

Restraint Issues Problem Identification

Based on Alabama 2011-2015 Data

1. Introduction

The goal of this problem identification is to assure that the restraint enforcement program considered by the state throughout FY 2017 is completely evidence-based, the evidence being derived from past data obtained from crash records.

A problem identification study was conducted based on data that were consistent with that used in the FY 2016 HSP, calendar years 2011-2015. This study was updated using five years of data (CY 2011 through 2015). CARE IMPACT displays are used to display the information. The comparisons made were between those crashes in which the causal drivers were not restrained (generally represented by the red bars in the charts) and those which were reported to be restrained (generally represented by the blue bars in the charts). The use of proper restraints by causal drivers is seen to be an excellent proxy for proper restraint use by all passengers in the vehicle.

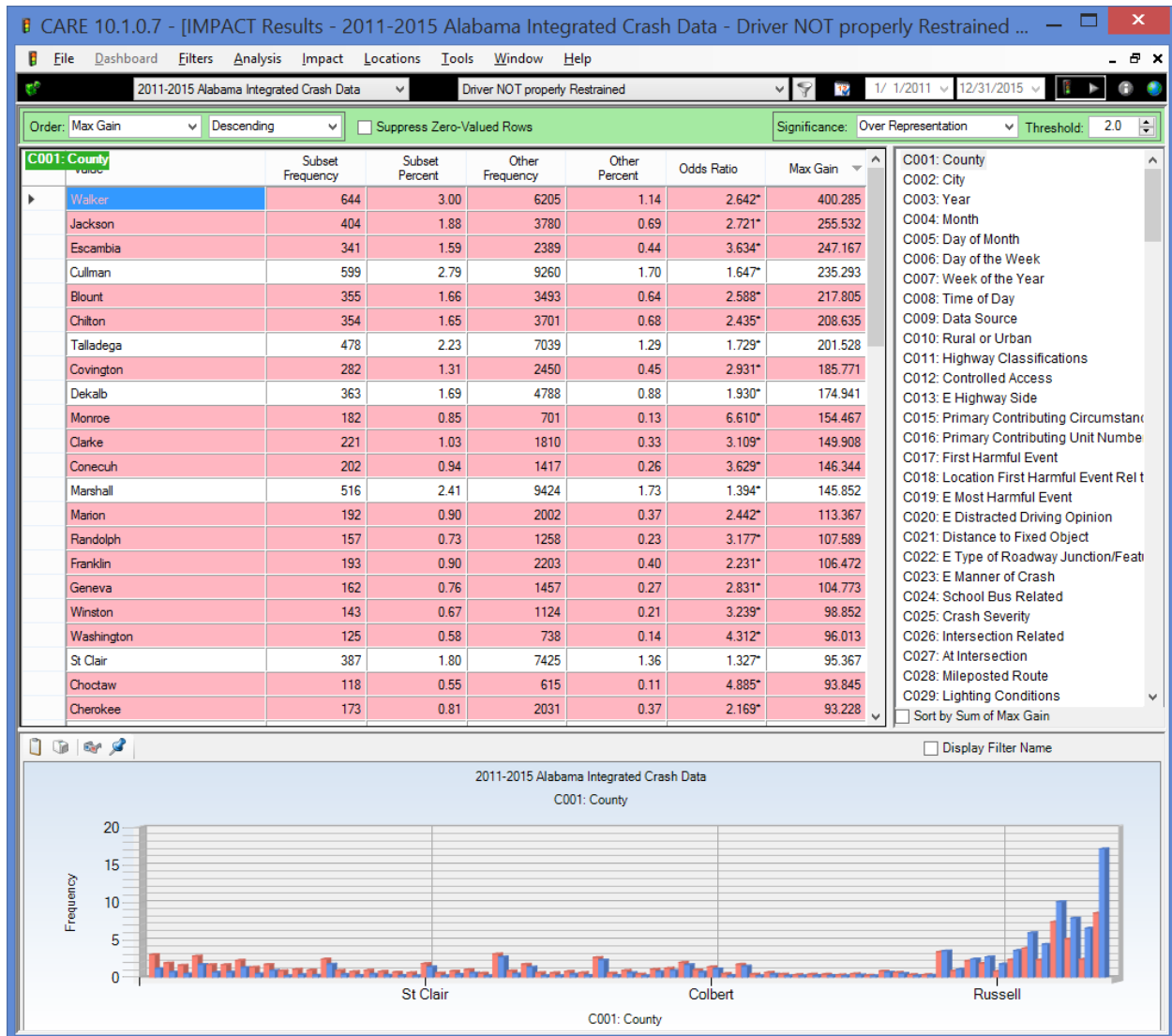
The results are presented in the following categories:

1. Introduction
2. Geographical
3. Time
4. Crash Causation
5. Severity
6. Driver Demographics
7. Analysis of Ejection
8. Analysis of Back Seat Occupants
9. Summary and Conclusions

2. Geographical Factors

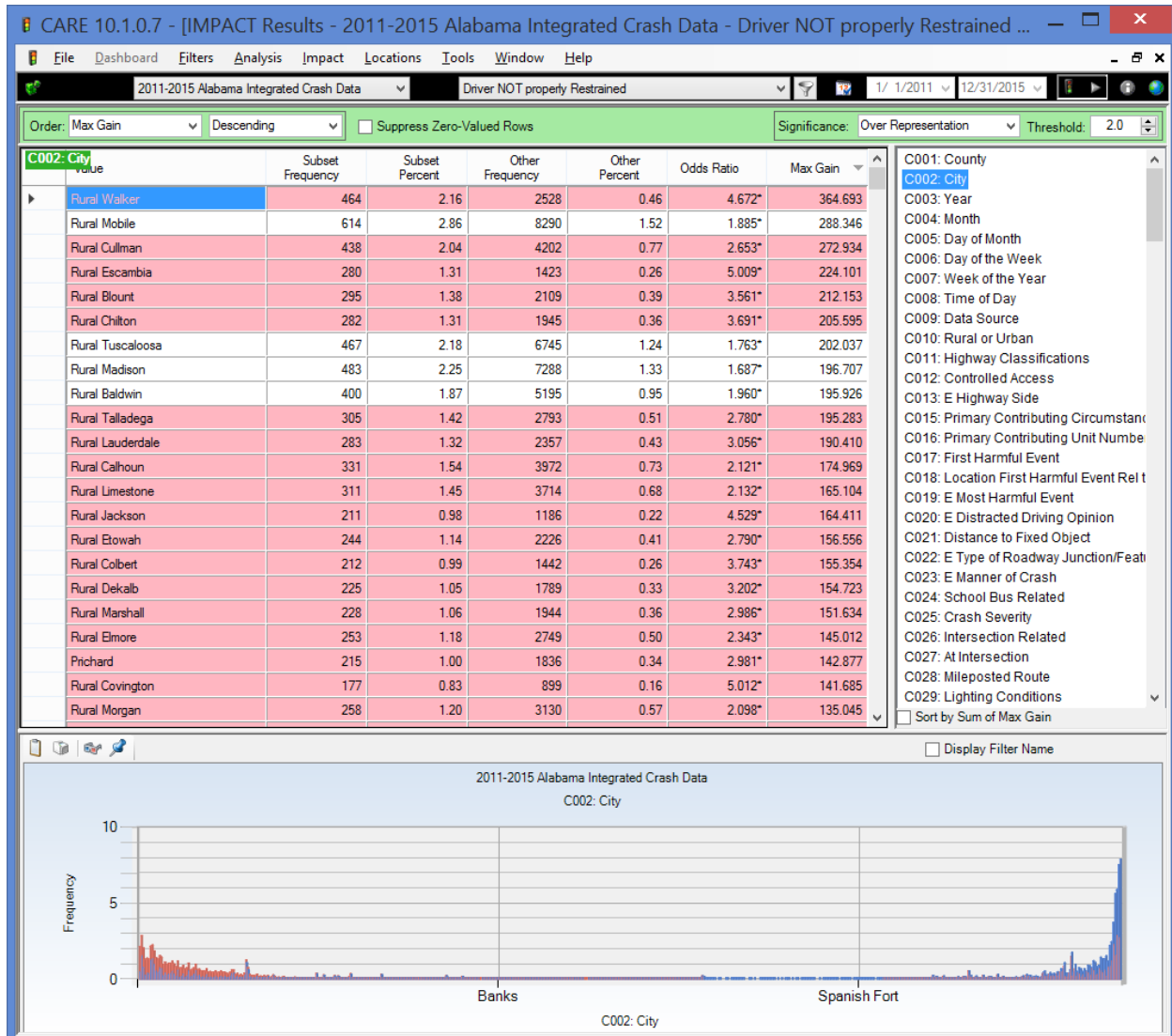
Geographical factors were analyzed in order to determine which areas are overrepresented for crashes involving drivers who did not use restraints. In order to determine these problem areas, geographical factors were analyzed in the following categories: county, city, rural versus urban, highway classification and locale.

2.1 County



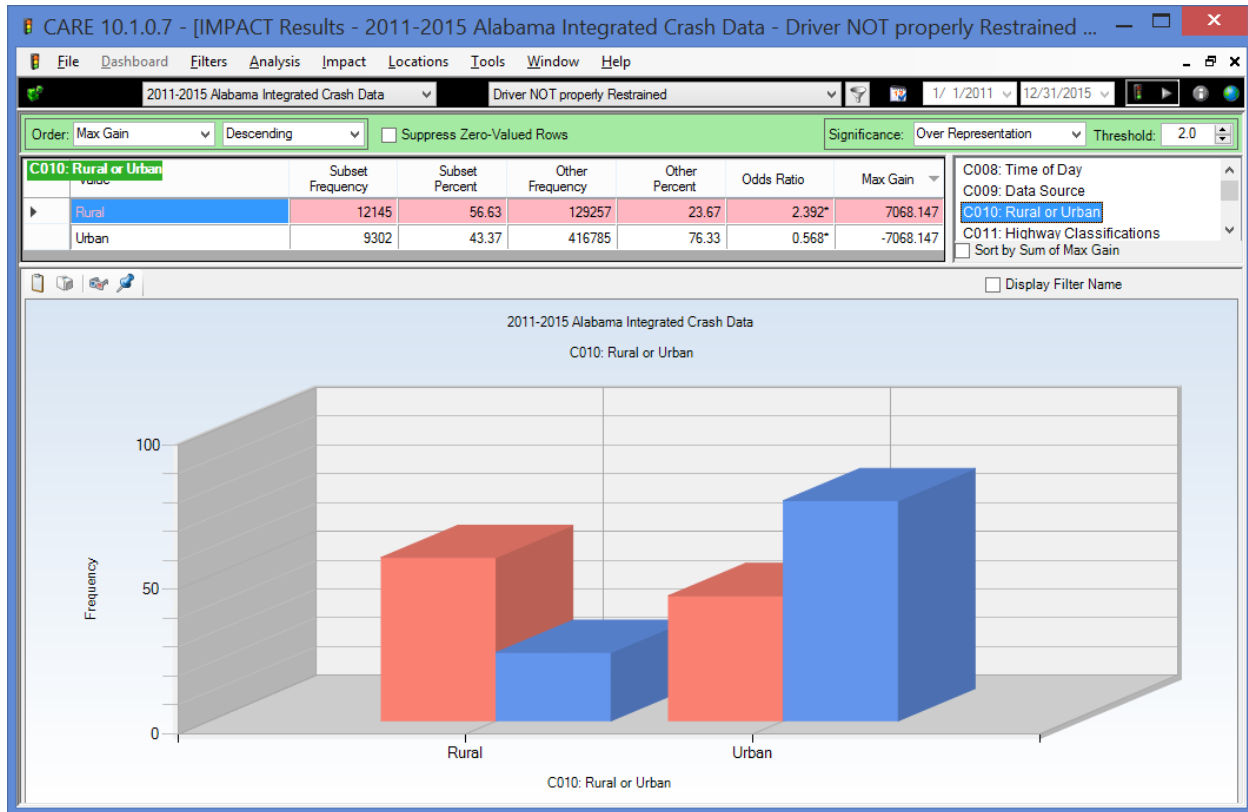
The counties with the greatest overrepresentation factors for crashes in which the driver failed to use restraints include Walker, Jackson, Escambia, Cullman and Blount. The more populated urbanized counties generally showed the highest restraint use.

