID crashes, the effects could well be cumulative, since there is no reason that the behavioral change will not continue throughout the lifetimes of the majority of those affected.

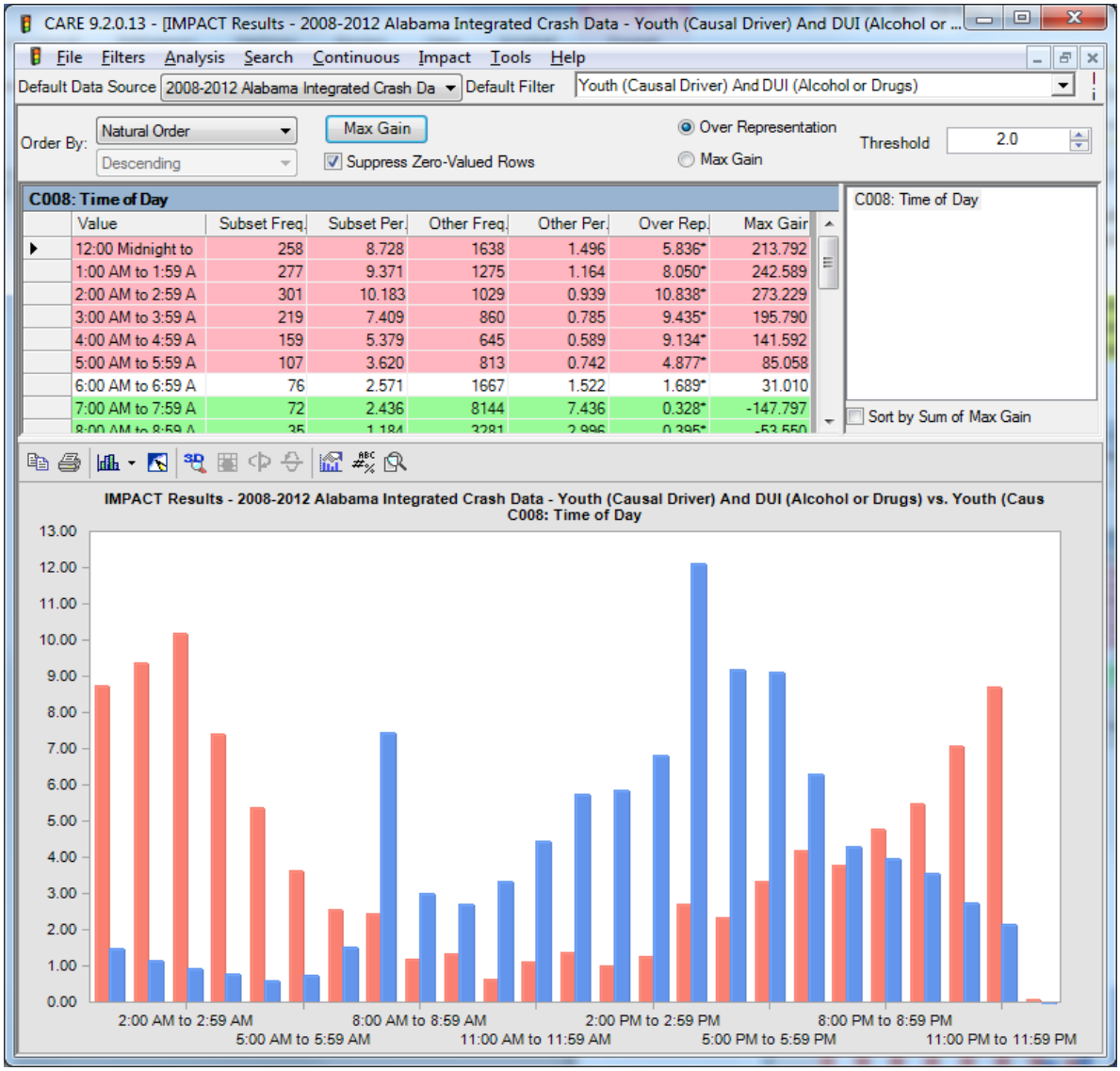
The analyses performed for the youth causal-driver ID subset of crashes in the CARE IMPACT (information mining) analysis compared youth causal-driver ID crashes against all youth causal-driver crashes in order to find out how their ID-related crash characteristics differ from other (non-ID) crashes that they experience. The most predominant root causes of the non-ID crashes are inexperience in the 16-17 age classification, and increased risk-taking in the 18-20 age group.

Comparison: Youth Id vs. General Youth Causal-Driver Crashes

The goal of comparing the youth causal-driver ID subset of crash records against all youth causal-driver crashes is to determine the characteristics of these crashes that might be amenable to countermeasure intervention. Of course, just because some attribute is over-represented does not mean that a countermeasure applied to address it will be successful. However, the application of a countermeasure on under-represented attributes is clearly a waste of resources, all other things being equal. The following variables are presented generally in the order of the total positive "Maximum Gain" (the amount by which crashes would be reduced if all over-representations within a given variable could be eliminated).

Note: in all graphics that follow, the red (or slightly lighter) bar on the left refers to the proportion of youth causal-driver ID crashes, and the blue (or darker bar) on the right refers to the control, in this case all youth crashes.

