## Special Study **Restraint Issues Problem Identification** David B. Brown, PhD, P.E., Research Associate University of Alabama Center for Advanced Research October 2018

For general information on restraints from NHTSA and other sources, please see "Restraints" in: <u>http://www.safehomealabama.gov/safety-topics/</u>

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# **Restraint Issues Problem Identification**

#### Recommendations

Typical recommendations to increase restraint use can be found throughout the SafeHomeAlabam.gov web pages that are devoted to restraint issues. These are:

- Child restraints: <u>http://web01-staging.caps.ua.edu/safehome/tag/child-safety-seats/</u>
- Safety belts: <u>http://web01-staging.caps.ua.edu/safehome/tag/safety-belts/</u>
- Click It or Ticket: <u>http://web01-staging.caps.ua.edu/safehome/tag/click-it-or-ticket/</u>

The motivational content given on these web pages will generally not be repeated here. Instead, we will focus on practical guidance that can make the findings of this study useful to those who are involved with countermeasure development. No priority should be inferred from the ordering; recommendations will be ordered as in the report.

**Geographical Factors.** Counties, cities and virtual cities (rural areas within counties) that are over-represented should be given additional resources for PI&E and selective enforcement programs. Rural areas adjacent to major metropolitan areas are particularly in need of additional resources. Sheriffs' officers should get involved on the county roadways in giving out warnings if nothing else. Shopping or Business locales are the most significantly under-represented and can be avoided in favor of the rural areas.

**Time Factors.** Time of Day and Day of the Week together are some of the best proxies for impaired driving (ID). Other studies done by CAPS that centered on the causes for the increase in fatalities in 2016 made the high correlation between ID and failing to use restraints quite clear. Thus, the ID days and hours should be the targets, perhaps with seatbelt use being supplemental to the ID enforcement.

**Crash Causal Factors.** Restraint non-use was also correlated to other risk taking behaviors, such as speeding, aggressive operation, running off the road and fatigue/sleep. It is recommended that these behaviors be sought out similar to ID, as indicators of restraint non-use. It is recognized that since these factors tend to cause the crashes, they might be of greater law enforcement interest than the failure to use restraints. However, to reduce fatalities, we strongly recommend that restraint enforcement be performed in conjunction with that of any other behaviors.

**Severity Factors.** There should be some way to impress risk-takers that the odds are against them, but perhaps everything has already been said. The numbers are in the details, and probably the most impressive is that the chances of getting killed if not wearing a seatbelt is 30 times that than if restrained. The problem is that risk-takers think they are immune to getting in a crash in any event. Perhaps playing on the fact that about half of the crashes are not the fault of the unbelted victim drivers would help. There is ample evidence here to make a case, and this case has been made effectively to the vast majority of drivers. But these have not been effective in influencing those who are prone to taking risks. We strongly recommend that psychological research be performed for this purpose.

**Driver Demographics.** As would be expected, younger male drivers are over-represented mainly because of their affinity toward risk taking. Countermeasures that do not concentrate on trying to change the risk-taking nature of this demographic are not going to be effective. Countermeasures addressing other demographics have been extremely effective, and for the most part, they have already reaped their benefits. Since they are proven, they should be continued as countermeasures to risk-taking are developed. It is interesting that the "young age" problem is not isolated to the "under 25" males whose brains generally have not yet developed to the point where they fully understand and appreciate risk. The over-representation was found to be extended up to age 39, although it diminished somewhat with age.

**Ejection and Back Seat Restraints.** To the extent possible, the statistics presented in the summary and the IMPACT analyses should be exploited to increase restraint use. We feel the most effective ones are as follow:

- Non-restrained persons are over 300 times more likely to be totally ejected than those who are properly restrained.
- Being ejected results in a probability of death about 50 times that of those not ejected, so the odds of survival are to those who stay within the protection of the vehicle.
- If all back-seat occupants were properly restrained it would result in an estimated saving of 62 lives per year. Being in the back seat is no protection. To the contrary, those unrestrained in the back seat can become projectiles that can cause injury or death to other passengers.

# **Executive Summary**

The following summarizes the findings of the analysis, corresponding to the respective sections of this report (given in parentheses):

- Geographical Factors (2)
  - Counties with the greatest overrepresentation factors for unrestrained driver crashes include Walker, Talladega, Jackson, DeKalb, Monroe and Cullman,
  - 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 about 2.5 times that of what would be expected if rural and urban restraint use were the same.
  - The most overrepresented (worst) areas are the rural county areas in Walker, Talladega, Mobile, Tuscaloosa and Cullman Counties.
  - The most underrepresented (best) cities are Birmingham, Mobile, Montgomery, and Huntsville.
  - Crash incidents with no driver restraints being used are greatly overrepresented on county highways, with 2.75 times the expected number of crashes. County and State were the only roadway classification that were overrepresented. Federal, Interstate and Municipal roads were significantly under-represented.
  - In the analysis of locale, crashes involving no restraints are most commonly overrepresented in Open Country areas, and Shopping or Business locales are the most significantly under-represented.