2.2 City



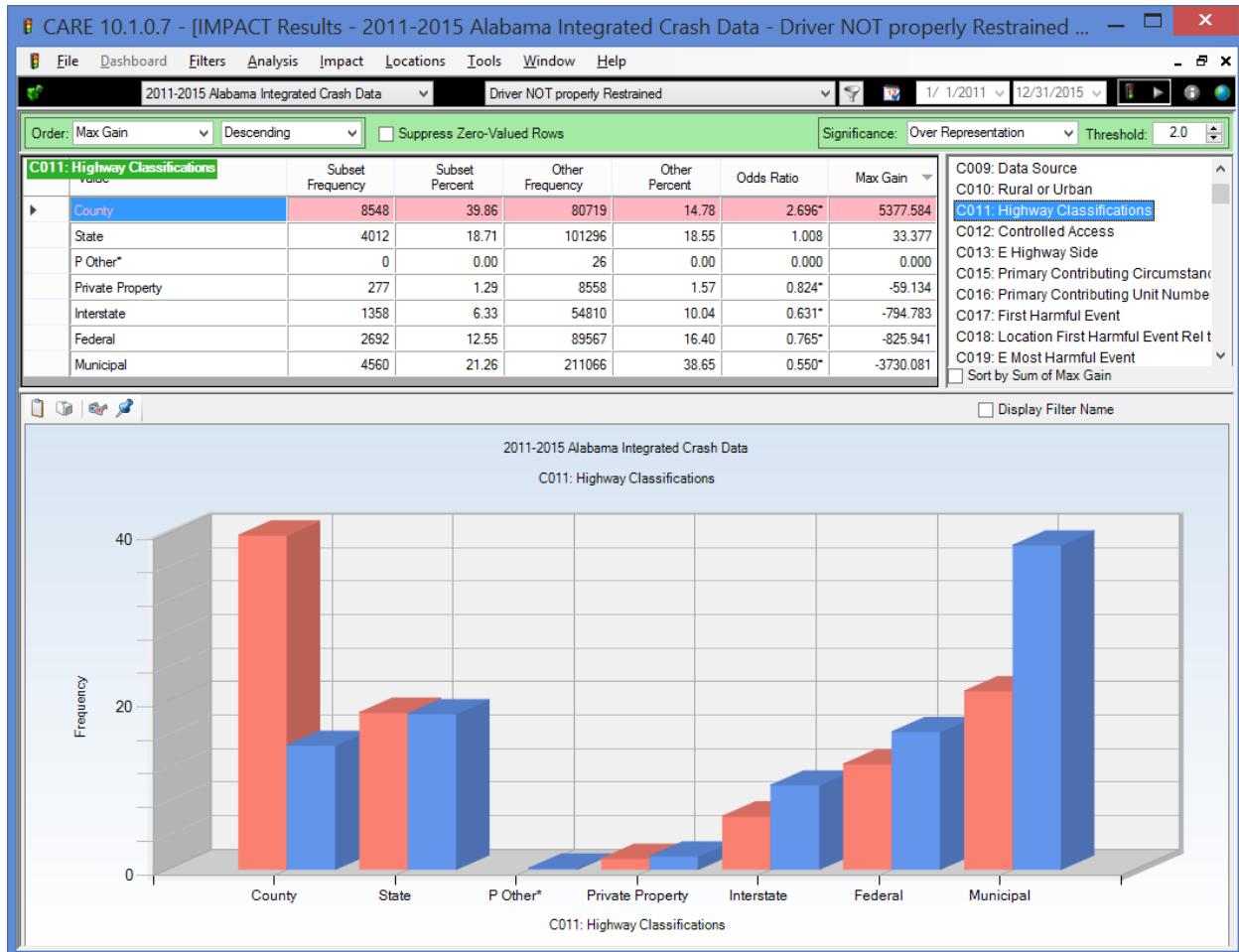
Overrepresented cities and county rural areas listed in the order of maximum gain are: rural Walker, rural Mobile, rural Cullman, and rural Escambia. Almost all of the over representation occurs in the rural county areas. The most under represented cities in order of “best” first are as follows: Birmingham, Mobile, Montgomery, Huntsville and Tuscaloosa.

2.3 Rural/Urban



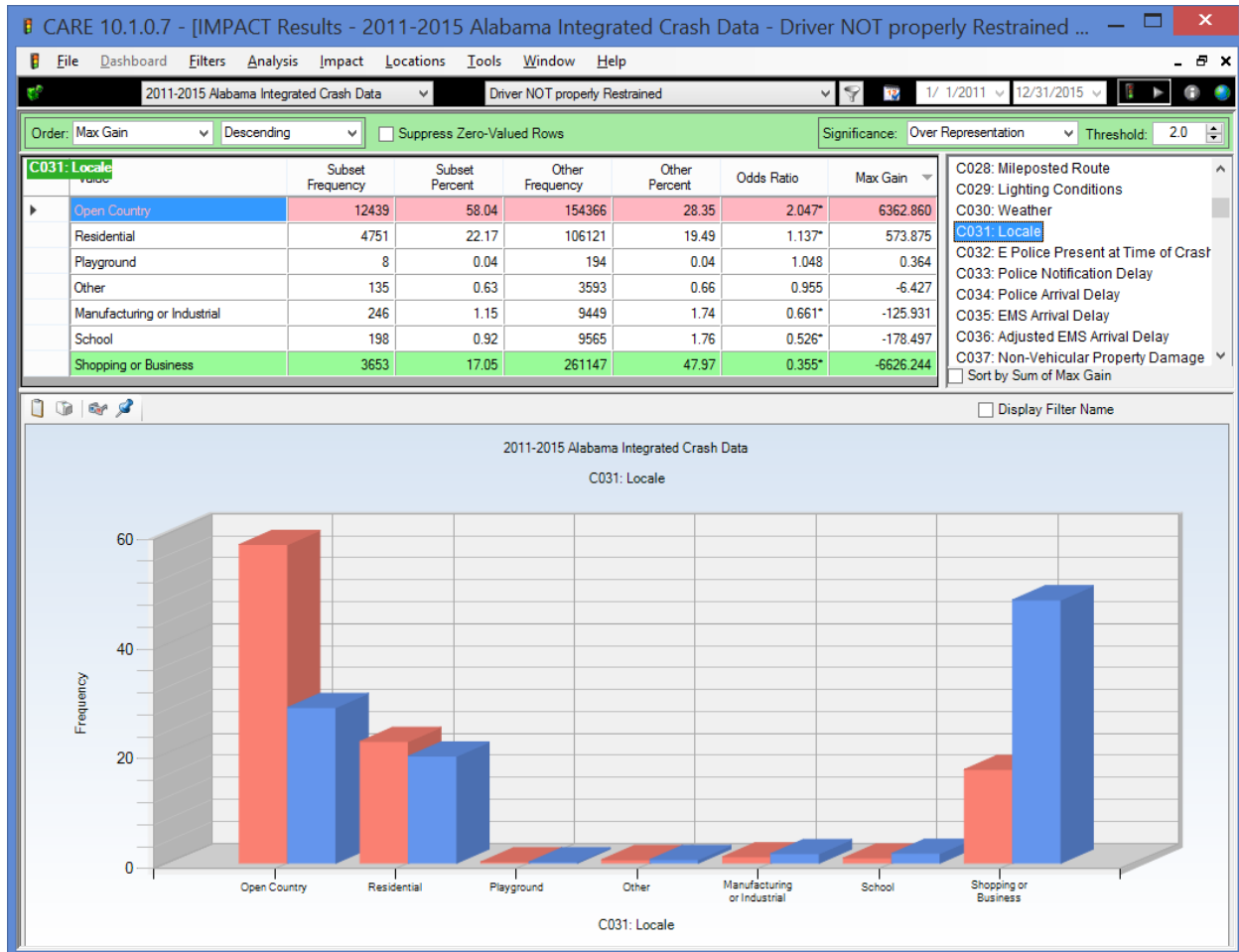
As expected from the city results above, the number of crashes involving drivers who use no restraints is greatly overrepresented in rural areas. The increased number of crashes in which restraints were used in urban areas might be attributed to greater police presence, newer vehicles, public information and education efforts, and the demographics of urban drivers in general.

2.4 Highway Classification



Crash incidents in which no restraints were used are greatly overrepresented on county highways with nearly 2.7 times the expected number of crashes. The proportion of crashes in which restraints were used is greater in state, interstate, federal, and municipal highway areas.

2.5 Locale

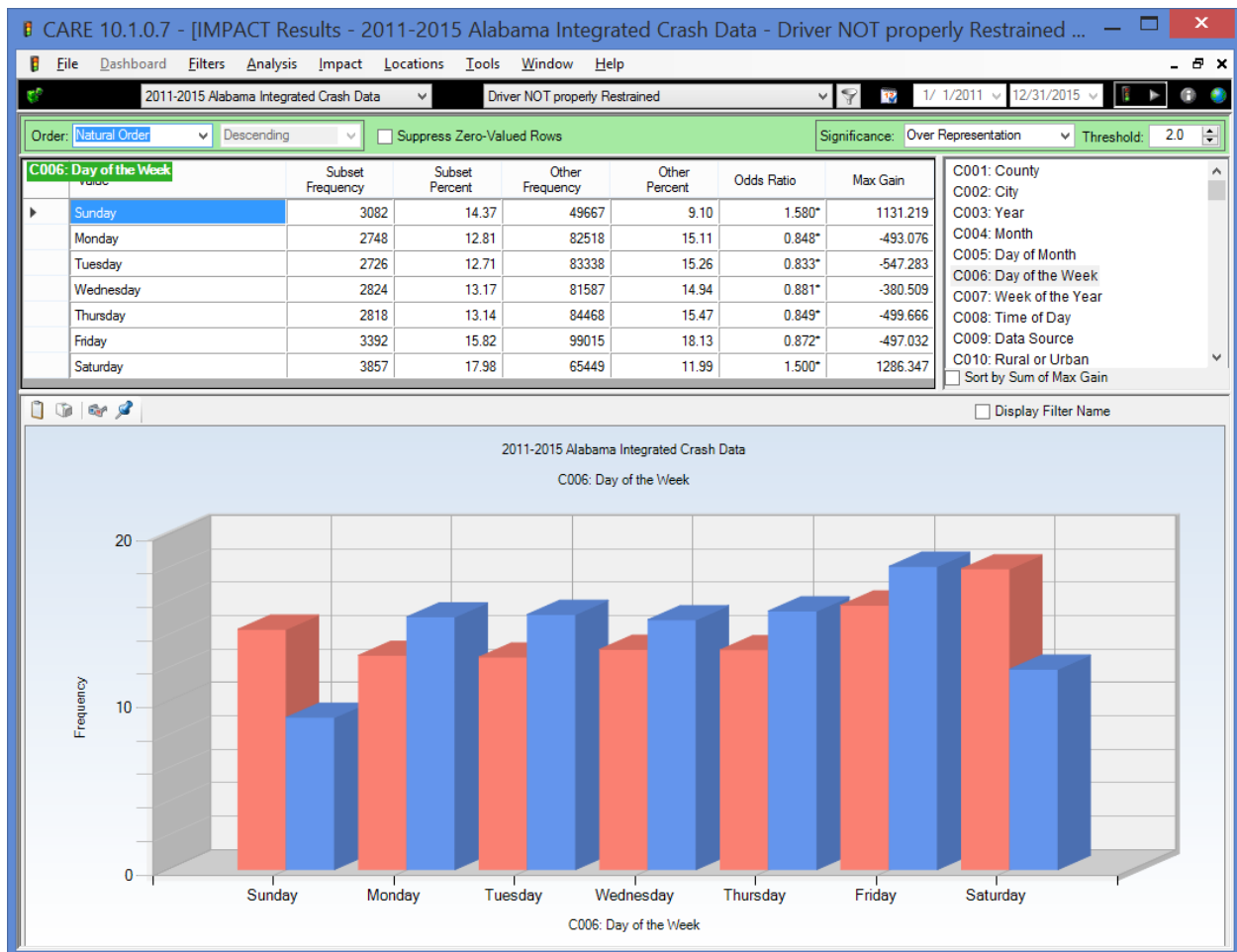


The crash incidents involving no restraints are overrepresented in open country areas. However, school and shopping areas are significantly underrepresented, indicating that crashes in these areas generally involve drivers who were much more apt to use their restraints.

3. Time Factors

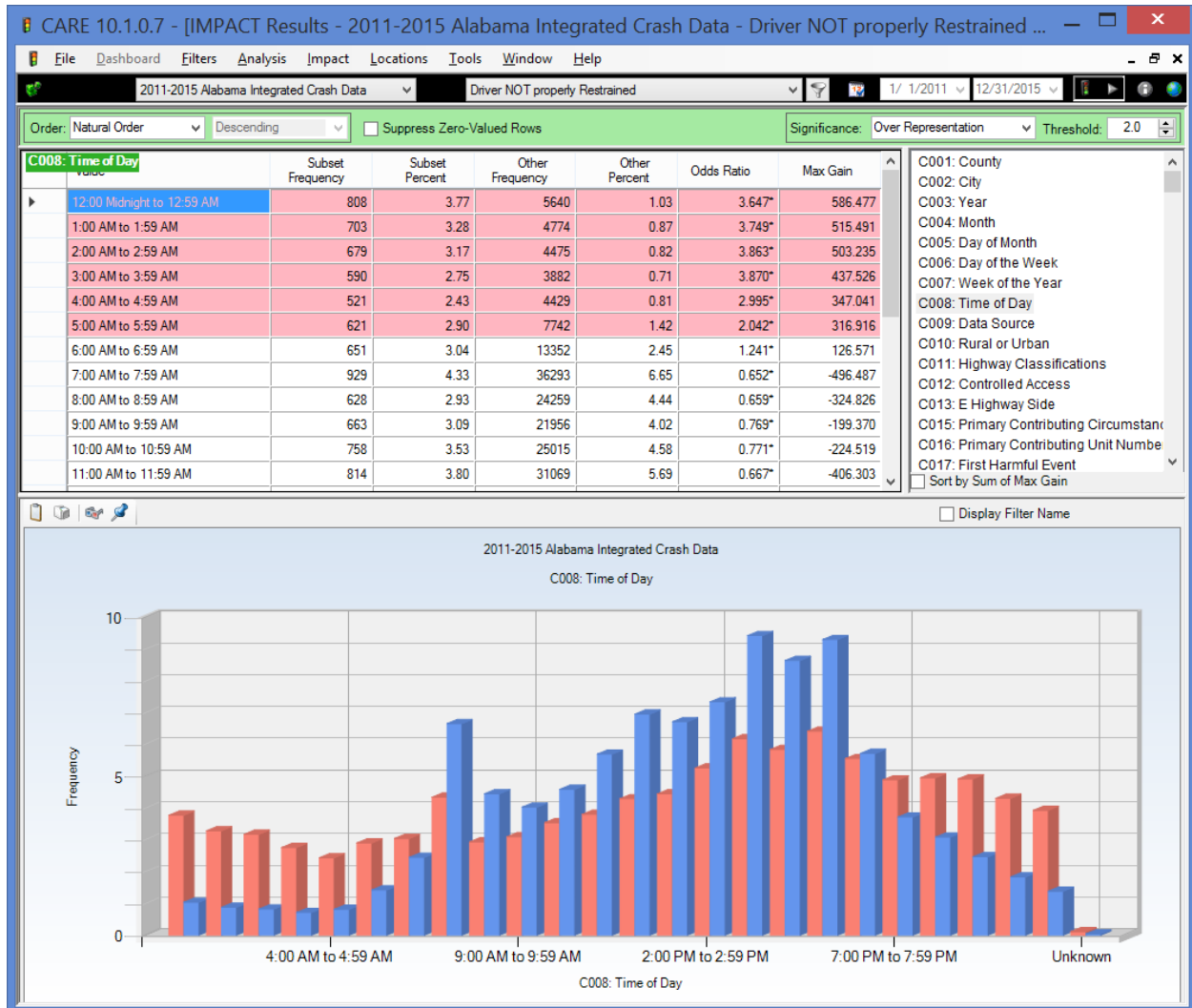
Time factors were also analyzed in several different categories to determine overrepresentation for day of the week and time of day. Analysis of these time factors allows for the determination of particular days of week or times of day in which more crashes occur with drivers who did not use restraints, and thus, those times in which enforcement would be more fruitful.