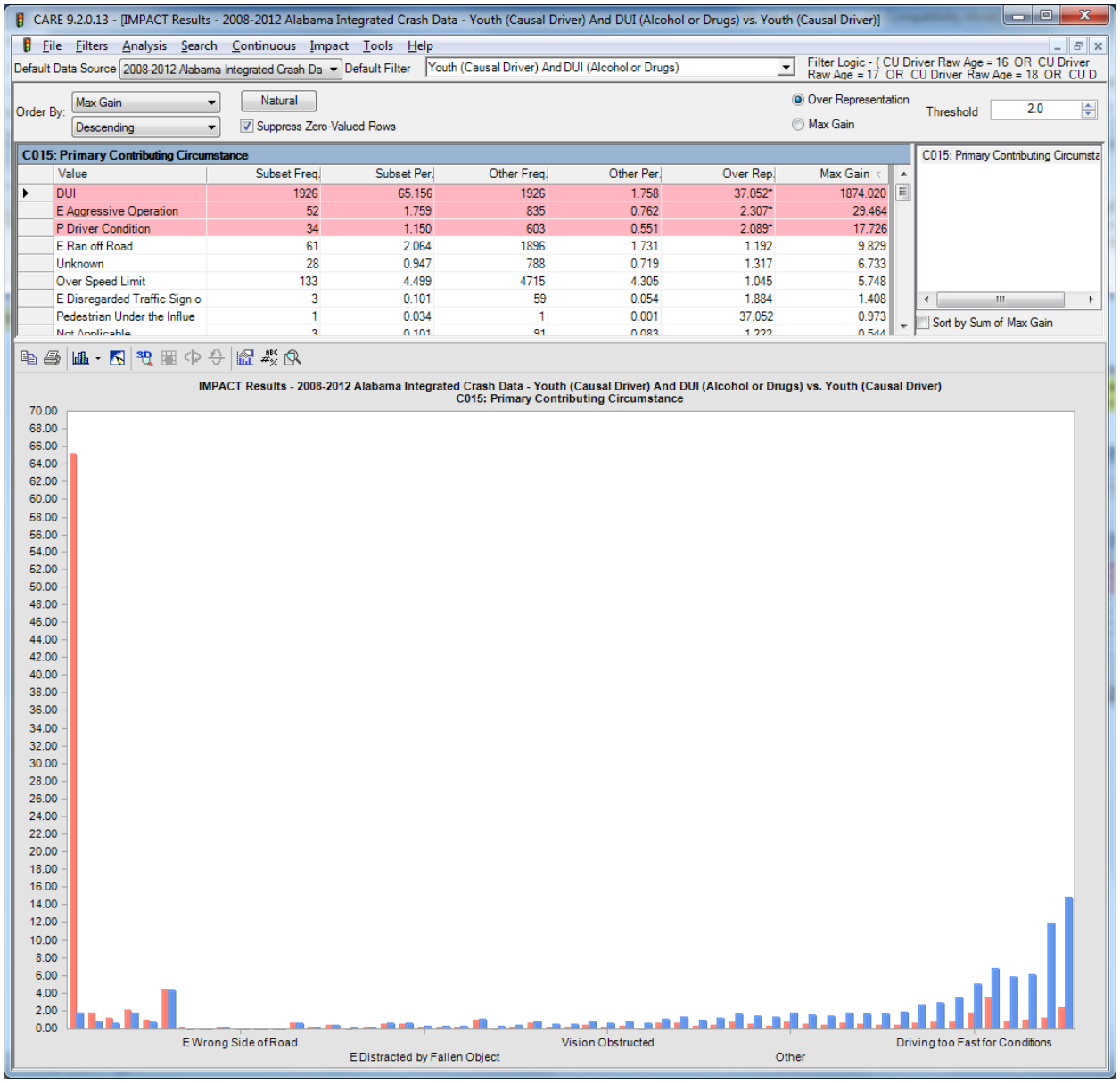
Time of Day (C008). This variable had the most significance, and it comes as no surprise that the time of day that youth causal-driver ID crashes occur varies dramatically from those of other youth causal-driver general crashes. The following chart demonstrates the most over-represented times.



Youth causal-driver crashes in general are over-represented before and after school (blue bars on the right). However, after 10 PM the probability of ID being involved goes up dramatically. It peaks at the 12 PM to 5 AM hours and then tapers off, falling back below the youth non-ID crashes in the 6 AM to 7 AM time period.

Related variables: C031 shows darkness, and especially darkness with no artificial lighting, indicating rural areas (see geographic analysis below).

Other Circumstances (C015). There are certain risk-taking characteristics that often go together in this type of crash. For example, if you look at the other circumstances included in Variable 15, aggressive operation is also over represented, with over two times the expected number of crashes. This shows very clearly that aggressive operation is very highly correlated with youth alcohol/drug use.



Value	Subset Freq.	Subset Per.	Other Freq.	Other Per.	Over Rep.	Max Gain
DUI	1926	65.156	1926	1.758	37.052*	1874.020
E Aggressive Operation	52	1.759	835	0.762	2.307*	29.464
P Driver Condition	34	1.150	603	0.551	2.089*	17.726
E Ran off Road	61	2.064	1896	1.731	1.192	9.829
Unknown	28	0.947	788	0.719	1.317	6.733
Over Speed Limit	133	4.499	4715	4.305	1.045	5.748
E Disregarded Traffic Sign o	3	0.101	59	0.054	1.884	1.408
Pedestrian Under the Influe	1	0.034	1	0.001	37.052	0.973
Not Applicable	3	0.101	91	0.083	1.222	0.544

Vehicle Most Harmful Event (C201). Ordered by greatest potential for reduction, the following factors were found to be significantly over represented: overturned, tree, ditch, utility pole, and parked vehicle. The most under-represented is collision with non-parked vehicle in traffic, indicating that a larger than expected number of single-vehicle crashes. While this is only about 64% of expected, it still accounts for just under 30% of the youth causal-driver ID crashes, so it should not be discounted altogether.

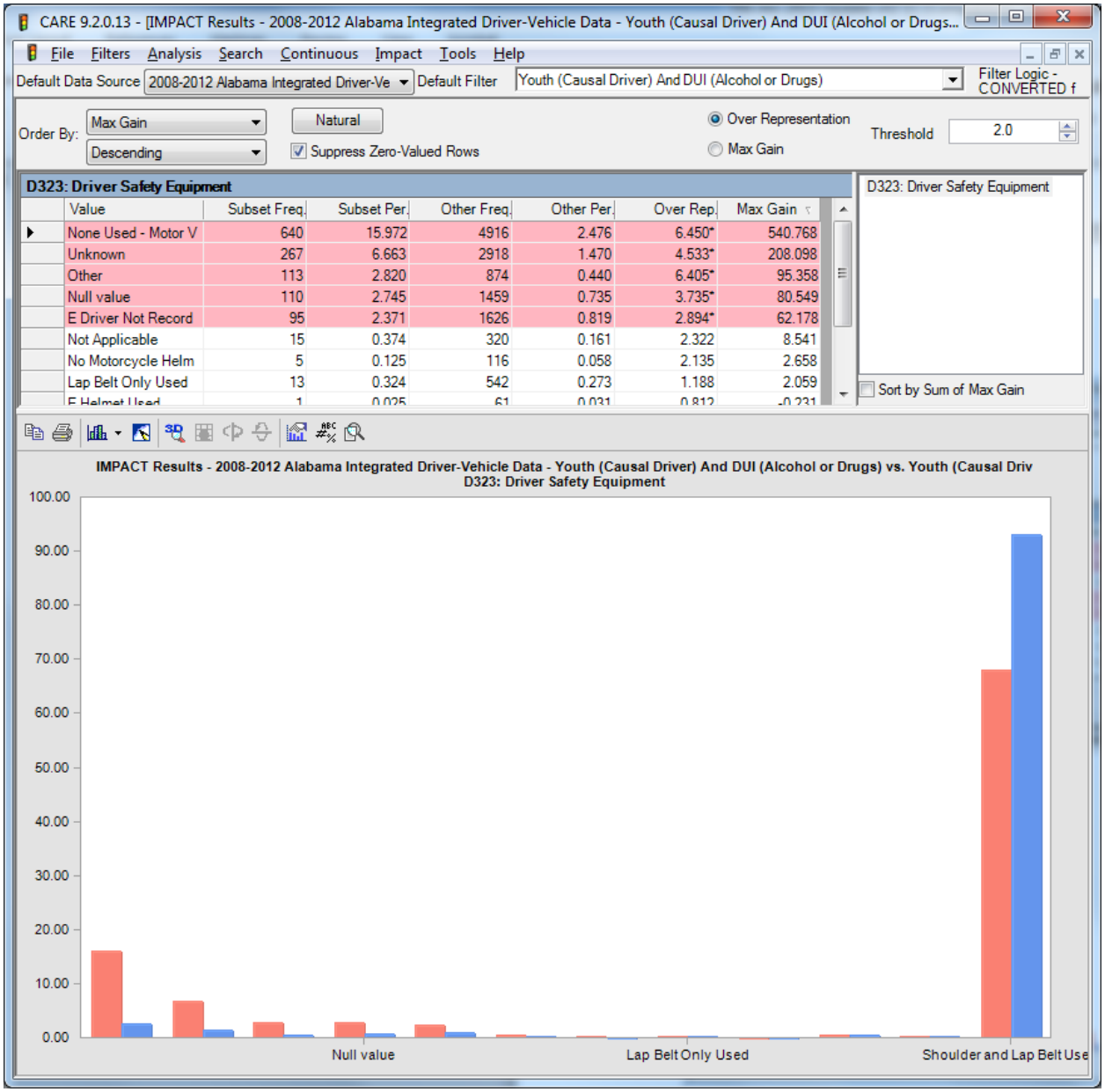
Related variables: (**C017), First Harmful Event** is basically the same as C201, but the order of the over represented factors are as follows: ditch, tree, overturned, utility pole, mailbox, parked vehicle, and curbing.