#### • Time Factors (3)

- 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, overrepresentations peak during the 7 PM to 6 AM time periods and then taper off, falling back below crashes involving causal drivers who use restraints in the 7 AM to 7 PM time periods. Additional crosstabulations were performed for crashes involving injury.

#### • Analysis of Time of Day by Day of Week (3.3-3.4)

 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. Two analyses were performed and compared for all crashes with restraint deficiencies and injury crashes for restraint deficiencies. The late night and early morning over-representations were largely on the weekend days starting on Friday night and ending on Sunday morning.

• The cross-tabulation of time of day by day of the week that was restricted to injury crashes showed a very high resemblance to the same analysis for impaired driving (alcohol and other drugs involvement).

#### • Crash Causal Factors (4)

- 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 1960-2004, 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 restraint-deficient crashes is significantly overrepresented in all of the categories above 45 MPH, indicating that these crashes consistently occur at higher speeds than crashes in which restraints were used by the causal driver. This is highly correlated with rural driving and risk taking.

#### • Severity Factors (5)

- 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 highly overrepresented on interstate, federal and state roadways. "Possible Injuries and Property Damage Only were highly overrepresented on municipal highways.
- Analysis of number injured 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 (6)

- 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 19-39).
- Male drivers account for a majority of crashes in which restraints are not used, and they are overrepresented by a factor of 1.296.

#### • Ejection and Back Seat Analysis (5.5-5.8; 7)

- The non-restrained person is over 300 times more likely to be totally ejected than those who are properly restrained.
- Being ejected results in a probability of death about 50 times that of those not ejected.
- If all back-seat occupants were properly restrained it would result in an estimated saving of 62 lives per year.

# **1** Introduction

This section contains the result of a problem identification study that was conducted based on data from Fiscal Years (FY) FY2014-FY2017. This was the latest data that were available at the time of the study, and it is quite representative of the restraint picture going forward into FY2019.

CARE was used to process and display the information. Generally, 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 that 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, and the results obtained are very consistent with expectations in this regard.

The goal of this problem identification is to assure that the restraint enforcement program considered by the state throughout FY2019 is completely evidence-based, the evidence being derived from past data obtained from crash records. Changes from what appeared in the previous year HSP will only be noted in cases where they are considered to be of significance for decision-making.

The major subsections within this problem identification are as follows:

- 2 Geographical Factors
- 3 Time Considerations
- 4 Crash Causal Factors
- 5 Severity Factors
- 6 Driver Demographics
- 7 Analysis for Back Seat Occupants
- 8 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
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CODI- Subset         Subset Frequency         Percent Percent         Other Radio         Odds Gan         Max Gan	<b>6</b> 2	2014-2017 Alabama Integrate	d Crash Data		~	FY2015-2017 /	ND Dr Restra	int Not Used	✓ ♥ 〒 1/ 1/2014 ∨ 10/16/
Node         Frequency         Percent         Frequency         Percent         Fails         Gain           V Walker         347         2.66         3309         1.08         2.637         215.408           Jackson         2.27         2.24         2568         0.073         30.667         132.231           Jackson         2.27         2.24         2568         0.073         30.667         132.231           Dekab         2.265         2.13         3132         0.89         2.449         186.764           Morroe         166         1.37         705         0.02         6.816*         141.644           Cullman         356         2.53         6.72         2.201*         109.139           Morroe         1.62         1.42         1.447         10.450*         104.472           S Clar         2.77         2.231*         109.139         100*42         1.42         1.656*         104.483           Lineatorine         2.42         1.42         1.656*         104.483         1.42         1.656*         104.483           Cohet         2.232         1.91         3.33*         87.963         1.682*         98.070           Cobet	Orde	er: Max Gain 🗸 D	escending	<ul><li></li></ul>	Suppress Zero	-Valued Rows	Si	ignificance: Over	Representation V Threshold: 2.0
Taladega       356       2.93       4464       1.27       2.08       201.77         Jackson       272       2.24       2568       0.73       3.0666       13321         Dekab       265       2.18       3132       0.08       2.449       156.796         Morroe       166       1.37       705       0.20       6.816       141.644         Culman       336       2.23       6.228       1.77       1.555       140.037         Bourt       214       1.461       0.42       3.406       121.526         Chiton       200       1.65       2630       0.75       2.201       109.103         S Ciar       2.77       2.28       4394       1.42       1.606       104.468         Conecuh       130       1.07       85       96.079       0.662       0.675         Codett       2.32       1.91       3440       1.12       1.704       95.882         Corecuh       130       1.07       85       96.079       0.663       66.75         Colect       2.32       1.91       3440       1.12       1.704       95.882         Corecuh       149       9.39       90.28 </td <td>C001</td> <td>I: County</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>C001: County</td>	C001	I: County							C001: County
Jackson       272       2.24       2568       0.73       3.066       183.281         Dekab       265       2.18       3132       0.89       2.449       166.766         Morone       166       1.37       705       0.20       6.816       141.644         Culman       336       2.233       6528       1.77       1.655       140.837         Bourt       214       1.76       2262       0.64       2.738       135.853         Bourt       214       1.76       2262       0.64       2.738       135.853         Chlorn       200       1.65       2.503       0.75       2.201       109.139         Mashall       3229       2.71       64.72       1.84       1.471       105.607         St Car       2.77       2.28       4394       1.42       1.606       104.482         Umestone       242       1.99       4.224       1.20       1.655       66.070         Colect       2.331       3.940       1.12       1.704       95.822       0.566         Cowngton       1.46       1.20       1.74       0.43       2.237       75.133         Browah       3.49	•	Walker	347	2.86	3809	1.08	2.637*	215.408	
Dekabb         265         2.18         3132         0.89         2.445         156.796           Morroe         166         1.37         705         0.20         6.816         141.644           Culman         356         2.93         66228         1.77         1.655         140.837           Bourt         124         1.76         2262         0.64         2.737         135.851           Examble         172         1.42         1461         0.42         3.408         121.526           Ohton         200         1.65         2630         0.75         2.201         100.139           Marhall         323         2.71         6.472         1.84         1.471         106.407           St Clar         2.77         2.28         4994         1.42         1.666         104.468           Coneauh         130         10.7         855         0.24         4.401         100.462           Limeatone         242         1.94         4.224         1.20         1.656         96.070           Cohet         232         1.91         340         0.42         2.437         86.094           Geneva         109         0.90		Talladega	356	2.93	4464	1.27	2.308*	201.779	
Monroe         166         1.37         705         0.20         6.815         141.644           Culman         356         2.93         6228         1.77         1.555         140.837           Bourt         214         1.76         2262         0.64         2.738         133.853           Escambia         172         1.42         1.640         2.201         109.139           Marshall         329         2.71         6.472         1.84         1.471         105.407           St.Clar         2.77         2.28         4.994         1.42         1.056         104.488           Conecuh         130         1.07         855         0.24         4.401         100.462           Limestone         2.42         1.99         4.224         1.20         1.765         56.070           Cobet         2.22         1.91         4.942         2.830         93.766         Geneva           Covington         145         1.19         1443         0.42         2.830         93.766           Cake         1.26         1.04         1101         0.31         3.315         72.583           Bowah         3.49         2.87         8001 <td></td> <td>Jackson</td> <td>272</td> <td>2.24</td> <td>2568</td> <td>0.73</td> <td>3.066*</td> <td>183.281</td> <td></td>		Jackson	272	2.24	2568	0.73	3.066*	183.281	
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Conecuh         130         1.07         855         0.24         4.40*         100.462           Limestone         242         1.99         4224         1.20         1.658*         96.070           Colect         232         1.91         3940         1.12         1.704*         95.882           Covington         145         1.19         1483         0.42         2.830*         93.766           Clarke         126         1.04         1101         0.31         3.313*         87.963           Tallapoosa         146         1.20         1.724         0.49         2.437*         86.094           Geneva         109         0.90         980         0.28         3.219*         75.143           Etowah         3.49         2.87         8001         2.28         1.663*         72.583           Marion         116         0.95         1266         0.37         2.511*         71.572           Granklin         110         0.91         1.428         0.41         2.230*         60.6666           Lawrence         104         0.86         1.291         0.37         2.332*         59.399           Barbour         109         0		Marshall	329	2.71	6472	1.84	1.471*	105.407	
Limestorie         242         1.99         4224         1.20         1.658*         96.070           Cobert         232         1.91         3940         1.12         1.704*         95.882           Covington         145         1.19         1483         0.42         2.830*         93.766           Carke         126         1.04         1101         0.31         3.313*         87.963           Geneva         109         0.90         980         0.28         3.215*         75.143           Browah         349         2.87         8001         2.28         1.263*         72.583           Marion         116         0.95         1226         0.37         2.611*         71.572           Cherokee         114         0.94         1283         0.36         2.572*         69.675           Lawrence         104         0.81         1291         0.37         2.332*         59.399           Barbour         109         0.90         1440         0.41         2.191*         59.251 v         )         Sort by Sum of Max Gain           Origing         2014-2017 Alabama Integrated Crash Data         Court: County         Court         Shelby		St Clair	277	2.28	4994	1.42	1.606*	104.468	
Cobert         232         1.91         3940         1.12         1.704'         95.882           Covington         145         1.19         1483         0.42         2.830'         93.766           Carke         126         1.04         1101         0.31         3.313'         87.963           Talapoosa         146         1.20         1774         0.49         2.437'         88.094           Geneva         109         0.90         980         0.28         3.219''         75.143           Bowah         349         2.87         8001         2.28         72.583           Marion         116         0.95         1226         0.37         2.611''         71.572           Cherokee         114         0.94         1283         0.36         2.572''         69.675           Franklin         110         0.91         1428         0.41         2.302''         59.399           Bmore         2.24         1.93         5054         1.44         1.340''         59.356           Barbour         109         0.90         1440         0.41         2.191''         59.51''         Sort by Sum of Max Gain           Oregregreg         2014-		Conecuh	130	1.07	855	0.24	4.401*	100.462	
Covington         145         1.19         1483         0.42         2.830*         93.766           Clarke         126         1.04         1101         0.31         3.313*         87.963           Tallapoosa         146         1.20         1734         0.49         2.437*         86.094           Geneva         109         0.90         980         0.28         3.219*         75.143           Elowah         349         2.87         8001         2.28         1.263*         72.583           Marion         116         0.95         1286         0.37         2.611*         71.572           Cherokee         114         0.94         1283         0.36         2.572*         69.675           Lawrence         104         0.91         1283         0.37         2.532*         59.399           Bmore         2.24         1.33         5054         1.44         1.340*         59.251 v         ) Sort by Sum of Max Gain           Upgud         0.90         0.90         1440         0.41         2.191*         59.251 v         ) Sort by Sum of Max Gain           Upgud         0         0         9.90         1440         0.41         2.191*		Limestone	242	1.99	4224	1.20	1.658*	96.070	
Clarke         126         1.04         1101         0.31         3.313'         87.963           Tallapoosa         146         1.20         1734         0.49         2.437         86.094           Geneva         109         0.90         980         0.28         3.219'         75.143           Elowah         349         2.87         8001         2.28         1.263'         72.583           Marion         116         0.95         1286         0.37         2.611'         71.572           Cherokee         114         0.94         1283         0.36         2.572'         69.675           Franklin         110         0.91         1428         0.41         2.230'         60.666           Barbour         109         0.90         1440         0.41         2.191'         59.396           Emore         2.34         1.93         5054         1.44         1.340'         59.396           Barbour         109         0.90         1440         0.41         2.191'         59.251 v         Sort by Sum of Max Gain           Order         Order         Order         Order         Order         Order         Order         Order		Colbert	232	1.91	3940	1.12	1.704*	95.882	
Tallapoosa       146       1.20       1734       0.49       2.437       86.094         Geneva       109       0.90       980       0.28       3.219       75.143         Bowah       349       2.87       8001       2.28       1.263*       72.583         Marion       116       0.95       1286       0.37       2.611*       71.572         Cherokee       114       0.94       1283       0.36       2.572*       69.675         Franklin       110       0.91       1428       0.41       2.230*       60.666         Lawrence       104       0.86       1291       0.37       2.332*       59.399         Binore       224       1.93       5054       1.44       1.340*       59.356         Barbour       109       0.90       1440       0.41       2.191*       59.251 v       Sort by Sum of Max Gain         Other state         C014-2017 Alabama Integrated Crash Data         C001: County         Other shelp         Marshall       Marion       Butler       Shelby		Covington	145	1.19	1483	0.42	2.830*	93.766	
Geneva         109         0.90         980         0.22         3.219*         75.143           Eowah         349         2.87         8001         2.28         1.263*         72.583           Marion         116         0.95         1286         0.37         2.611*         71.572           Cherokee         114         0.94         1283         0.36         2.572*         69.675           Franklin         110         0.91         1428         0.41         2.230*         60.666           Lawrence         104         0.86         1291         0.37         2.332*         59.399           Binore         2.24         1.93         50.54         1.44         1.340*         59.396           Barbour         109         0.90         1440         0.41         2.191*         59.251          Sort by Sum of Max Gain           C001: County         County         2014-2017 Alabama Integrated Crash Data         County         Displa           Marion         Butler         Shelby         Shelby         Shelby         Shelby		Clarke	126	1.04	1101	0.31	3.313*	87.963	
Bowah       349       2.87       8001       2.28       1.263*       72.583         Marion       116       0.95       1286       0.37       2.611*       71.572         Cherokee       114       0.94       1283       0.36       2.572*       69.675         Franklin       110       0.91       1428       0.41       2.230*       60.666         Lawrence       104       0.86       1291       0.37       2.332*       59.399         Bmore       234       1.93       5054       1.44       1.340*       59.396         Barbour       109       0.90       1440       0.41       2.191*       59.251 *       Sort by Sum of Max Gain		Tallapoosa	146	1.20	1734	0.49	2.437*	86.094	
Marion         116         0.95         1286         0.37         2.611         71.572           Cherokee         114         0.94         1283         0.36         2.572         69.675           Franklin         110         0.91         1428         0.41         2.230*         60.666           Lawrence         104         0.86         1291         0.37         2.332*         59.399           Emore         234         1.93         5054         1.44         1.340*         59.396           Barbour         109         0.90         1440         0.41         2.191*         59.251         Sort by Sum of Max Gain		Geneva	109	0.90	980	0.28	3.219*	75.143	
Cherokee         114         0.94         1283         0.36         2.572*         69.675           Franklin         110         0.91         1428         0.41         2.230*         60.666           Lawrence         104         0.86         1291         0.37         2.332*         59.399           Elmore         234         1.93         5054         1.44         1.340*         59.396           Barbour         109         0.90         1440         0.41         2.191*         59.251         Sort by Sum of Max Gain           C011: County         C001: County         C001: County         Display         Display         Display           Marshall         Marion         Butler         Shelby         Shelby         Shelby		Etowah	349	2.87	8001	2.28	1.263*	72.583	
Franklin         110         0.91         1428         0.41         2.230*         60.666           Lawrence         104         0.86         1291         0.37         2.332*         59.399           Emore         234         1.93         5054         1.44         1.340*         59.396           Barbour         109         0.90         1440         0.41         2.191*         59.251         )         Sort by Sum of Max Gain		Marion	116	0.95	1286	0.37	2.611*	71.572	
Lawrence         104         0.86         1291         0.37         2.332*         59.399           Emore         234         1.93         5054         1.44         1.340*         59.396           Barbour         109         0.90         1440         0.41         2.191*         59.251 v         Sort by Sum of Max Gain           Image: Contrast of the state of the stat		Cherokee	114	0.94	1283	0.36	2.572*	69.675	
Emore 234 1.93 5054 1.44 1.340° 59.396 Barbour 109 0.90 1440 0.41 2.191° 59.251 v Sort by Sum of Max Gain Coll 2014-2017 Alabama Integrated Crash Data COll: County Coll Co		Franklin	110	0.91	1428	0.41	2.230*	60.666	
Barbour 109 0.90 1440 0.41 2.191* 59.251 v Sort by Sum of Max Gain Displa 2014-2017 Alabama Integrated Crash Data C001: County 20 10 0 Marshall Marion Butler Shelby		Lawrence	104	0.86	1291	0.37	2.332*	59.399	
Displa 2014-2017 Alabama Integrated Crash Data C001: County 20 10 0 Marshall Marion Butler Shelby		Elmore	234	1.93	5054	1.44	1.340*	59.396	
2014-2017 Alabama Integrated Crash Data C001: County		Barbour	109	0.90	1440	0.41	2.191*	59.251 🗸	Sort by Sum of Max Gain
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Por shell Marion Butler Shelby					2014-2017 A	_		a	
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The display above is restricted to those counties that: (1) had at least 100 crashes in which the driver was reported to be unrestrained, and (2) the county had an over-representation (Odds Ration) of at least two times their expectation when compared to the proportion of their crashes statewide. For example, Walker County had a proportion of Drivers not restrained of 2.86% while their statewide proportion of all crashes is only 1.08%, which leads to an Odds Ratio of 2.637 (the asterisk \* indicates that this difference is statistically significant at a very high level. The counties are arranged in Max Gain order, meaning those with the greatest potential for improvement are at the top. Max Gain is the number of crashes that could be reduced if the overrepresentation was reduced to zero. The more populated urbanized counties generally showed the highest occupant restraint use.