3.1 Day of the Week



The weekend is overrepresented for crashes involving causal drivers who failed to use restraints, demonstrating a heavy correlation with alcohol-involved crashes. Both Saturday and Sunday had about 1.5 times the expected number of crashes involving causal drivers who failed to use restraints.

3.2 Time of Day

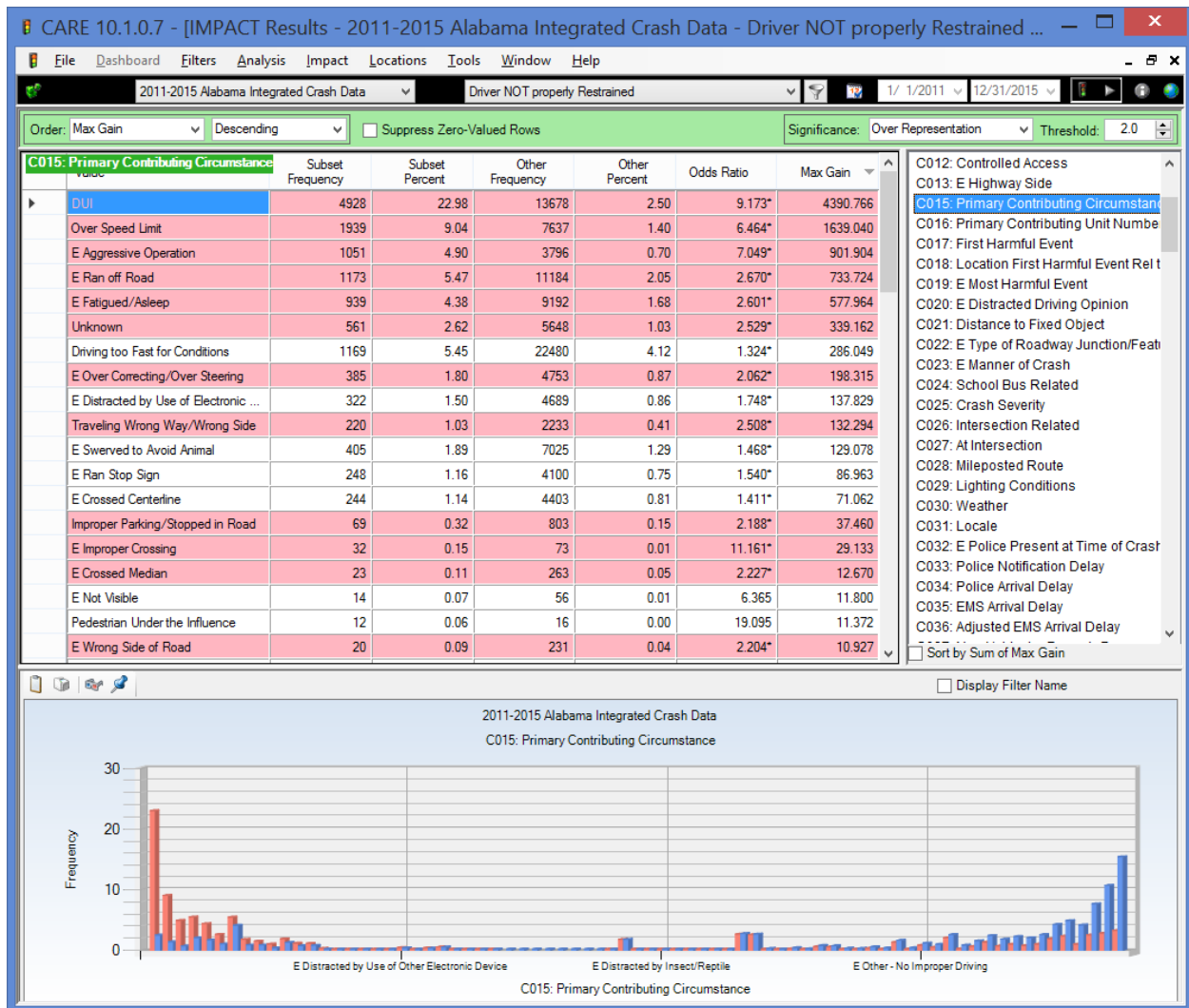


The relative probability of crashes involving no restraints is generally greater before and after standard work and rush hours. Over representation peaks during the 12 PM to 5 AM period and then tapers off, falling back below crashes involving causal drivers who use restraints in the 7 AM to 8 AM time period. This chart has a very strong resemblance to its DUI counterpart.

4 Crash Causal Factors

Analysis of crash causal factors determines which factors are the most likely contributors to crashes in which drivers did not use restraints. The primary contributing circumstances of the crashes were analyzed, and overrepresentation values indicate certain risk-taking behaviors associated with this type of crash. Vehicle model year and speed at impact were also evaluated to characterize factors that are consistently associated with crashes in which drivers do not use restraints.

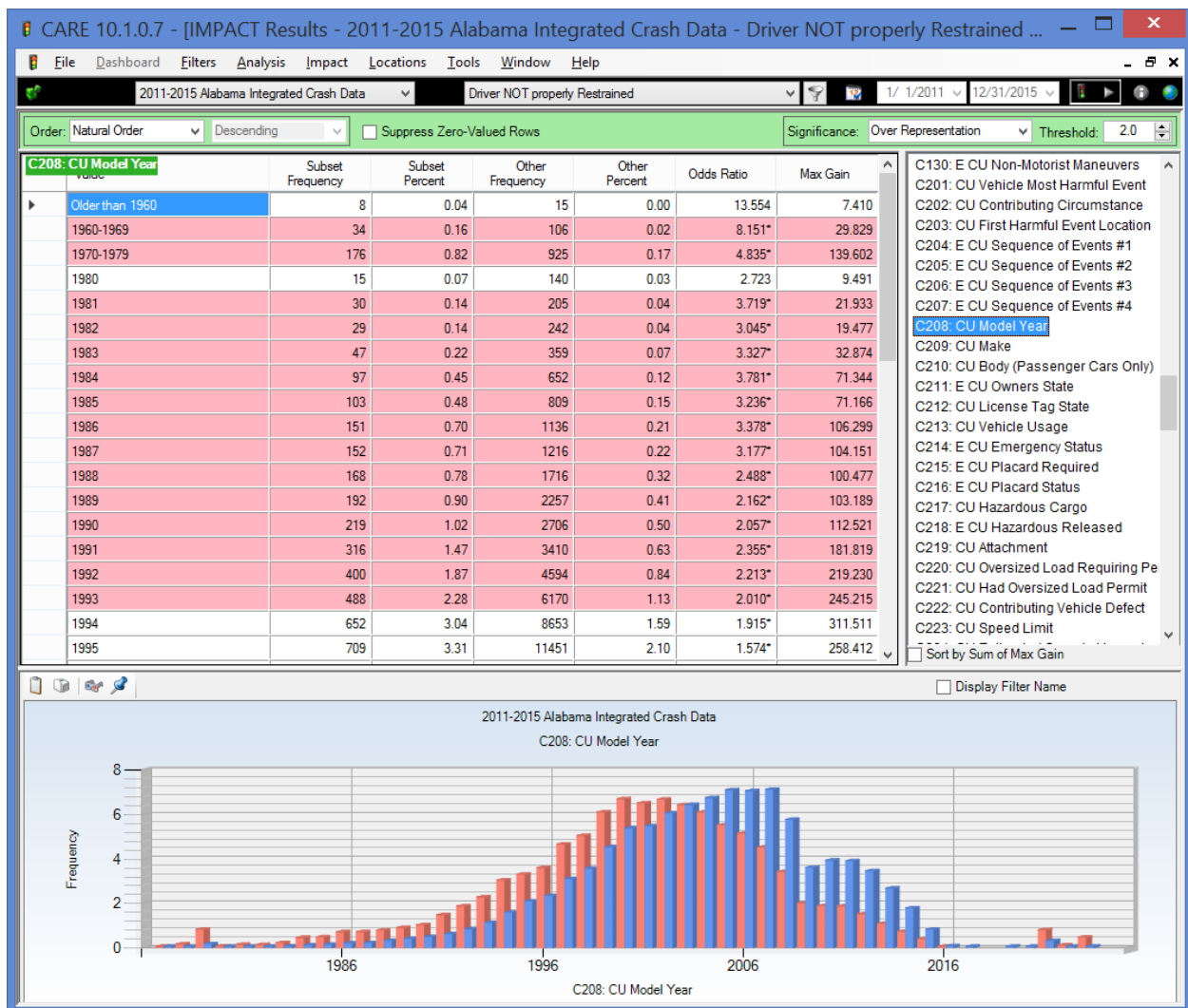
4.1 Primary Contributing Circumstance



Over representation factors indicate that certain risk-taking behaviors are often associated with the crashes in which drivers do not use restraints. In order of maximum potential expected gain (Max Gain), these include: DUI, over the speed limit, aggressive operation, running off the road and fatigued/asleep. It is obvious that the presence of seat belts will not have a large impact on the causation of these crashes, although the increased ability to maintain control in adverse situations should not be minimized as a benefit of restraints. However, the correlation here would be

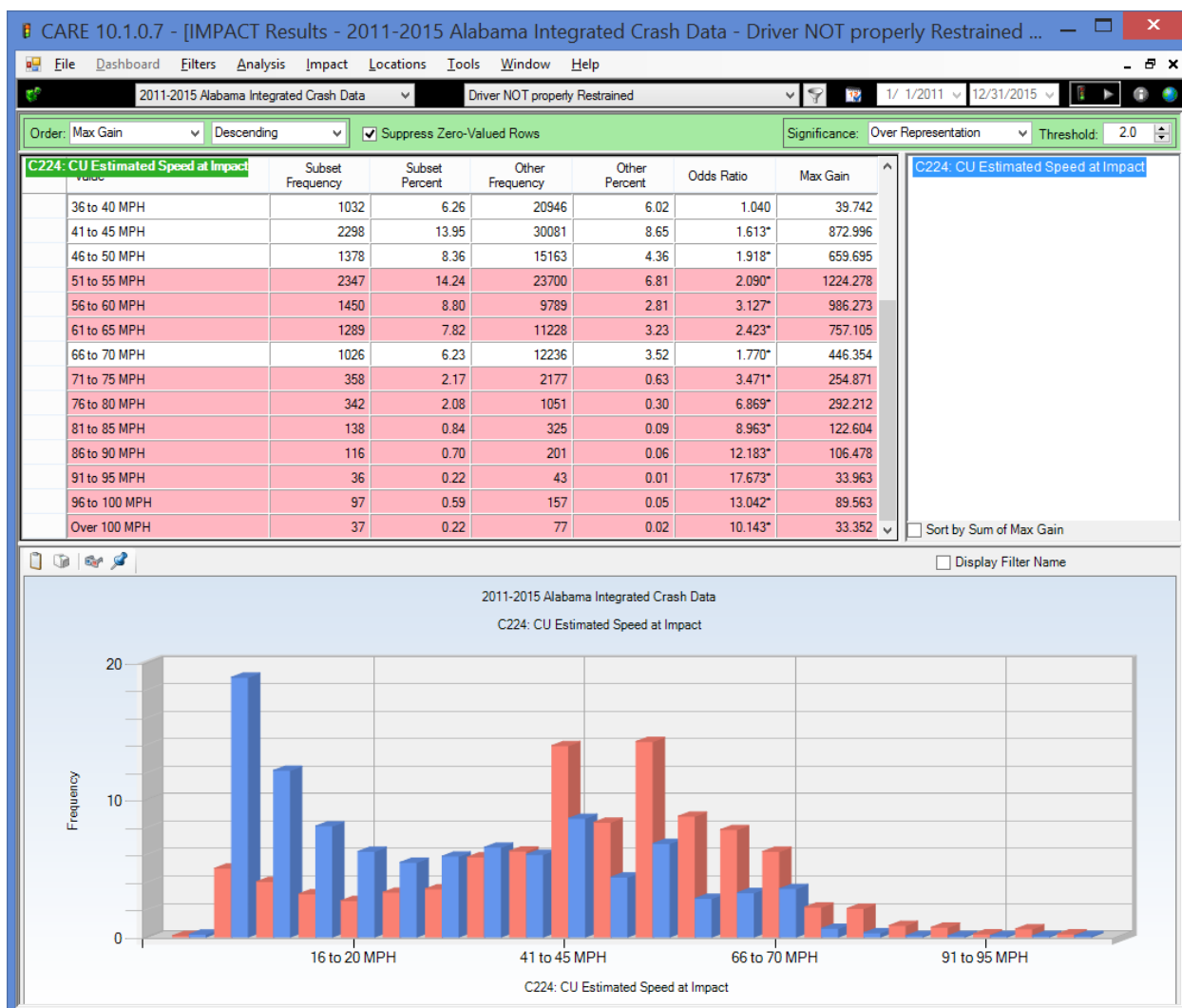
the result of risk acceptance in general, and the inability or unwillingness of those who are impaired to consider the life-saving benefits of restraint use. Additionally, analysis of other contributing circumstances presented similar risk-taking behaviors associated with crashes in which causal drivers did not use restraints. In the order of maximum gain, these include: DUI, over the speed limit, running off the road, aggressive operation, and over correction. Other overrepresented contributing circumstances include traveling the wrong way, vehicle left in road, running stop signs, driver condition, improper parking, and wrong side of the road.