Number of Vehicles (C051). Single vehicle crashes are over 2.68 times their expectation and account for over 68% of the youth causal-driver ID crashes.

Restraints (D323). The following are the significantly over-represented categories:

	Over-representation Factor (OverRep)*
No Restraints Used	6.45
Unknown	4.53

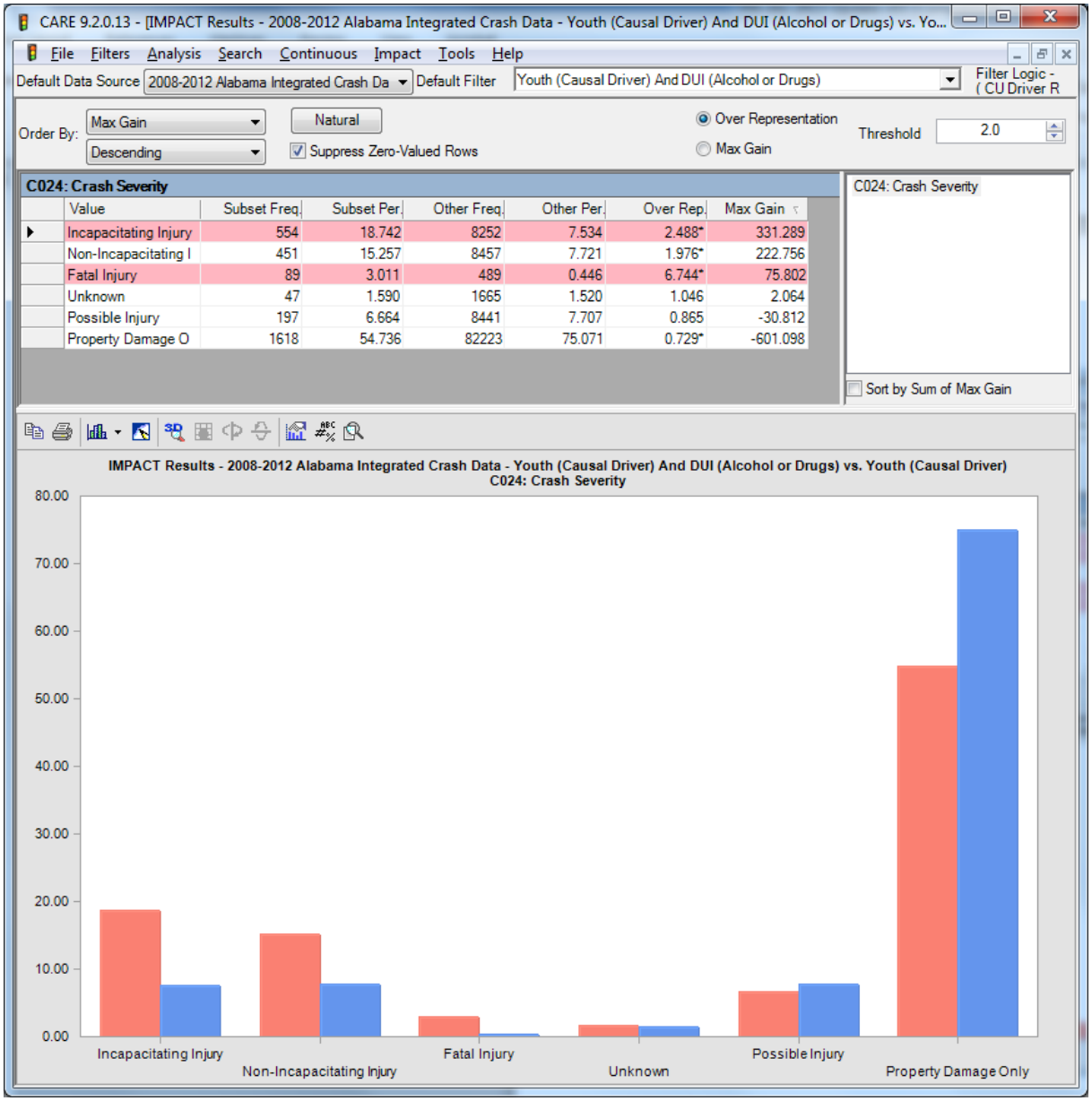
* This is the odds ratio, or the number of times that the proportion of the value is above the same value for non-ID cases (= Subset Percent/Other Percent).