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8 1 8	2014-2017 Alabama Integrated			_	_	D Dr Restraint No	ot Used	✓ ♥ 〒 1/ 1/2014 ∨ 10/1
Orde		escending		ppress Zero-V			cance: Over F	
C002	: City Value	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max -	C002: City
,	Rural Walker	264	5.26	1551	1.03	5.123*	212.466	
	Rural Talladega	266	5.30	1945	1.29	4.116*	201.375	
	Rural Mobile	345	6.87	5045	3.34	2.058*	177.374	
	Rural Tuscaloosa	315	6.27	4554	3.01	2.082*	163.688	
	Rural Cullman	250	4.98	2764	1.83	2.722*	158.163	
	Rural Madison	315	6.27	4838	3.20	1.960*	154.252	
	Rural Baldwin	266	5.30	3394	2.25	2.359*	153.231	
	Rural Blount	172	3.43	1366	0.90	3.790*	126.613	
	Rural Limestone	200	3.98	2252	1.49	2.673*	125.175	
	Rural Marshall	153	3.05	1383	0.92	3.330*	107.048	
	Rural Elmore	160	3.19	1608	1.06	2.995*	106.572	
	Rural Chilton	152	3.03	1411	0.93	3.242*	105.118	
	Rural St. Clair	167	3.33	1911	1.26	2.630*	103.505	
	Rural Calhoun	181	3.61	2546	1.69	2.140*	96.406	
	Bessemer	171	3.41	3956	2.62	1.301*	39.558	
	Rural Jefferson	151	3.01	5069	3.36	0.897	-17.423	
	Huntsville	285	5.68	20647	13.67	0.415*	-401.019	
	Montgomery	258	5.14	21565	14.27	0.360*	-458.521	
	Mobile	462	9.20	27764	18.38	0.501*	-460.490	
	Bimingham	487	9.70	35517	23.51	0.413*	-693.092	Sort by Sum of Max Gain
] (	) 🕼 🖉							🗌 Displa
			:	2014-2017 Alal	bama Integrated	l Crash Data		
					C002: City			
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	0	Rura	l Cullman		Rural Marsha	II	Bessem	ner Birmingham
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**2.2 City** 