4.2 Vehicle Age – Model Year



Crashes attributed to drivers who used no restraints are greatly overrepresented in vehicles with model years 1960-2002. This might be attributed to the lack of standard safety restraints in the older model vehicles. Vehicles with model years 2003 and later indicate that the numbers involving restraints very significantly surpasses those involving drivers who did not use restraints. One factor that would increase the rural problem could well be the economic disadvantages of those in the rural areas, and thus their use of older vehicles.

4.3 Speed at Impact

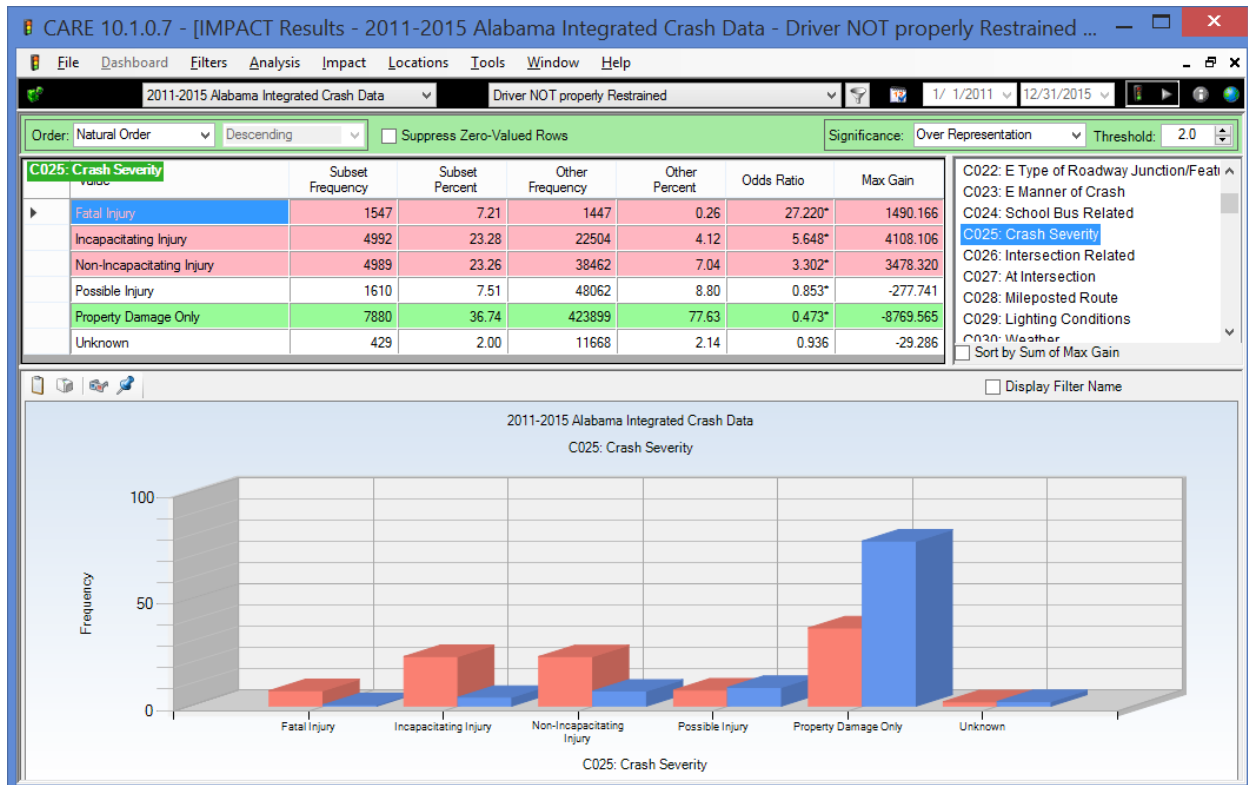


Speed at impact for crashes in which drivers failed to use restraints is overrepresented in the range of 45-100 MPH. This indicates that crashes in which restraints were not used consistently occur at higher speeds than crashes in which restraints were used by the causal driver. This confirms the rural-urban finding, in that speeds are generally higher in the rural areas. It also exacerbates the problem, resulting in greater severity caused by the high-speed, unrestrained situations. Severity factors are considered in the next section.

5 Severity Factors

Severity factors were analyzed in several different categories to determine to what extent the use of restraints affects the safety of the drivers. These factors analyzed include crash severity, crash severity in urban versus rural areas, number injured, number killed, driver ejection status, and driver injury type.

5.1 Crash Severity



Fatal, incapacitating, and non-incapacitating injuries are all overrepresented in crashes that occurred without the use of restraints. This expected result quantifies the effects of the benefits of restraint use. Property damage only was far more common in crashes in which drivers employed the use of restraints.

5.2 Crash Severity by Highway Classification for Driver Not Restrained

CARE 10.1.0.7 - [Crosstab Results - 2011-2015 Alabama Integrated Crash Data - Filter = Driver NOT properly Re...]

File Dashboard Filters Analysis Crosstab Locations Tools Window Help

2011-2015 Alabama Integrated Crash Data Driver NOT properly Restrained 1/ 1/2011 12/31/2015

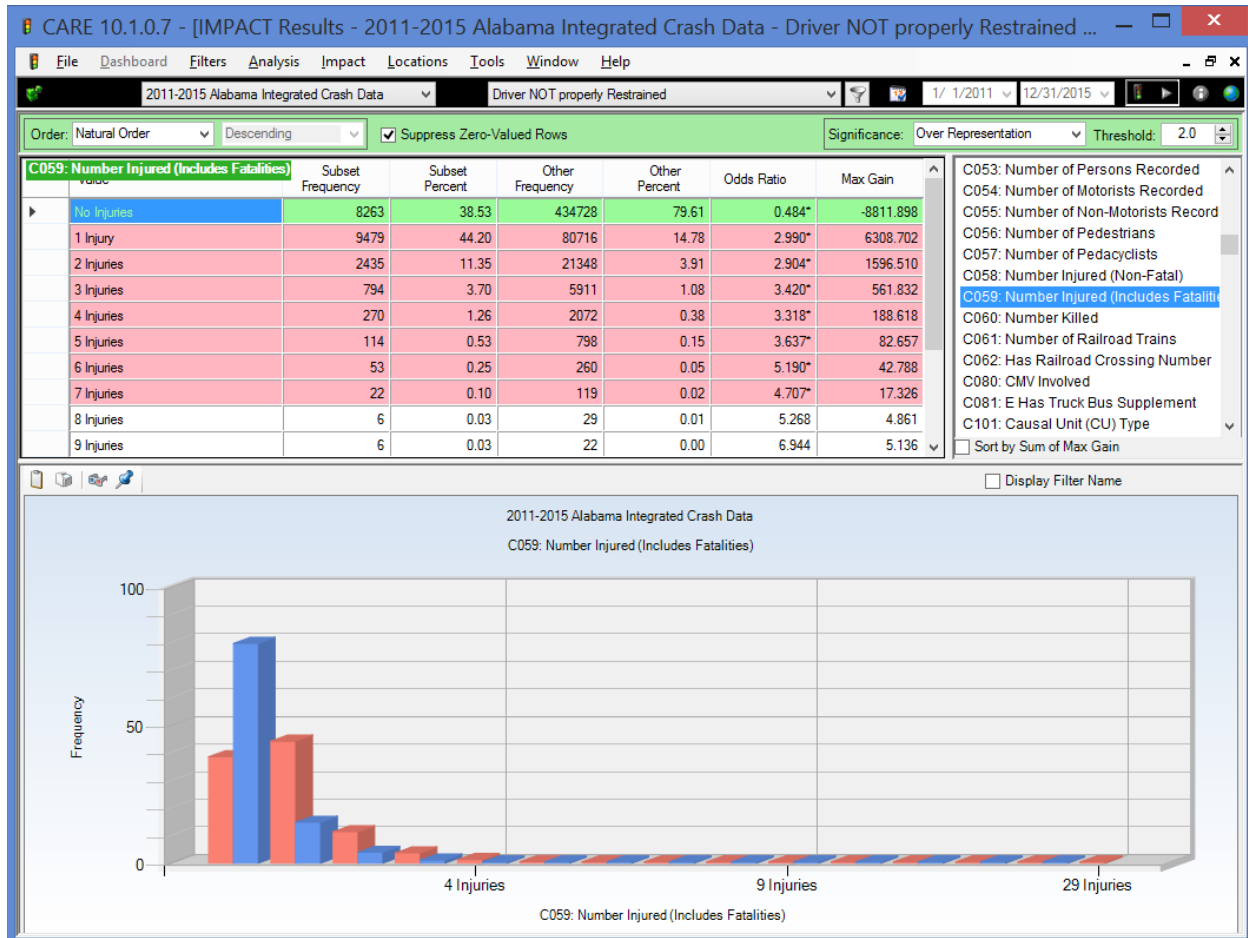
Suppress Zero Values: None Select Cells: Column: Crash Severity ; Row: Highway Classifications

	Fatal Injury	Incapacitating Injury	Non-Incapacitating Inju	Possible Injury	Property Damage Only	Unknown	TOTAL
Interstate	143 9.24%	310 6.21%	323 6.47%	103 6.40%	464 5.89%	15 3.50%	1358 6.33%
Federal	250 16.16%	641 12.84%	637 12.77%	214 13.29%	905 11.48%	45 10.49%	2692 12.55%
State	350 22.62%	996 19.95%	877 17.58%	322 20.00%	1379 17.50%	88 20.51%	4012 18.71%
County	643 41.56%	2332 46.71%	2210 44.30%	441 27.39%	2824 35.84%	98 22.84%	8548 39.86%
Municipal	156 10.08%	687 13.76%	894 17.92%	510 31.68%	2137 27.12%	176 41.03%	4560 21.26%
Private Property	5 0.32%	26 0.52%	48 0.96%	20 1.24%	171 2.17%	7 1.63%	277 1.29%
P Other*	0 0.00%	0 0.00%	0 0.00%	0 0.00%	0 0.00%	0 0.00%	0 0.00%
TOTAL	1547 7.21%	4992 23.28%	4989 23.26%	1610 7.51%	7880 36.74%	429 2.00%	21447 100.00%

Analysis of crash severity by highway classification for crashes in which the causal driver did not use restraints shows that fatal injuries are overrepresented on Interstate, Federal and State roadways. Possible injuries and Property Damage Only were overrepresented on municipal highways.