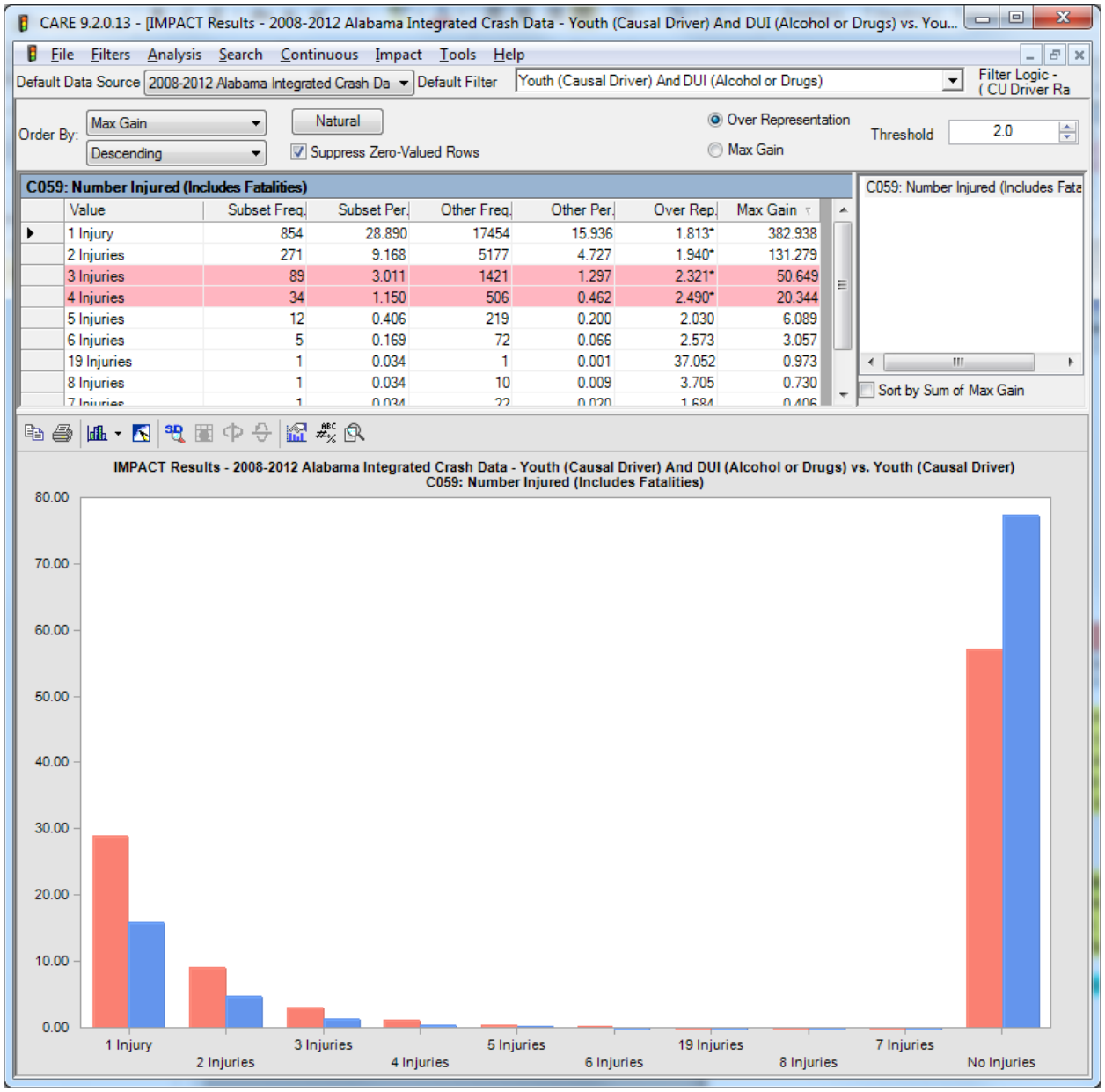
All other categories of restraint use were under-represented or not significantly over-represented. This shows very clearly that the lack of restraint use is very highly correlated with ID. Qualifier: failure to use restraints is an indication of increased risk taking, which seems to be further exacerbated by alcohol/drug use

Event Location (C018). Off roadway crashes are about 2.75 times their expectation and account for about 56% of youth causal-driver ID crashes.

Severity of Crash. Proportion disabled (C225) is significantly over represented with over 1.8 times the expected number of crashes. Proportion of damage that totaled the vehicle (C225) was over 1.76 times its expected value. Injury, and multiple injury crashes are over-represented as shown below.



Value	Subset Freq.	Subset Per.	Other Freq.	Other Per.	Over Rep.	Max Gain
Incapacitating Injury	554	18.742	8252	7.534	2.488*	331.289
Non-Incapacitating I	451	15.257	8457	7.721	1.976*	222.756
Fatal Injury	89	3.011	489	0.446	6.744*	75.802
Unknown	47	1.590	1665	1.520	1.046	2.064
Possible Injury	197	6.664	8441	7.707	0.865	-30.812
Property Damage O	1618	54.736	82223	75.071	0.729*	-601.098