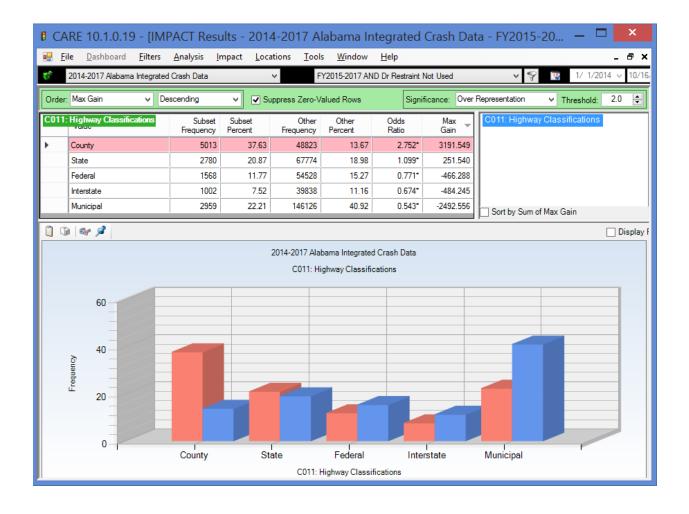
# The display above is for all cities that had over 150 or more crashes in which the drivers were not properly restrained. It is in Max Gain order so some of the Odds Ratios will not be over two and thus the line will not appear red. In these crashes the large number of crashes drives up the Max Gain value, which is the potential for non-restrained driver crash reduction. Cities listed at the bottom of the list generally have a high number of non-restrained driver crashes, but their proportion is less than their overall proportion of all crashes. These displays demonstrate the CARE capabilities; if similar runs would be useful with different constraints, please contact CAPS (brown@cs.ua.edu).