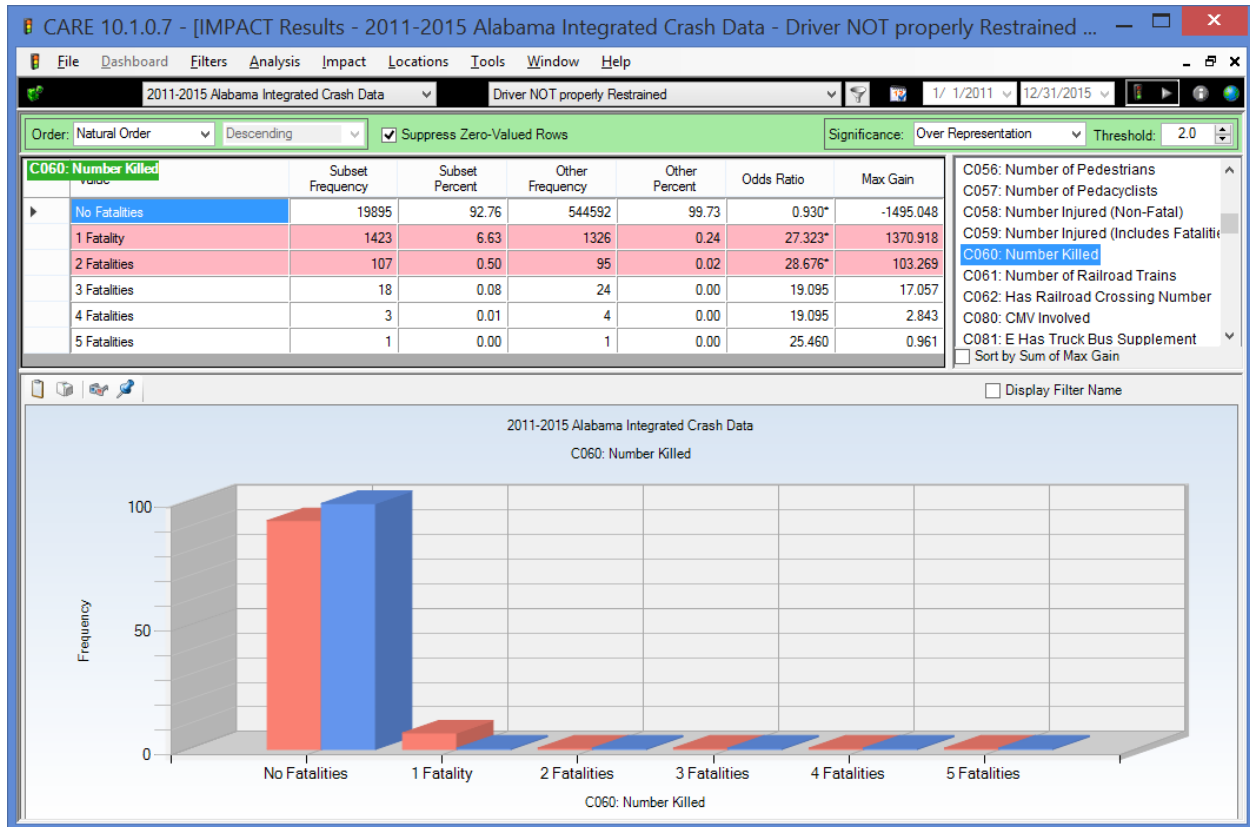
In a comparison of crash severity in rural versus urban areas for causal drivers who did not use restraints, possible injuries were overrepresented in urban areas. However, in rural areas, fatal injuries crashes with causal drivers who did not use restraints were significantly overrepresented, comprising 70% of fatal injuries.

5.3 Number Injured



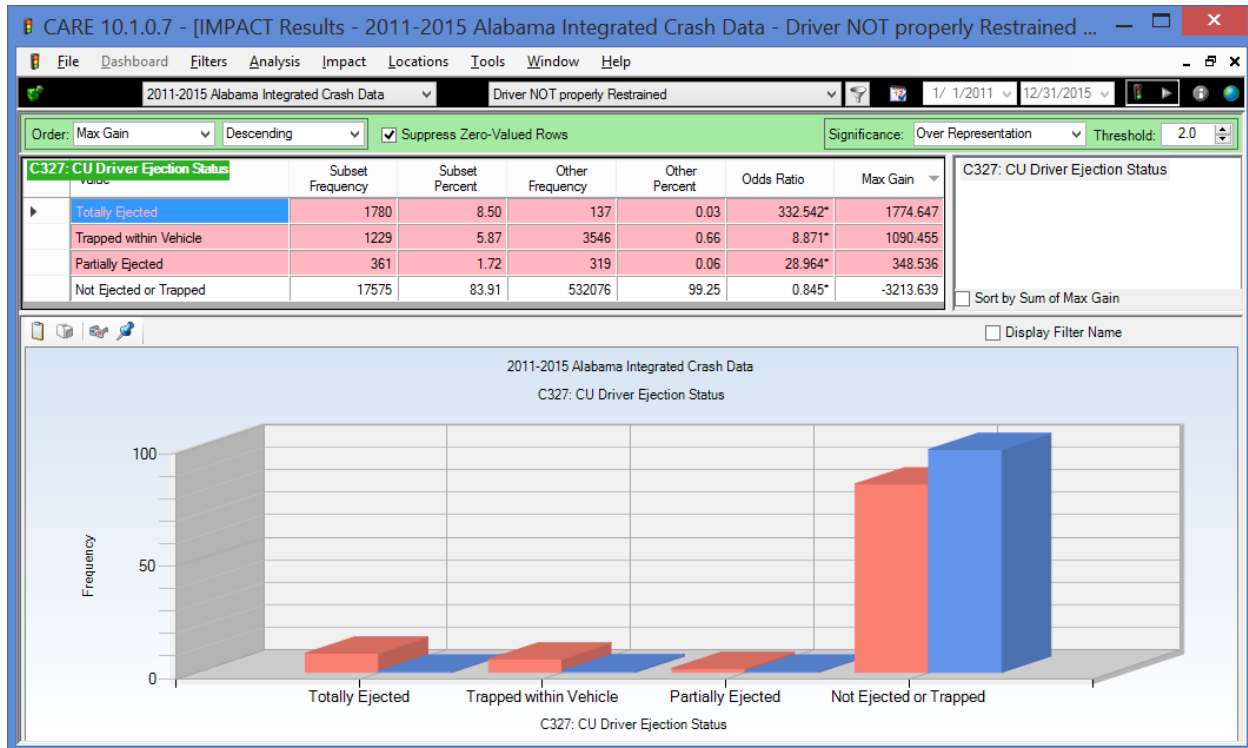
The proportion of injuries (including fatalities) in crashes in which no restraints were used is overrepresented by more than a factor of two when there were 1 to 7 injuries per crash. These results show quite plainly that crashes in which the causal driver was not restrained are much more severe in their effects to all passengers than when the causal driver is restrained. The overrepresentation of multiple injuries in the causal vehicle might also indicate a tendency to travel with multiple individuals in the vehicle. This also demonstrates that the use of a seat belt by the driver is an excellent proxy for seat belt use in general in the corresponding vehicle.

5.4 Number Killed



The proportion of fatalities in general as well as the proportion of multiple fatality crashes is dramatically overrepresented when restraints are not used.

5.5 Driver Ejection Status



Totally Ejected is overrepresented by a factor of over 300 in crashes in which the driver did not use restraints, indicating the cause for many fatalities. Partial ejection, total ejection, or entrapments in the vehicle are expected in crashes in which safety equipment is not properly utilized.

5.6 Ejection Status by Severity

CARE 10.1.0.7 - [Crosstab Results - 2011-2015 Alabama Integrated Crash Data - Filter = Driver NOT properly Re...

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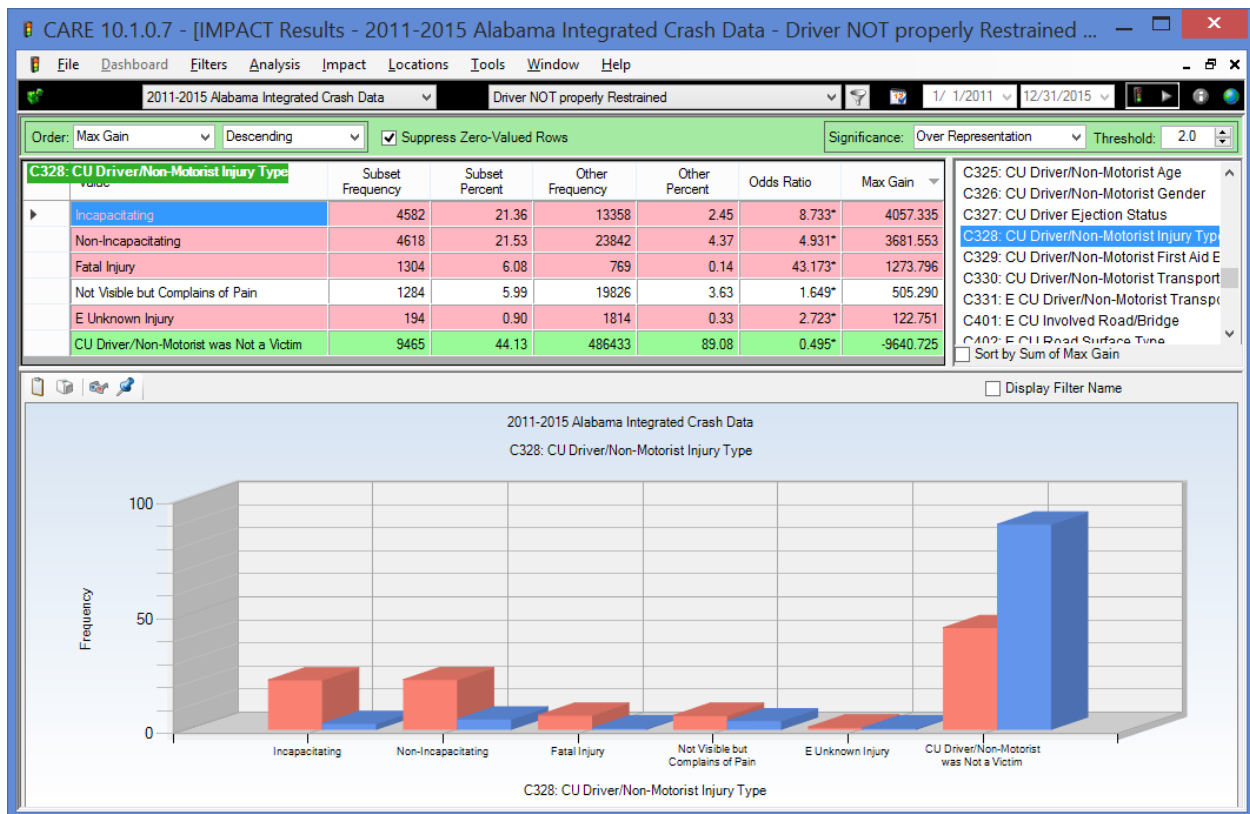
2011-2015 Alabama Integrated Crash Data Driver NOT properly Restrained 1/1/2011 12/31/2015

Suppress Zero Values: None Select Cells: Column: Crash Severity ; Row: CU Driver Ejection Status

	Fatal Injury	Incapacitating Injury	Non-Incapacitating Inju	Possible Injury	Property Damage Only	Unknown	TOTAL
Not Ejected or Trapped	540 34.91%	3339 66.89%	4233 84.85%	1463 90.87%	7635 96.89%	365 85.08%	17575 81.95%
Partially Ejected	136 8.79%	128 2.56%	65 1.30%	14 0.87%	16 0.20%	2 0.47%	361 1.68%
Totally Ejected	490 31.67%	836 16.75%	361 7.24%	37 2.30%	44 0.56%	12 2.80%	1780 8.30%
Trapped within Vehicle	347 22.43%	579 11.60%	209 4.19%	47 2.92%	27 0.34%	20 4.66%	1229 5.73%
Unknown	3 0.19%	30 0.60%	27 0.54%	6 0.37%	41 0.52%	18 4.20%	125 0.58%
Not Applicable	12 0.78%	52 1.04%	65 1.30%	30 1.86%	107 1.36%	9 2.10%	275 1.28%
CU is Not a Vehicle	19 1.23%	28 0.56%	29 0.58%	13 0.81%	10 0.13%	3 0.70%	102 0.48%
CU is Unknown	0 0.00%	0 0.00%	0 0.00%	0 0.00%	0 0.00%	0 0.00%	0 0.00%
E CU Driver Not Recorded	0 0.00%	0 0.00%	0 0.00%	0 0.00%	0 0.00%	0 0.00%	0 0.00%
TOTAL	1547 7.21%	4992 23.28%	4989 23.26%	1610 7.51%	7880 36.74%	429 2.00%	21447 100.00%

All crashes in the above cross-tabulation involved drivers who were not properly restrained. In evaluating crash severity by ejection status, data show that fatal and incapacitating injuries were significantly overrepresented in crashes in which the driver was partially ejected, totally ejected, or trapped within the vehicle. Because the ejection status is strongly associated with the use of restraints, this data indicates that failure to use restraints results in greater severity of injuries in crashes. The table given above quantifies this increase in severity.