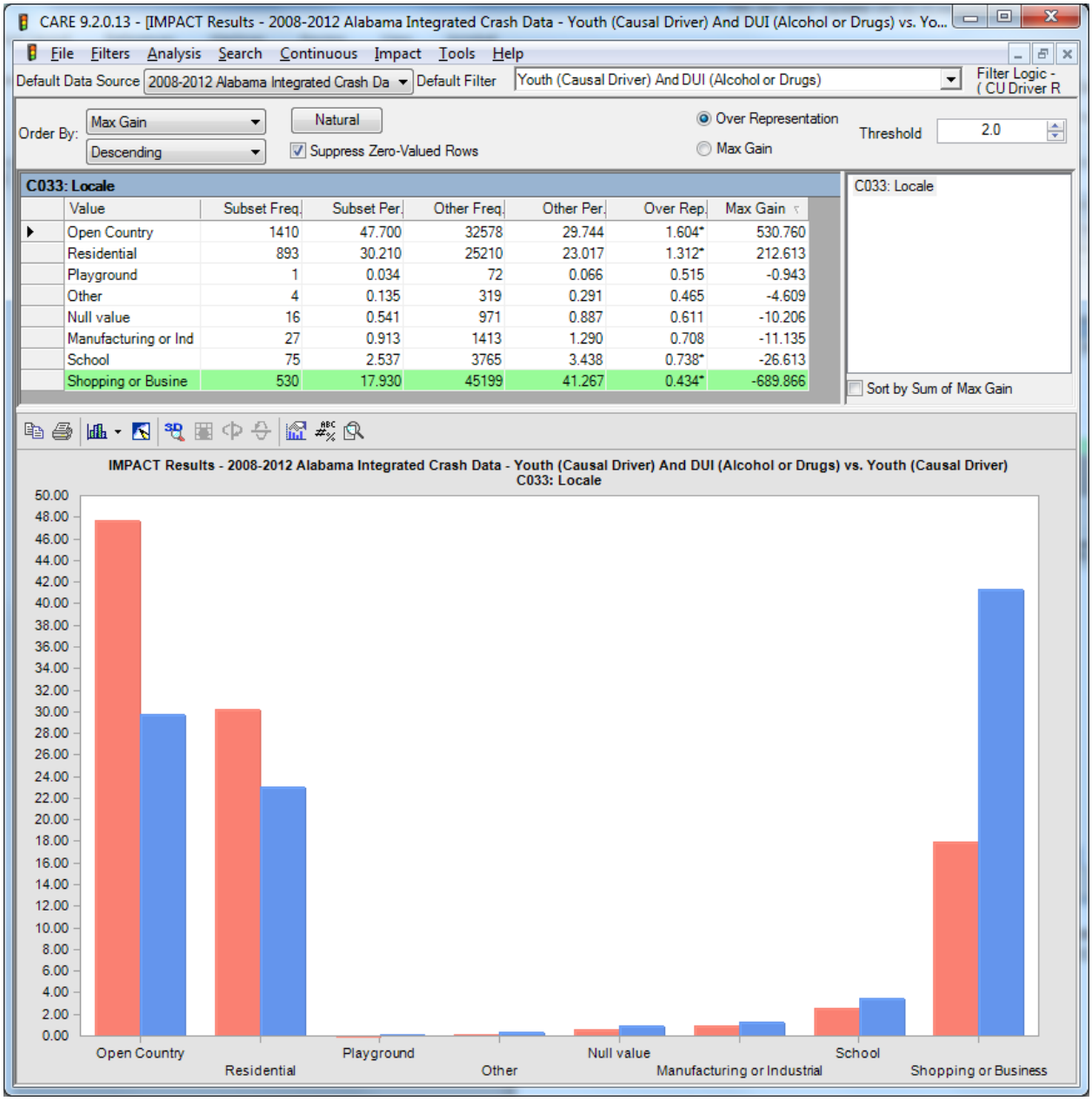


Value	Subset Freq.	Subset Per.	Other Freq.	Other Per.	Over Rep.	Max Gain
1 Injury	854	28.890	17454	15.936	1.813*	382.938
2 Injuries	271	9.168	5177	4.727	1.940*	131.279
3 Injuries	89	3.011	1421	1.297	2.321*	50.649
4 Injuries	34	1.150	506	0.462	2.490*	20.344
5 Injuries	12	0.406	219	0.200	2.030	6.089
6 Injuries	5	0.169	72	0.066	2.573	3.057
19 Injuries	1	0.034	1	0.001	37.052	0.973
8 Injuries	1	0.034	10	0.009	3.705	0.730
7 Injuries	1	0.034	22	0.020	1.684	0.406

These results all show quite plainly that youth causal-driver ID crashes are much more severe in their effects than are other youth causal-driver crashes. The over representation of multiple injuries in the causal vehicle also indicates a tendency for young people to travel with multiple individuals in the vehicle. Because they tend to travel with their friends, they are putting not only their individual safety at risk but that of their friends when they choose to drink and drive.

Geographic location. Over-represented counties (C001) in order of maximum gain are: Macon and Escambia. The bigger problem appears to be in the rural areas near metropolitan areas. The most under-represented cities (in order of "best" first): Montgomery, Birmingham, and Mobile.

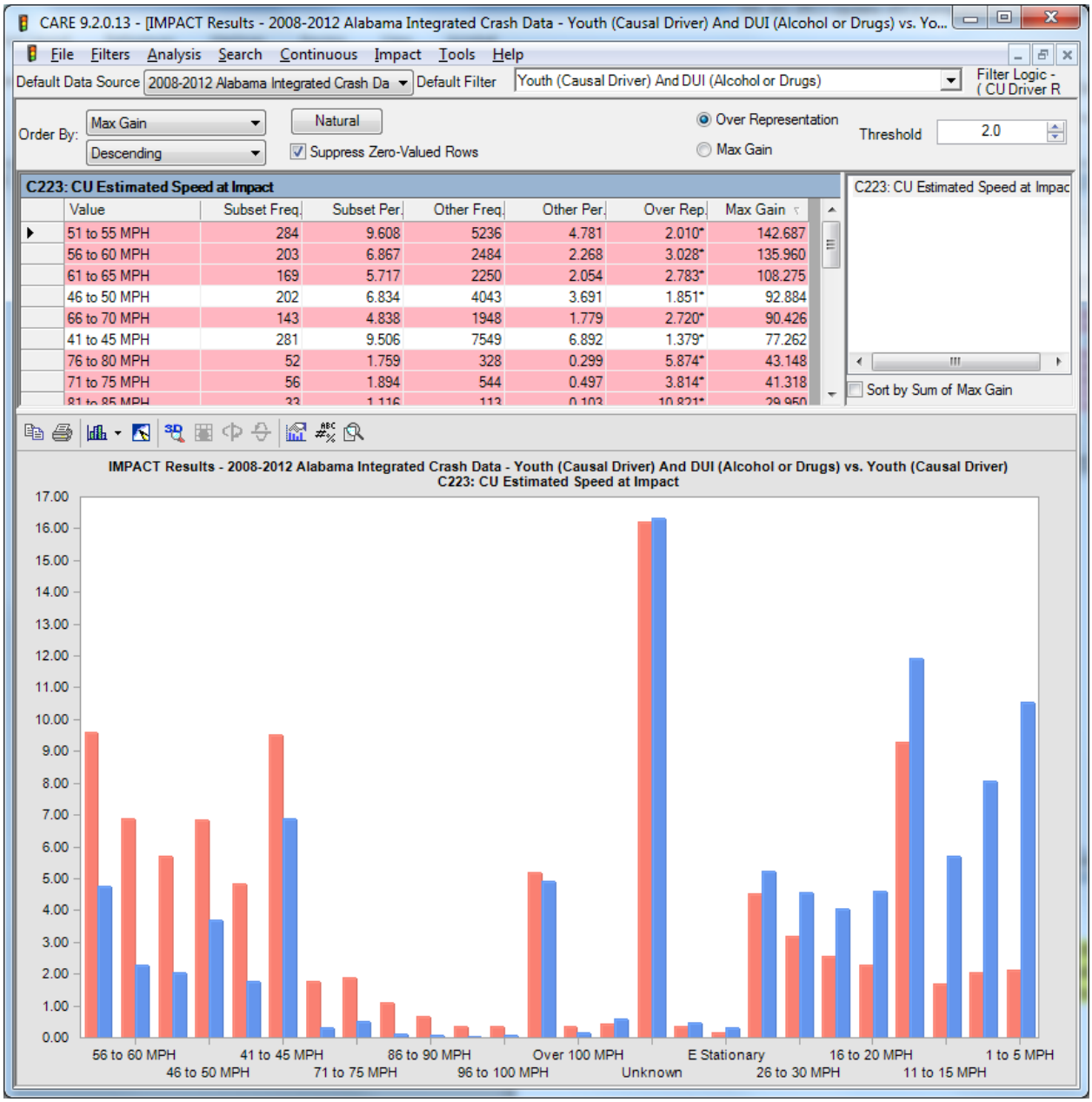
Locale (C033) shows the greatest over-representation in open country, as indicated in the diagram below.