## 2.3 Rural/Urban



As expected from the city results above, the proportion of crashes involving drivers who use no restraints is greatly overrepresented in rural areas, being well over double what it is in the urban 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. Speeds are generally much higher in the rural area and thus there is also a very high correlation of fatalities to rural driving. These results are effectively the same as in the former problem identification study (CY2012-CY2016)

# 2.4 Highway Classification



Crash incidents in which no restraints were used are greatly overrepresented on county highways with over 2.752 times the expected number of crashes. The restraint deficiencies are about what would be expected on state roads, although there is a small but significant over-representation of about 10% of the proportion. The proportion of crashes in which restraints were used is greater on federal, interstate, and municipal highway areas.

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<u> </u>	2014-2017 Alabama Integrated C	irash Data	¥	FY2015-20	17 AND Dr Restr	aint Not Used	¥		
Orde	er: Max Gain 🗸 Desc	cending v	Suppress	Zero-Valued Ro	ws	Sigr	nificance: Over	Representation v Threshold: 2.0 🛓	
C03	1: Locale	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain 💌	C027: At Intersection C028: Mileposted Route	
•	Open Country	7896	58.33	102906	28.07	2.078*	4096.507	C029: Lighting Conditions	
	Residential	2894	21.38	69606	18.98	1.126*	324.009	C030: Weather C031: Locale	
	Playground	3	0.02	123	0.03	0.661	-1.541	C032: E Police Present at Time of Crast	
	Other	89	0.66	3071	0.84	0.785	-24.387	C033: Police Notification Delay	
	Manufacturing or Industrial	155	1.15	6630	1.81	0.633*	-89.793	C034: Police Arrival Delay	
	School	108	0.80	5697	1.55	0.513*	-102.345	C035: EMS Arrival Delay C036: Adjusted EMS Arrival Delay	
	Shopping or Business	2392	17.67	178605	48.71	0.363*	-4202.450	Sort by Sum of Max Gain	
2014-2017 Alabama Integrated Crash Data C031: Locale									
					J31: Locale				
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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. This, along with the Highway Classification, gives the general area of the locations at which restraint enforcement will be most effective.

# **3 Time Considerations**

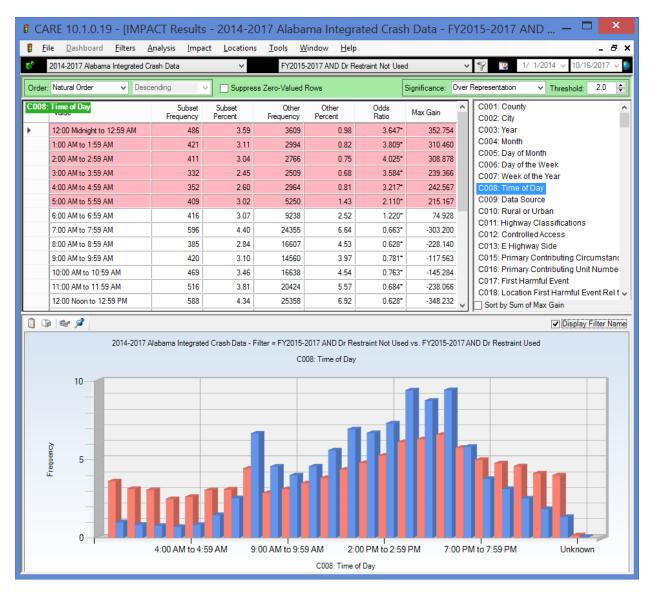
Time factors were analyzed in several different categories to determine overrepresentation for day of the week and time of day. Analysis of these time factors allows for the determination of particular days of week and time of day combinations in which more crashes occur with drivers who are not properly restrained, and thus, those times in which enforcement would have a greater effect.