5.7 Driver Injury Type

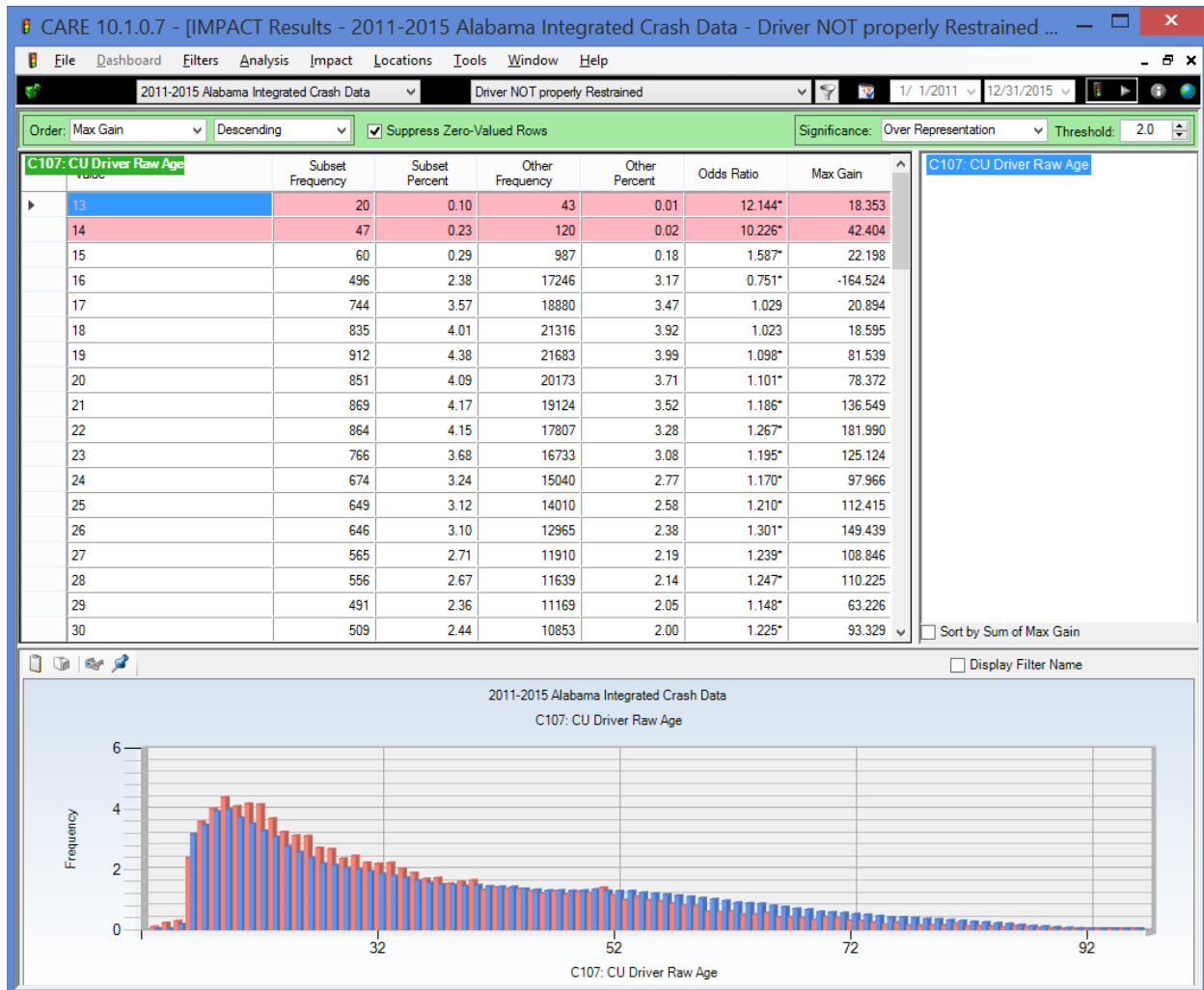


Various types of driver injuries, including fatalities, are consistently overrepresented in crashes where no restraints were used by the driver. Fatalities in these crashes are overrepresented by a factor of over 43. In crashes in which safety restraints were used, drivers and non-motorists were far less likely to be injured.

6 Driver Demographics

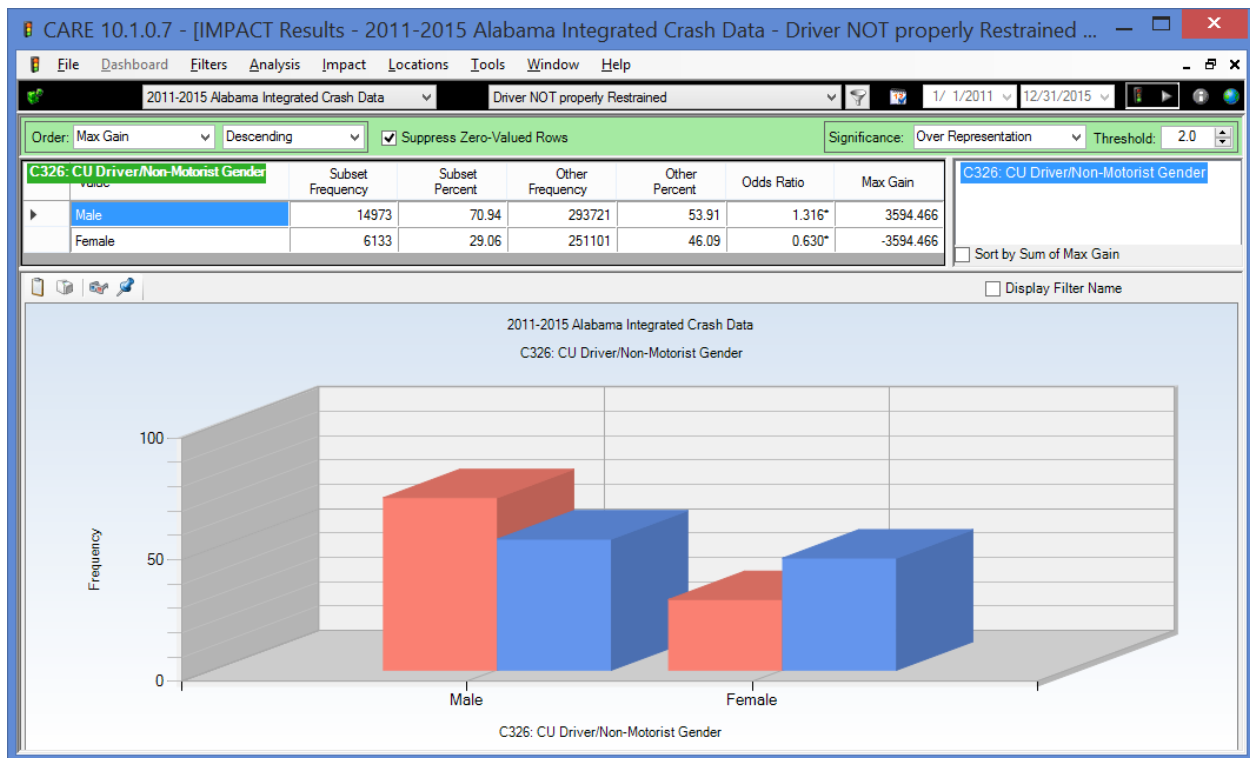
The study of driver demographics provides information about which gender or age groups are more likely to be involved in these crashes in which no restraints are used. Determination of overrepresentation can help to target the gender or age group that is more likely to be involved in this type of crash.

6.1 Driver Age



Analysis of individual driver ages indicates that crashes involving no restraints are overrepresented in the years above the teen-drivers (age range 19-35). While it appears that 16-18 teen-aged drivers are more likely to use safety equipment (perhaps due to the emphasis on it placed during training), there is still a very large proportion that are unrestrained, and this problem is multiplied by their overrepresentation in crashes in general (note that, in general, they are at least twice the average of the other ages).

6.2 Driver Gender



Males account for about 55% of crashes in which restraints are not used, and they are overrepresented by a factor of 1.292. Since males also do the majority of the driving, they become a clear target for restraint countermeasures.

6.3 Driver Gender by Severity

CARE 10.1.0.7 - [Crosstab Results - 2011-2015 Alabama Integrated Crash Data - Filter = Driver NOT properly Re...]

File Dashboard Filters Analysis Crosstab Locations Tools Window Help

2011-2015 Alabama Integrated Crash Data Driver NOT properly Restrained 1/ 1/2011 12/31/2015

Suppress Zero Values: None Select Cells: Column: CU Driver Gender ; Row: Crash Severity

	Male	Female	Unknown	Not Applicable	CU is Not a Vehicle	CU is Unknown	TOTAL
Fatal Injury	1184 7.96%	343 5.61%	0 0.00%	1 10.00%	19 18.63%	0 0.00%	1547 7.21%
Incapacitating Injury	3455 23.22%	1504 24.61%	5 1.46%	0 0.00%	28 27.45%	0 0.00%	4992 23.28%
Non-Incapacitating Inju	3484 23.41%	1464 23.95%	11 3.21%	1 10.00%	29 28.43%	0 0.00%	4989 23.26%
Possible Injury	1001 6.73%	590 9.65%	6 1.75%	0 0.00%	13 12.75%	0 0.00%	1610 7.51%
Property Damage Only	5486 36.87%	2081 34.05%	296 86.30%	7 70.00%	10 9.80%	0 0.00%	7880 36.74%
Unknown	270 1.81%	130 2.13%	25 7.29%	1 10.00%	3 2.94%	0 0.00%	429 2.00%
TOTAL	14880 69.38%	6112 28.50%	343 1.60%	10 0.05%	102 0.48%	0 0.00%	21447 100.00%

When driver gender by severity was studied, data indicate that “Possible Injuries” are overrepresented for female drivers in this type of crash. Generally, the distribution of severity is skewed toward more severe injuries for unrestrained male drivers.

6.4 Restraints Not Used in Rural Crashes – Times

CARE 10.1.0.7 - [Crosstab Results - 2011-2015 Alabama Integrated Crash Data - Filter = Driver NOT properly Re...]

File Dashboard Filters Analysis Crosstab Locations Tools Window Help

2011-2015 Alabama Integrated Crash Data Driver NOT properly Restrained and Rural 1/ 1/2011 12/31/2015

Suppress Zero Values: None Select Cells: Column: Day of the Week ; Row: Time of Day

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	TOTAL
12:00 Midnight to 12:59 AM	144 7.45%	47 3.07%	44 3.04%	51 3.39%	56 3.70%	53 2.84%	127 5.41%	522 4.30%
1:00 AM to 1:59 AM	140 7.24%	35 2.28%	32 2.21%	41 2.73%	37 2.45%	48 2.57%	122 5.20%	455 3.75%
2:00 AM to 2:59 AM	133 6.88%	34 2.22%	21 1.45%	29 1.93%	38 2.51%	50 2.68%	120 5.12%	425 3.50%
3:00 AM to 3:59 AM	111 5.74%	20 1.30%	21 1.45%	19 1.26%	20 1.32%	42 2.25%	129 5.50%	362 2.98%
4:00 AM to 4:59 AM	85 4.40%	24 1.57%	28 1.93%	32 2.13%	30 1.98%	40 2.14%	95 4.05%	334 2.75%
5:00 AM to 5:59 AM	83 4.29%	42 2.74%	31 2.14%	42 2.79%	58 3.84%	60 3.21%	76 3.24%	392 3.23%
6:00 AM to 6:59 AM	74 3.83%	65 4.24%	53 3.66%	58 3.86%	51 3.37%	51 2.73%	60 2.56%	412 3.39%
7:00 AM to 7:59 AM	38 1.97%	88 5.74%	83 5.73%	78 5.19%	73 4.83%	88 4.71%	56 2.39%	504 4.15%
8:00 AM to 8:59 AM	45 2.33%	48 3.13%	56 3.87%	53 3.52%	39 2.58%	53 2.84%	57 2.43%	351 2.89%
9:00 AM to 9:59 AM	36 1.86%	47 3.07%	55 3.80%	57 3.79%	57 3.77%	56 3.00%	52 2.22%	360 2.96%
10:00 AM to 10:59 AM	42 2.17%	54 3.52%	43 2.97%	53 3.52%	56 3.70%	59 3.16%	68 2.90%	375 3.09%
11:00 AM to 11:59 AM	57 2.95%	70 4.57%	54 3.73%	56 3.72%	44 2.91%	60 3.21%	70 2.98%	411 3.38%
12:00 Noon to 12:59 PM	61 3.16%	58 3.78%	54 3.73%	54 3.59%	70 4.63%	53 2.84%	73 3.11%	423 3.48%
1:00 PM to 1:59 PM	71 3.67%	85 5.54%	59 4.07%	63 4.19%	69 4.56%	58 3.10%	98 4.18%	503 4.14%
2:00 PM to 2:59 PM	76 3.93%	92 6.00%	59 4.07%	91 6.05%	70 4.63%	95 5.08%	98 4.18%	581 4.78%
3:00 PM to 3:59 PM	102 5.28%	91 5.94%	112 7.73%	76 5.05%	101 6.68%	98 5.24%	103 4.39%	683 5.62%
4:00 PM to 4:59 PM	93 4.81%	99 6.46%	97 6.70%	107 7.11%	82 5.42%	99 5.30%	95 4.05%	672 5.53%
5:00 PM to 5:59 PM	92 4.76%	103 6.72%	109 7.53%	104 6.91%	105 6.94%	97 5.19%	110 4.69%	720 5.93%
6:00 PM to 6:59 PM	100 5.17%	79 5.15%	94 6.49%	73 4.85%	87 5.75%	114 6.10%	116 4.94%	663 5.46%
7:00 PM to 7:59 PM	85 4.40%	78 5.09%	83 5.73%	85 5.65%	74 4.89%	106 5.67%	125 5.33%	636 5.24%
8:00 PM to 8:59 PM	84 4.35%	79 5.15%	84 5.80%	78 5.19%	66 4.37%	104 5.56%	132 5.63%	627 5.16%
9:00 PM to 9:59 PM	73 3.78%	78 5.09%	72 4.97%	91 6.05%	100 6.61%	122 6.53%	119 5.07%	655 5.39%
10:00 PM to 10:59 PM	65 3.36%	65 4.24%	52 3.59%	63 4.19%	69 4.56%	129 6.90%	116 4.94%	559 4.60%
11:00 PM to 11:59 PM	40 2.07%	49 3.20%	52 3.59%	49 3.26%	60 3.97%	130 6.96%	125 5.33%	505 4.16%
Unknown	3 0.16%	3 0.20%	0 0.00%	1 0.07%	0 0.00%	4 0.21%	4 0.17%	15 0.12%
TOTAL	1933 15.92%	1533 12.62%	1448 11.92%	1504 12.38%	1512 12.45%	1869 15.39%	2346 19.32%	12145 100.00%

Crosstab analysis of time of day by day of the week for rural crashes in which restraints were not used helps target specific times in which officers should increase patrols in order to prevent these crashes. The above applies to all rural areas, pulled out since the severity in rural areas is generally higher.