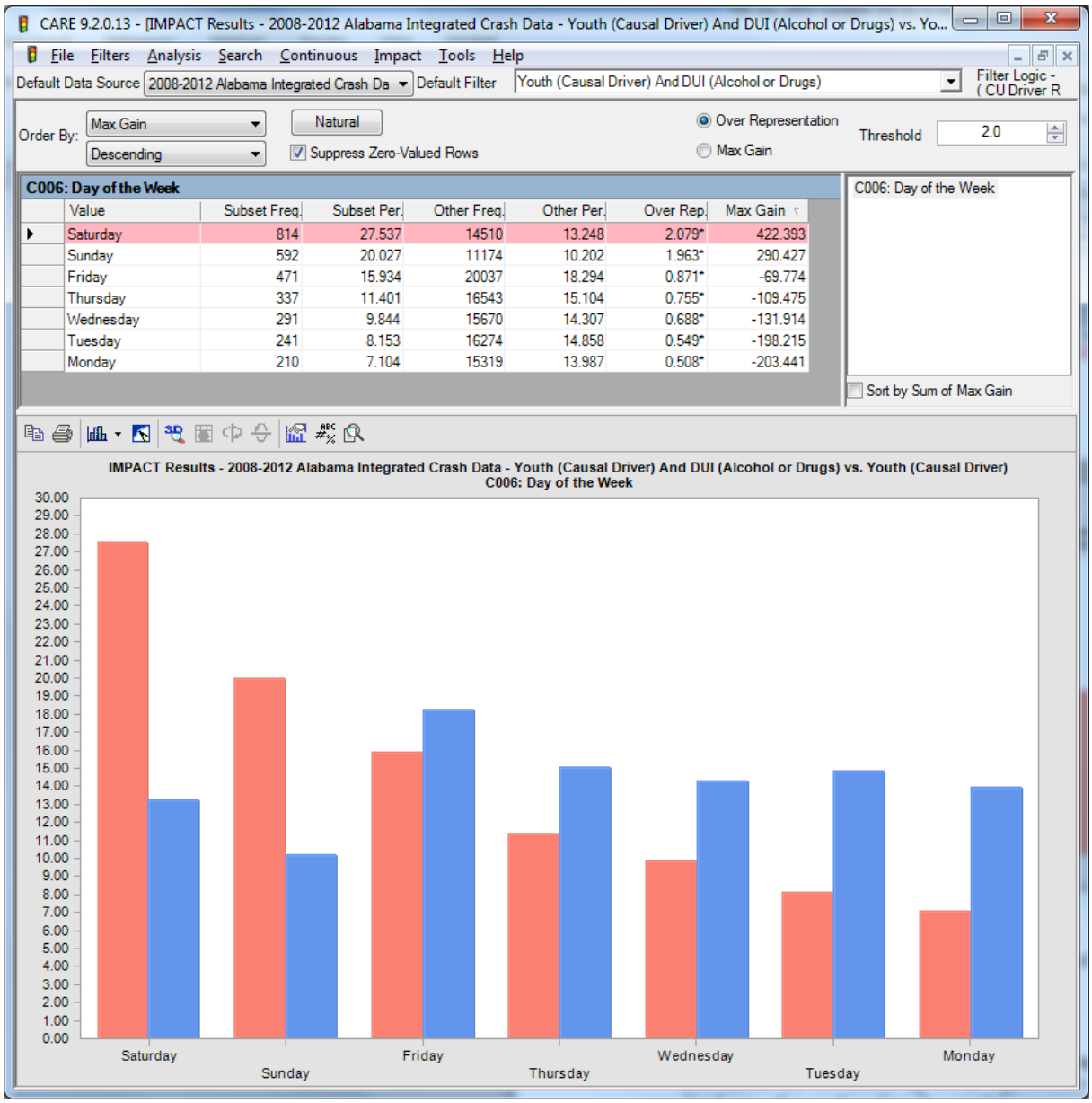
Value	Subset Freq.	Subset Per.	Other Freq.	Other Per.	Over Rep.	Max Gain
Open Country	1410	47.700	32578	29.744	1.604*	530.760
Residential	893	30.210	25210	23.017	1.312*	212.613
Playground	1	0.034	72	0.066	0.515	-0.943
Other	4	0.135	319	0.291	0.465	-4.609
Null value	16	0.541	971	0.887	0.611	-10.206
Manufacturing or Ind	27	0.913	1413	1.290	0.708	-11.135
School	75	2.537	3765	3.438	0.738*	-26.613
Shopping or Busine	530	17.930	45199	41.267	0.434*	-689.866

Two-lane roadways (C412) are over-represented by a factor of 1.34. Rural Crashes (C010) are over-represented by a factor of 1.7, and County Road Crashes (C011) are over-represented by a factor of 1.73.

Estimated Speed (C223). From the following display, it is clear that youth causal-driver ID crashes (shown in the red bars on the left) occur at significantly higher speeds than do other types of youth causal-driver crashes.