# 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. Saturday and Sunday averaged out to 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. Overrepresentation 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 and the fatality study completed for 2016 showed clearly the lack of restraints correlated heavily with DUI (alcohol or other drugs).

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2014-2017 A	abama Integrated Ci	rash Data	~	FY2015-2017 AND I	Or Restraint Not Used	4 v	• 💡 🌃 1/ 1	/2014 v 10/16/201
uppress Zero Valu	ues: None	✓ Se	ect Cells: 🔳 🗸 🌃	9		Column: Day of the Week ; Row: Time of Da		
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	TOTAL
:00 Midnight to	122	53	50	49	34	61	117	486
12:59 AM	6.12%	2.98%	2.89%	2.86%	1.92%	2.78%	4.99%	3.59%
:00 AM to 1:59 AM	118	39	28	40	42	53	101	421
	5.92%	2.19%	1.62%	2.33%	2.37%	2.41%	4.31%	3.11%
:00 AM to 2:59 AM	113 5.67%	1.63%	21	1.92%	36 2.03%	63 2.87%	116 4.94%	411 3.04%
:00 AM to 3:59	85	26	23	24	26	34	114	332
AM to 3.55	4.26%	1.46%	1.33%	1.40%	1.46%	1.55%	4.86%	2.45%
00 AM to 4:59	96	29	36	26	36	44	85	352
AM	4.81%	1.63%	2.08%	1.52%	2.03%	2.00%	3.62%	2.60%
00 AM to 5:59	79	57	52	42	53	59	67	409
AM	3.96%	3.20%	3.00%	2.45%	2.99%	2.69%	2.86%	3.02%
00 AM to 6:59	62	66	54	68	46	58	62	416
AM	3.11%	3.71%	3.12%	3.97%	2.59%	2.64%	2.64%	3.07%
00 AM to 7:59 AM	56	102	101	93	88	92	64	596
	2.81%	5.73%	5.83%	5.42%	4.96%	4.19%	2.73%	4.40%
00 AM to 8:59 AM	35 1.76%	77 4.33%	58 3.35%	56 3.27%	49 2.76%	54 2.46%	56 2.39%	385 2.84%
0 AM to 9:59	60	4.53%	59	60	78	51	58	420
AM to 5.55	3.01%	3.04%	3.40%	3.50%	4.39%	2.32%	2.47%	3.10%
00 AM to 10:59	50	71	62	62	68	66	90	469
AM	2.51%	3.99%	3.58%	3.62%	3.83%	3.01%	3.84%	3.46%
0 AM to 11:59	65	78	76	68	73	79	77	516
AM	3.26%	4.38%	4.39%	3.97%	4.11%	3.60%	3.28%	3.81%
2:00 Noon to	63	84	79	88	89	100	85	588
12:59 PM	3.16%	4.72%	4.56%	5.13%	5.01%	4.56%	3.62%	4.34%
00 PM to 1:59 PM	71	84	81	97	94	121	97	645
	3.56%	4.72%	4.67%	5.66%	5.30%	5.51%	4.13%	4.76%
00 PM to 2:59 PM	92	98	104	81	105	117	111	708
	4.61%	5.51%	6.00%	4.72%	5.92%	5.33%	4.73%	5.23%
00 PM to 3:59 PM	90 4.51%	121 6.80%	136 7.85%	110 6.41%	114 6.42%	156 7.11%	98 4.18%	825 6.09%
:00 PM to 4:59	90	135	118	134	126	139	109	851
PM PM 10 4.55	4.51%	7.59%	6.81%	7.81%	7.10%	6.33%	4.65%	6.29%
00 PM to 5:59	93	116	135	149	132	136	128	889
PM	4.66%	6.52%	7.79%	8.69%	7.44%	6.20%	5.46%	6.57%
00 PM to 6:59	126	90	119	95	98	127	121	776
PM	6.32%	5.06%	6.87%	5.54%	5.52%	5.79%	5.16%	5.73%
00 PM to 7:59	102	98	80	77	82	111	122	672
PM	5.12%	5.51%	4.62%	4.49%	4.62%	5.06%	5.20%	4.96%
00 PM to 8:59 PM	107	86	85	69	78	112	105	642
	5.37%	4.83%	4.90%	4.02%	4.39%	5.10%	4.48%	4.74%
0 PM to 9:59 PM	80 4.01%	70 3.93%	69 3.98%	75	4.34%	125 5.69%	120 5.12%	616 4.55%
00 PM to 10:59	71	55	51	4.37%	4.34%	107	124	555
PM PM	3.56%	3.09%	2.94%	3.79%	4.62%	4.87%	5.29%	4.10%
00 PM to 11:59	62	58	54	54	69	123	117	537
PM	3.11%	3.26%	3.12%	3.15%	3.89%	5.60%	4.99%	3.97%
Universit	6	3	2	0	0	7	2	20
Unknown	0.30%	0.17%	0.12%	0.00%	0.00%	0.32%	0.09%	0.15%
TOTAL	1994	1779	1733	1715	1775	2195	2346	13537
TOTAL	14.73%	13.14%	12.80%	12.67%	13.11%	16.21%	17.33%	100.00%