6.5 Restraints Not Used Causal Driver Age 16-20 – Times

CARE 10.1.0.7 - [Crosstab Results - 2011-2015 Alabama Integrated Crash Data - Filter = Driver NOT Properly Re...

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2011-2015 Alabama Integrated Crash Data Driver NOT Properly Restrained AND Age 16-20 1/ 1/2011 12/31/2015

Suppress Zero Values: Rows and Columns Select Cells: Column: Day of the Week ; Row: Time of Day

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	TOTAL
12:00 Midnight to 12:59 AM	49 8.46%	9 2.10%	9 1.67%	19 3.68%	14 2.83%	11 1.85%	39 5.69%	150 3.91%
1:00 AM to 1:59 AM	33 5.70%	7 1.64%	12 2.22%	12 2.33%	11 2.22%	17 2.86%	41 5.98%	133 3.47%
2:00 AM to 2:59 AM	34 5.87%	10 2.34%	4 0.74%	6 1.16%	6 1.21%	12 2.02%	40 5.83%	112 2.92%
3:00 AM to 3:59 AM	35 6.04%	9 2.10%	4 0.74%	6 1.16%	8 1.62%	11 1.85%	32 4.66%	105 2.74%
4:00 AM to 4:59 AM	24 4.15%	5 1.17%	7 1.30%	4 0.78%	10 2.02%	14 2.36%	27 3.94%	91 2.37%
5:00 AM to 5:59 AM	23 3.97%	7 1.64%	9 1.67%	11 2.13%	16 3.23%	10 1.68%	18 2.62%	94 2.45%
6:00 AM to 6:59 AM	19 3.28%	12 2.80%	15 2.78%	15 2.91%	4 0.81%	10 1.68%	19 2.77%	94 2.45%
7:00 AM to 7:59 AM	15 2.59%	32 7.48%	39 7.22%	43 8.33%	42 8.48%	42 7.07%	16 2.33%	229 5.97%
8:00 AM to 8:59 AM	11 1.90%	9 2.10%	16 2.96%	13 2.52%	19 3.84%	11 1.85%	11 1.60%	90 2.34%
9:00 AM to 9:59 AM	14 2.42%	12 2.80%	15 2.78%	14 2.71%	15 3.03%	14 2.36%	14 2.04%	98 2.55%
10:00 AM to 10:59 AM	17 2.94%	15 3.50%	19 3.52%	15 2.91%	15 3.03%	15 2.53%	29 4.23%	125 3.26%
11:00 AM to 11:59 AM	21 3.63%	14 3.27%	17 3.15%	24 4.65%	11 2.22%	14 2.36%	18 2.62%	119 3.10%
12:00 Noon to 12:59 PM	24 4.15%	17 3.97%	20 3.70%	25 4.84%	20 4.04%	17 2.86%	26 3.79%	149 3.88%
1:00 PM to 1:59 PM	20 3.45%	20 4.67%	25 4.63%	20 3.88%	18 3.64%	19 3.20%	35 5.10%	157 4.09%
2:00 PM to 2:59 PM	23 3.97%	23 5.37%	26 4.81%	42 8.14%	29 5.86%	26 4.38%	21 3.06%	190 4.95%
3:00 PM to 3:59 PM	37 6.39%	45 10.51%	63 11.67%	35 6.78%	43 8.69%	48 8.08%	26 3.79%	297 7.74%
4:00 PM to 4:59 PM	20 3.45%	27 6.31%	33 6.11%	47 9.11%	28 5.66%	45 7.58%	33 4.81%	233 6.07%
5:00 PM to 5:59 PM	21 3.63%	27 6.31%	52 9.63%	44 8.53%	46 9.29%	37 6.23%	30 4.37%	257 6.70%
6:00 PM to 6:59 PM	33 5.70%	25 5.84%	34 6.30%	22 4.26%	24 4.85%	37 6.23%	33 4.81%	208 5.42%
7:00 PM to 7:59 PM	24 4.15%	23 5.37%	23 4.26%	21 4.07%	20 4.04%	33 5.56%	32 4.66%	176 4.59%
8:00 PM to 8:59 PM	22 3.80%	28 6.54%	32 5.93%	19 3.68%	30 6.06%	27 4.55%	26 3.79%	184 4.79%
9:00 PM to 9:59 PM	22 3.80%	24 5.61%	26 4.81%	26 5.04%	29 5.86%	40 6.73%	33 4.81%	200 5.21%
10:00 PM to 10:59 PM	20 3.45%	16 3.74%	20 3.70%	17 3.29%	17 3.43%	42 7.07%	43 6.27%	175 4.56%
11:00 PM to 11:59 PM	18 3.11%	12 2.80%	20 3.70%	15 2.91%	20 4.04%	42 7.07%	43 6.27%	170 4.43%
Unknown	0 0.00%	0 0.00%	0 0.00%	1 0.19%	0 0.00%	0 0.00%	1 0.15%	2 0.05%
TOTAL	579 15.09%	428 11.15%	540 14.07%	516 13.44%	495 12.90%	594 15.48%	686 17.87%	3838 100.00%

Crosstab analysis of specific times of day by day of the week for crashes in which the causal driver was between the ages of 16-20 also help target specifically problematic times in which younger drivers are more likely to get into crashes. The most consistently overrepresented times include early morning hours on weekend days.

6.6 Restraints Not Used Causal Driver Age 21-25 – Times

CARE 10.1.0.7 - [Crosstab Results - 2011-2015 Alabama Integrated Crash Data - Filter = Driver NOT properly Re...]

File Dashboard Filters Analysis Crosstab Locations Tools Window Help

2011-2015 Alabama Integrated Crash Data Driver NOT properly Restrained and Age 21-25 1/1/2011 12/31/2015

Suppress Zero Values: None Select Cells: Column: Day of the Week ; Row: Time of Day

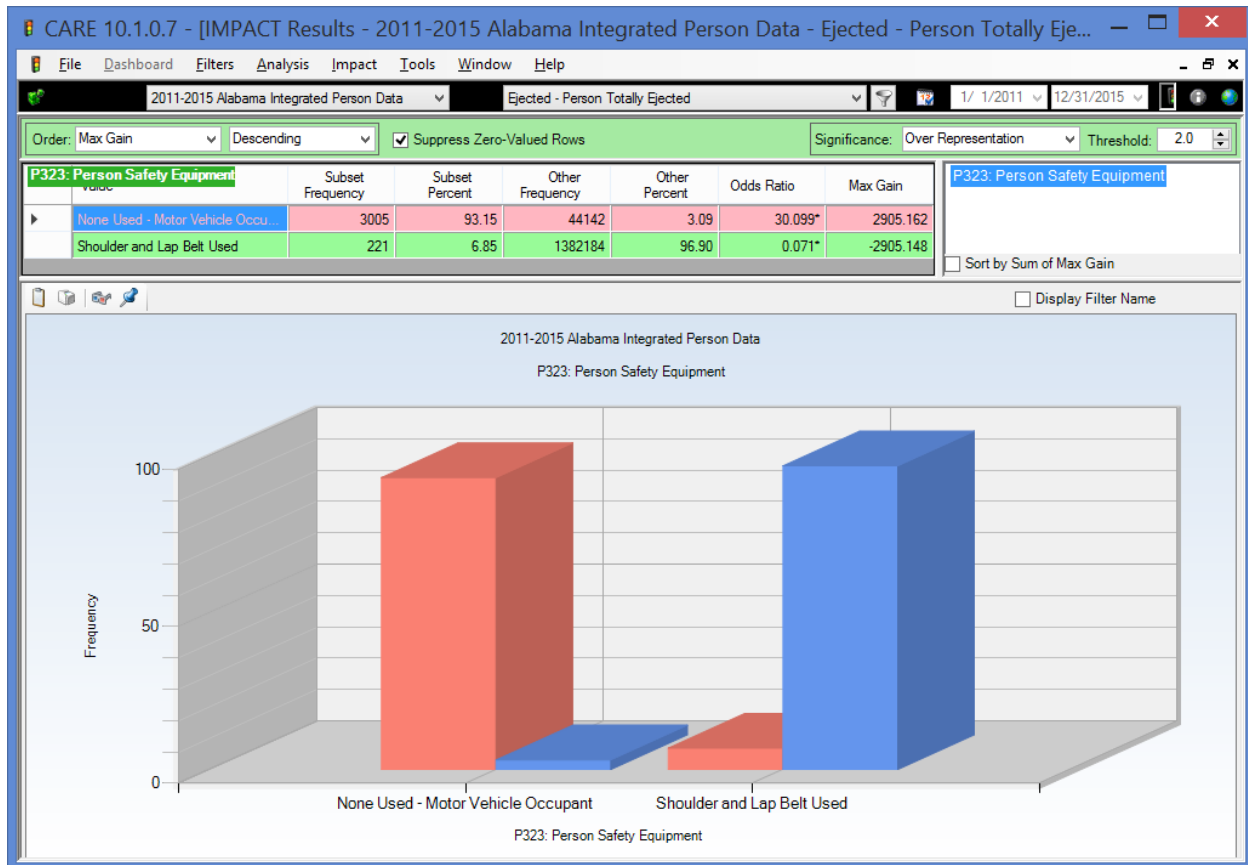
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	TOTAL
12:00 Midnight to 12:59 AM	45 7.23%	15 3.14%	26 5.57%	16 3.59%	18 3.51%	16 2.88%	43 5.80%	179 4.68%
1:00 AM to 1:59 AM	48 7.72%	11 2.31%	10 2.14%	16 3.59%	15 2.92%	21 3.78%	52 7.01%	173 4.53%
2:00 AM to 2:59 AM	69 11.09%	16 3.35%	9 1.93%	10 2.24%	15 2.92%	14 2.52%	53 7.14%	186 4.87%
3:00 AM to 3:59 AM	41 6.59%	5 1.05%	7 1.50%	10 2.24%	10 1.95%	23 4.14%	67 9.03%	163 4.26%
4:00 AM to 4:59 AM	38 6.11%	14 2.94%	5 1.07%	15 3.36%	9 1.75%	16 2.88%	50 6.74%	147 3.85%
5:00 AM to 5:59 AM	34 5.47%	15 3.14%	8 1.71%	9 2.02%	21 4.09%	18 3.24%	37 4.99%	142 3.72%
6:00 AM to 6:59 AM	27 4.34%	24 5.03%	12 2.57%	21 4.71%	18 3.51%	17 3.06%	20 2.70%	139 3.64%
7:00 AM to 7:59 AM	20 3.22%	21 4.40%	24 5.14%	26 5.83%	17 3.31%	24 4.32%	16 2.16%	148 3.87%
8:00 AM to 8:59 AM	13 2.09%	15 3.14%	23 4.93%	17 3.81%	10 1.95%	11 1.98%	18 2.43%	107 2.80%
9:00 AM to 9:59 AM	9 1.45%	18 3.77%	19 4.07%	21 4.71%	20 3.90%	13 2.34%	16 2.16%	116 3.04%
10:00 AM to 10:59 AM	12 1.93%	19 3.98%	13 2.78%	10 2.24%	21 4.09%	20 3.60%	17 2.29%	112 2.93%
11:00 AM to 11:59 AM	12 1.93%	15 3.14%	19 4.07%	15 3.36%	23 4.48%	13 2.34%	22 2.96%	119 3.11%
12:00 Noon to 12:59 PM	21 3.38%	15 3.14%	21 4.50%	16 3.59%	27 5.26%	21 3.78%	24 3.23%	145 3.79%
1:00 PM to 1:59 PM	17 2.73%	18 3.77%	17 3.64%	23 5.16%	28 5.46%	14 2.52%	18 2.43%	135 3.53%
2:00 PM to 2:59 PM	21 3.38%	27 5.66%	25 5.35%	25 5.61%	26 5.07%	28 5.05%	24 3.23%	176 4.60%
3:00 PM to 3:59 PM	23 3.70%	31 6.50%	33 7.07%	17 3.81%	22 4.29%	34 6.13%	29 3.91%	189 4.95%
4:00 PM to 4:59 PM	26 4.18%	29 6.08%	31 6.64%	28 6.28%	34 6.63%	25 4.50%	17 2.29%	190 4.97%
5:00 PM to 5:59 PM	25 4.02%	37 7.76%	32 6.85%	23 5.16%	40 7.80%	35 6.31%	29 3.91%	221 5.78%
6:00 PM to 6:59 PM	26 4.18%	27 5.66%	35 7.49%	28 6.28%	33 6.43%	36 6.49%	32 4.31%	217 5.68%
7:00 PM to 7:59 PM	21 3.38%	24 5.03%	17 3.64%	26 5.83%	20 3.90%	32 5.77%	27 3.64%	167 4.37%
8:00 PM to 8:59 PM	20 3.22%	20 4.19%	17 3.64%	13 2.91%	22 4.29%	22 3.96%	39 5.26%	153 4.00%
9:00 PM to 9:59 PM	16 2.57%	22 4.61%	24 5.14%	22 4.93%	26 5.07%	26 4.68%	31 4.18%	167 4.37%
10:00 PM to 10:59 PM	21 3.38%	21 4.40%	18 3.85%	19 4.26%	18 3.51%	46 8.29%	33 4.45%	176 4.60%
11:00 PM to 11:59 PM	16 2.57%	16 3.35%	22 4.71%	19 4.26%	20 3.90%	30 5.41%	27 3.64%	150 3.92%
Unknown	1 0.16%	2 0.42%	0 0.00%	1 0.22%	0 0.00%	0 0.00%	1 0.13%	5 0.13%
TOTAL	622 16.27%	477 12.48%	467 12.22%	446 11.67%	513 13.42%	555 14.52%	742 19.41%	3822 100.00%

Crosstab analysis of specific times of day by day of the week for crashes in which the causal driver was between the ages of 21-25 also help target specifically problematic times in which drivers in a different age range are more likely to get into crashes. The most consistently overrepresented times include early morning hours on weekend days and afternoon hours on weekdays.