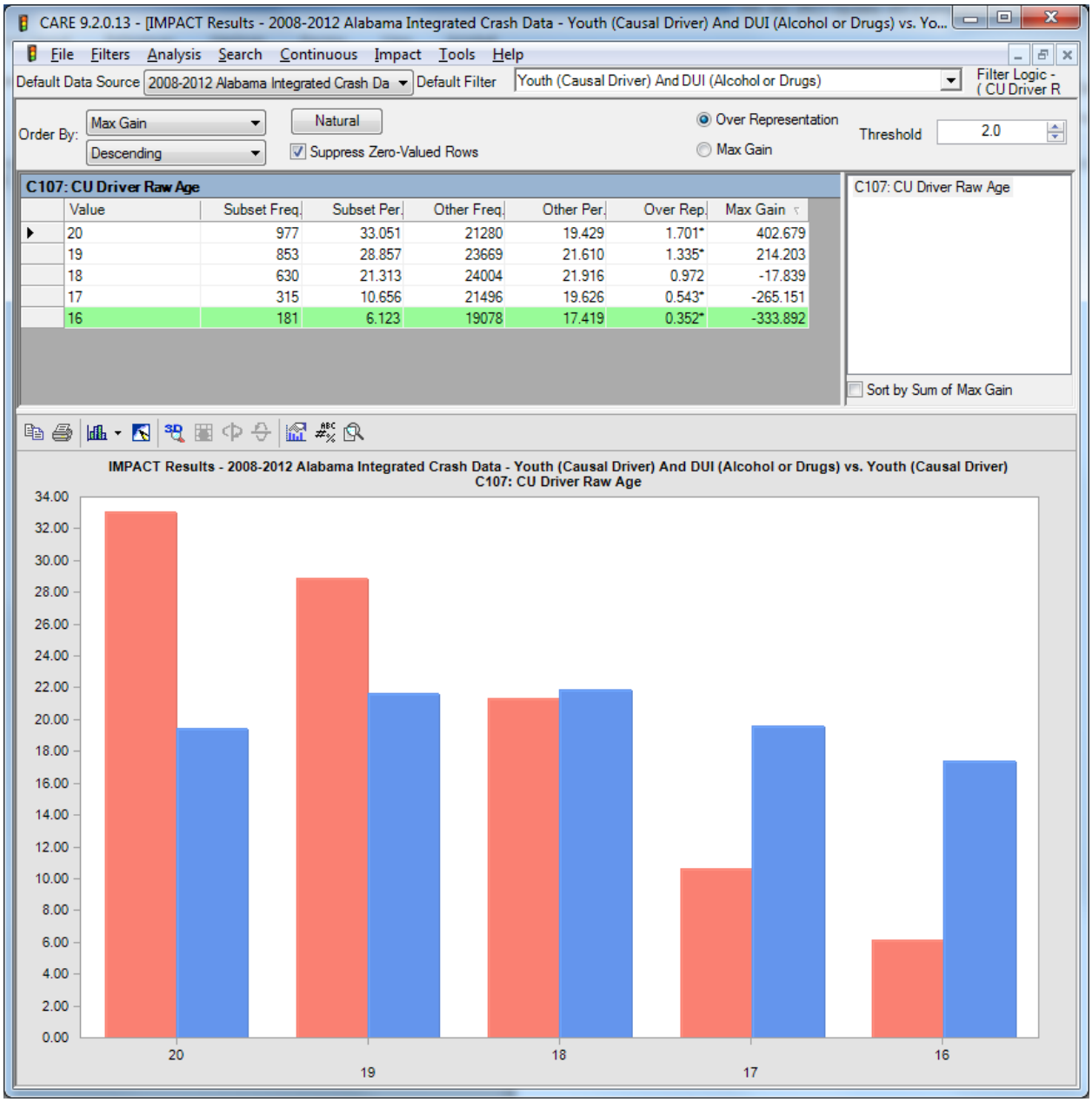
Day of Week (C006). As you might expect the weekend is over represented for this type of crash. As seen in the diagram below, Saturday is over represented with Saturday having 2.08 times the expected number of crashes.



Gender (C109). Males account for 71.01% of youth causal-driver ID crashes, and they are over-represented by a factor of 1.39.

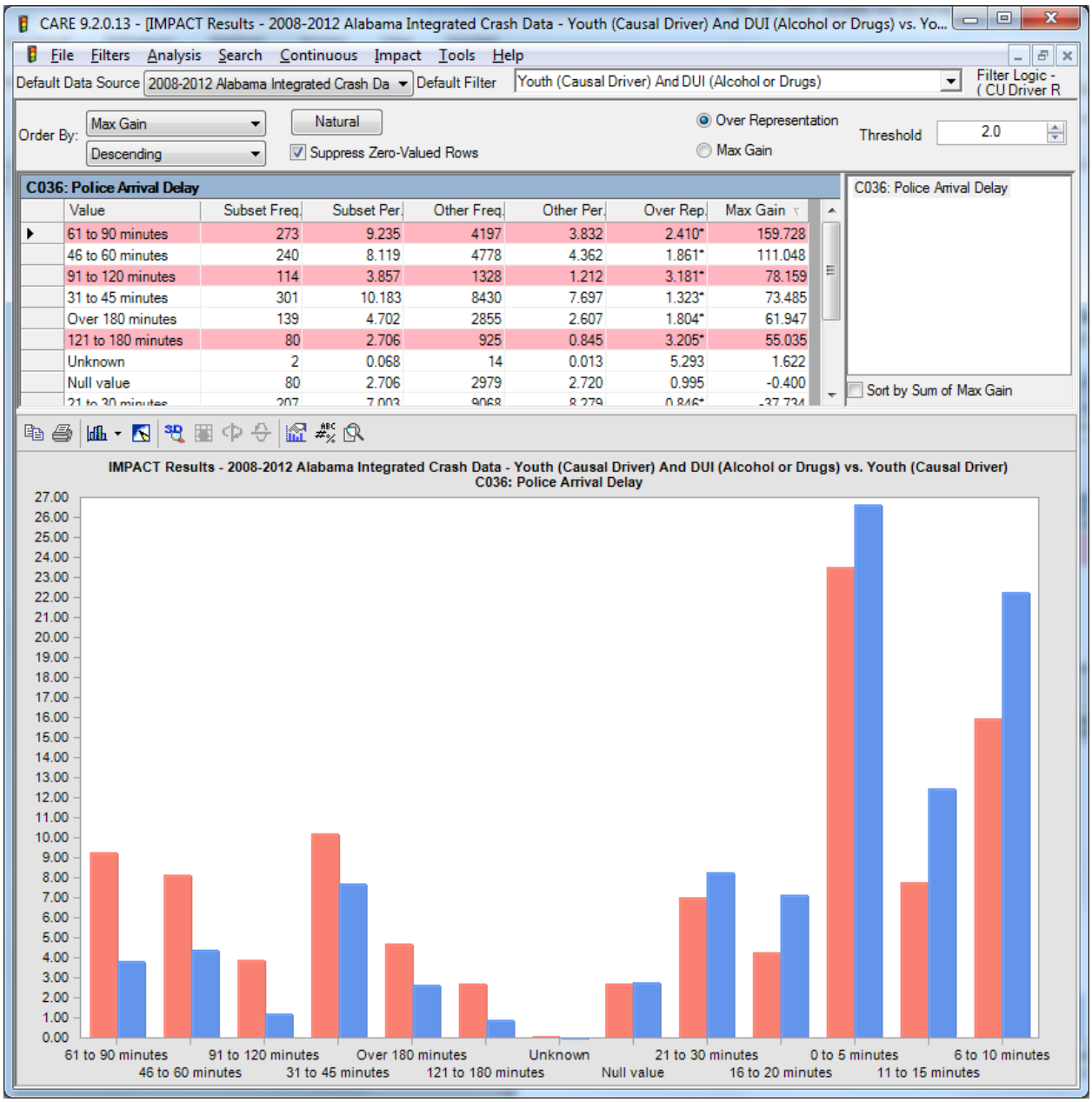
Raw Age of Driver C (C107). When looking at the age of the causal driver it is of interest to note that the Drivers that are age 20 are significantly over represented when comparing youth ID Crashes to other crashes where the causal driver was age 20. These numbers tell us that there are over 70% more than the expected number of 20 year old drivers that are involved in ID related crashes. Because these drivers are close to age 21, and likely have friends that are 21 and older, they seem to have a greater problem with

drinking and driving and could be a good group for targeted enforcement or education efforts. Age 19 is also over-represented but only to about half of the degree of the 20 year old drivers.

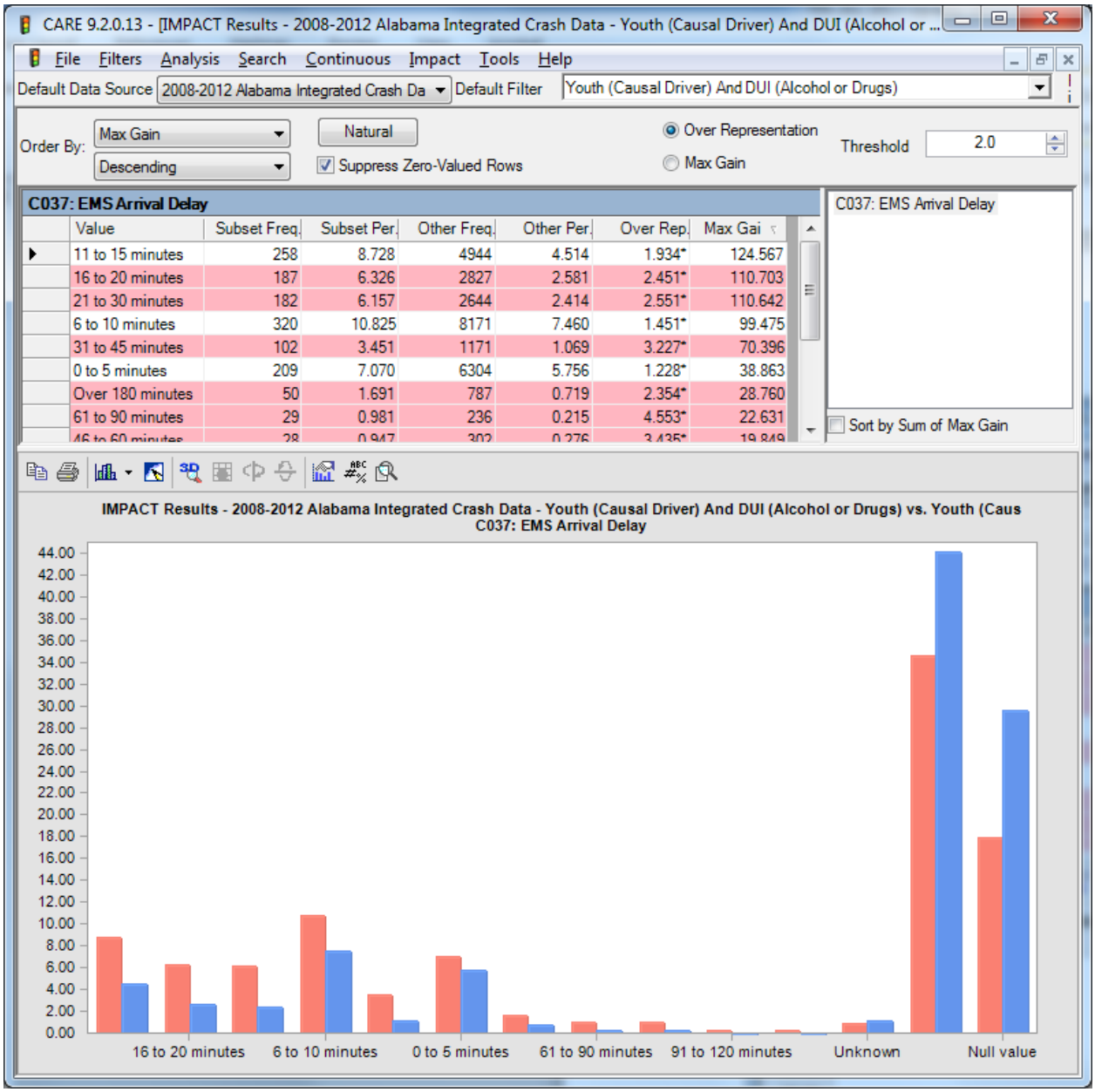


Value	Subset Freq.	Subset Per.	Other Freq.	Other Per.	Over Rep.	Max Gain
20	977	33.051	21280	19.429	1.701*	402.679
19	853	28.857	23669	21.610	1.335*	214.203
18	630	21.313	24004	21.916	0.972	-17.839
17	315	10.656	21496	19.626	0.543*	-265.151
16	181	6.123	19078	17.419	0.352*	-333.892

Police/Ambulance Arrival Delay (C036/C037). Due to the rural and late-night, week-end nature of these crashes, the severity is further complicated by arrival delays.



Value	Subset Freq.	Subset Per.	Other Freq.	Other Per.	Over Rep.	Max Gain
61 to 90 minutes	273	9.235	4197	3.832	2.410*	159.728
46 to 60 minutes	240	8.119	4778	4.362	1.861*	111.048
91 to 120 minutes	114	3.857	1328	1.212	3.181*	78.159
31 to 45 minutes	301	10.183	8430	7.697	1.323*	73.485
Over 180 minutes	139	4.702	2855	2.607	1.804*	61.947
121 to 180 minutes	80	2.706	925	0.845	3.205*	55.035
Unknown	2	0.068	14	0.013	5.293	1.622
Null value	80	2.706	2979	2.720	0.995	-0.400
21 to 30 minutes	207	7.003	9068	8.279	0.846*	-37.734



Vehicle Type (D101). Tractors and semi-trailers accounted for just under 44% of all youth causal-driver ID related crashes and were over-represented by a factor of 2.02.

Left Scene (C105). The proportion youth causal drivers who left the scene where ID was involved was 6.27 times over those where it was not.

REFERENCES

1. Transportation Research Board, "Alcohol and Other Drugs -- Their Role in Transportation," Transportation Research Circular Number 413, August 1993.

2. ADECA, Traffic Safety Section, Alabama Highway Safety Plan, 1994.