7 Analysis of Ejection

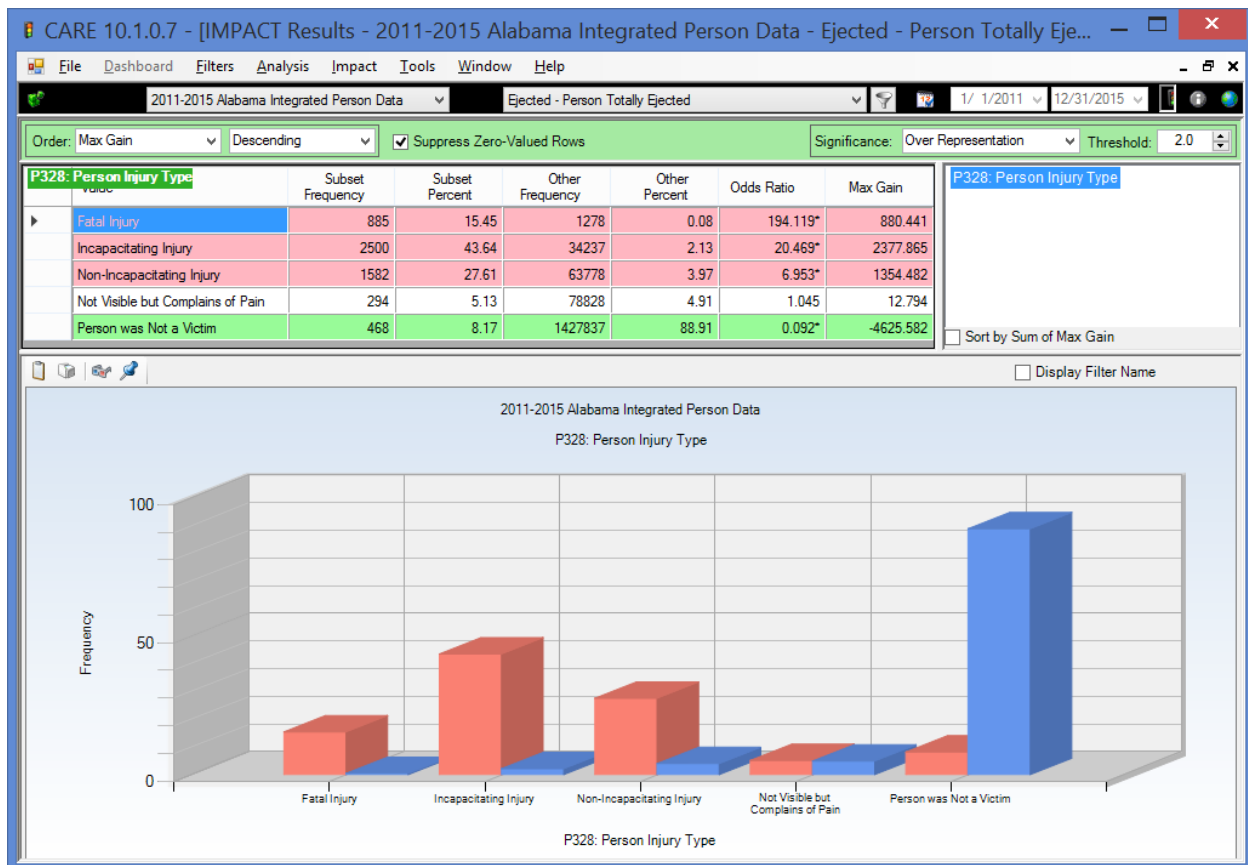
In the IMPACT outputs that follow, the red bars represent those who were ejected; the blue bars, those not ejected. This analysis is not by crash and driver as was true of those above; rather, it is counting all occupants of the vehicles who were either ejected or not ejected.

7.1 Probability of Ejection if Properly Restrained



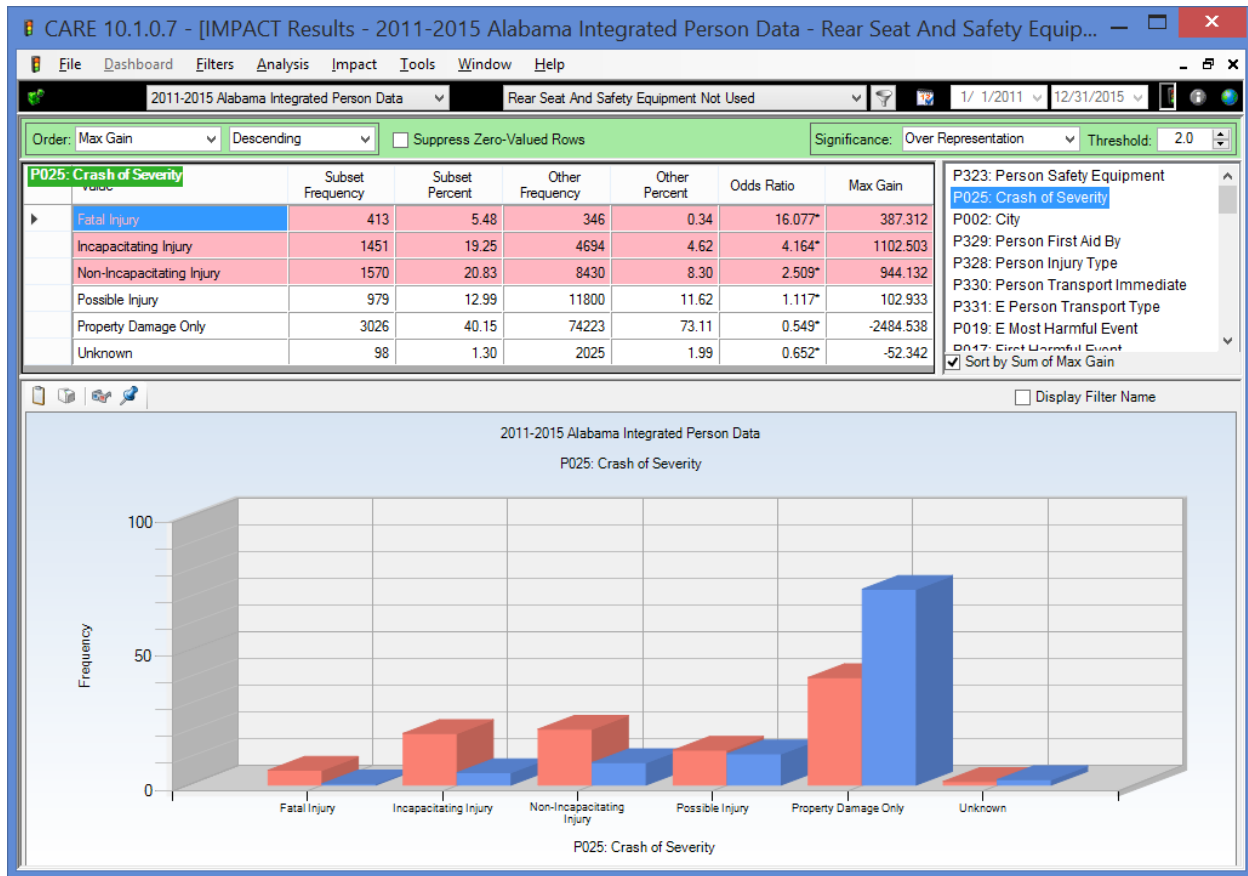
The analysis above tells us how much the probability of ejection increases when not properly restrained. The probability of a occupant of a vehicle being ejected when properly restrained is 6.85%, which is about one in 15. The odds ratio for no restraint used is over 30, indicating that the non-restrained person is over 30 times more likely to be ejected than those who are properly restrained.

7.2 Severity Increase with Ejection



The probability that an ejected occupant is killed is close to 200 times that of an occupant that is not ejected. While not nearly as high an multiple, the two higher injury classifications are also much higher. The Incapacitating Injury classification is increased over 20 times, and the Non-Incapacitating Injury classification increases by a factor of about 7.

8 Analysis of Back Seat Occupants



Back seat occupants who are not properly restrained have over 16 times the probability of being killed as do those who are properly restrained. The other highest two severity classifications are also greatly increase, although not by as great multipliers: 4.164 for Incapacitating Injury and 2.509 for Non-Incapacitating Injury.

Looking at the numbers, over the five year period there were 413 back seat occupants killed, which is about 82 per year. Question: how many of these would have been saved had they been properly restrained? Applying the 0.34% to the total unrestrained as opposed to the actual 5.48% yields 25.63 total fatalities, which would mean that the total fatality savings over the five years would have been 387 fatalities, a saving of 77 lives per year.

9 Summary and Conclusions

The following summarizes the findings of the analysis:

- **Geographical Factors**
 - Counties with the greatest overrepresentation factors for unrestrained driver crashes include Walker, Jackson, Escambia, Cullman and Blount.
 - The number of crashes involving drivers who use no restraints is greatly overrepresented in rural areas in comparison to the urban areas. The odds ratio for rural areas is well over twice what would be expected if rural and urban restraint use were the same.
 - The most overrepresented (worse) areas are the rural county areas in Walker, Mobile, Cullman, and Escambia Counties.
 - The most underrepresented (best) cities are Montgomery, Birmingham, Mobile, Montgomery, Huntsville and Tuscaloosa.
 - Crash incidents with no driver restraints being used are greatly overrepresented on county highways, with 2.7 times the expected number of crashes. County was the only roadway classification that was overrepresented.
 - In the analysis of locale, crashes involving no restraints are most commonly overrepresented in open country areas.
- **Time Factors**
 - The weekend days are the most overrepresented days of the week for crashes in which drivers did not use restraints. This correlates highly with impaired driving crashes.
 - In the evaluation of time of day, overrepresentation peaks during the 12 Midnight to 5 AM period and then tapers off, falling back below crashes involving causal drivers who use restraints in the 7 AM to 7 PM time periods. Additional cross-tabulations were performed for specific target groups (see below).
- **Crash Causal Factors**
 - The overrepresentation factors indicate that certain risk-taking behaviors are often associated with crashes in which restraints are not used, including DUI, over the speed limit, aggressive operation, running off the road, and fatigue/sleep.
 - Crashes attributed to drivers who used no restraints are greatly overrepresented in vehicles with model years 1960-2002, which could be attributed to the lack of standard safety restraints in some of these older model vehicles, or perhaps the removal of these safety devices over time.
 - The speed at impact for crashes for this type of crash is overrepresented in all of the categories above 40 MPH, indicating that these crashes consistently occur at higher speeds than crashes in which restraints were used by the causal driver.

- Severity Factors
 - Fatal, incapacitating, and non-incapacitating injuries are all overrepresented in crashes where drivers were not restrained; this analysis quantified the benefits of the restraint use.
 - Fatal injuries in crashes where no restraints are used are overrepresented on inter-state and state roadways. “Possible Injuries” were overrepresented on municipal highways.
 - Analysis of injuries shows that the proportion of injuries (including fatalities) in unrestrained driver crashes is overrepresented from 1 to 6 injuries per crash. Crashes without restraints are clearly causing much more severe injuries and a greater number of injuries and fatalities per crash.
 - The proportion of fatalities in general as well as the proportion of multiple fatality crashes is dramatically overrepresented in crashes where the causal driver is unrestrained.
 - As expected, ejection of the unrestrained driver is overrepresented, indicating one major cause for many fatalities in which safety equipment is not properly utilized.
 - All types of injuries, including fatalities, are consistently overrepresented in crashes where no restraints were used.
- Driver Demographics
 - Analysis of individual driver ages indicates that crashes involving no restraints are overrepresented in drivers in and immediately above the teen driver classification (age range 16-35).
 - Male drivers account for a majority of crashes in which restraints are not used, and they are overrepresented by a factor of 1.32.
- Analysis of Time of Day by Day of Week.
 - Crosstab analyses of time of day by day of the week of crashes in which restraints were not used enables officers to determine target times and days to enforce restraint laws so that severe crashes may be prevented. Three analyses were performed and compared for three target groups: rural crashes, crashes caused by drivers 16-20, and crashes caused by drivers 21-25. While the rural and 21-25 crosstabs were expected to correlate very heavily with impaired driving, it was found that the 16-20 year old causal drivers were not very much different. It seems clear that while they might not be involved with alcohol or drugs, they are out and engaged in risk-taking practices at the same time as the impaired driving by their older driver counterparts, further compounding the problem at these times. The drivers 16-20 would also reasonably be expected to be overrepresented in the week-day after school hours in the proximity of their schools and after-school activities.
- Ejection and Back Seat Analysis

- o The non-restrained person is over 30 times more likely to be ejected than those who are properly restrained.
- o If all back-seat occupants were properly restrained it would result in a saving of 77 lives per year.

End of Attachment B