## 3.3 Time of Day by Day of the Week for all Unstrained Causal Driver Crashes

The over-represented times for improperly restrained drivers is almost a perfect correlation with DUI (alcohol or other drugs). The correlation with age and DUI is also extremely high. If seatbelts are going to expand in their life-saving capabilities, some way will have to be found to get the impaired drivers to buckle up. In the past there has been a tendency to give up on these drivers, and this may be the result. However, some behavioral change was seen in 2017 with the reduced ID fatalities due to a reduction in impact speeds. If that change can be made, then there is no reason that persons who are impaired could not be convinced that it was in their interests to buckle up.

Eile Dashbo	ard <u>F</u> ilters <u>A</u>	<u>A</u> nalysis <u>C</u> ross	ab <u>L</u> ocations	<u>T</u> ools <u>W</u> indow	<u>H</u> elp				
2014-2017 A	abama Integrated Ci	rash Data	~	FY2015-2017 AND [	Dr R Not Used AND I	njury v	• 💡 🔞 1/ 1	/2014 v 10/16/2017 v	
uppress Zero Valu	es: None	✓ Sele	ct Cells: 🔳 🔻 🌃	9		Column: Day of the Week ; Row: Time of Day			
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	TOTAL	
2:00 Midnight to	81	35	33	33	23	41	70	316	
12:59 AM	6.26%	3.16%	3.21%	3.11%	2.06%	3.06%	4.72%	3.75%	
00 AM to 1:59 AM	76	26	15	27	25	43	57	269	
	5.88%	2.35%	1.46%	2.55%	2.24%	3.21%	3.85%	3.19%	
00 AM to 2:59 AM	79 6.11%	17 1.53%	11	20	20	40 2.99%	79 5.33%	266 3.16%	
00 AM to 3:59	54	1.55%	13	1.05%	1.75%	2.55%	78	216	
AM 0 5.55	4.18%	1.62%	1.26%	1.51%	1.43%	1.57%	5.26%	2.56%	
:00 AM to 4:59	63	21	25	18	28	36	50	241	
AM	4.87%	1.90%	2.43%	1.70%	2.51%	2.69%	3.37%	2.86%	
00 AM to 5:59	52	41	33	24	41	42	42	275	
AM	4.02%	3.70%	3.21%	2.26%	3.67%	3.14%	2.83%	3.26%	
00 AM to 6:59	44	40	33	40	31	37	44	269	
AM	3.40%	3.61%	3.21%	3.77%	2.78%	2.76%	2.97%	3.19%	
:00 AM to 7:59 AM	36	62	55	57	58	61	47	376	
	2.78%	5.60%	5.35%	5.38%	5.20%	4.56%	3.17%	4.46%	
:00 AM to 8:59 AM	26	52	36	32	22	35	29	232	
9:00 AM to 9:59 AM	2.01%	4.69%	3.50%	3.02%	1.97%	2.61%	1.96%	2.75%	
	43 3.33%	32 2.89%	39 3.79%	36 3.40%	47 4.21%	37 2.76%	32	266	
AM 10:00 AM to 10:59 AM	33	45	32	39	43	36	56	284	
	2.55%	4.06%	3.11%	3.68%	3.85%	2.69%	3.78%	3.37%	
:00 AM to 11:59	47	49	49	38	46	48	49	326	
AM	3.63%	4.42%	4.77%	3.58%	4.12%	3.58%	3.31%	3.87%	
12:00 Noon to	38	50	50	56	51	53	45	343	
12:59 PM	2.94%	4.51%	4.86%	5.28%	4.57%	3.96%	3.04%	4.07%	
:00 PM to 1:59	43	53	47	55	60	76	58	392	
PM	3.33%	4.78%	4.57%	5.19%	5.38%	5.68%	3.91%	4.65%	
:00 PM to 2:59	54	63	61	54	56	65	73	426	
PM	4.18%	5.69%	5.93%	5.09%	5.02%	4.85%	4.93%	5.06%	
:00 PM to 3:59 PM	51	63	73	69	70	79	63	468	
	3.94%	5.69%	7.10%	6.51%	6.27%	5.90%	4.25%	5.55%	
:00 PM to 4:59 PM	60 4.64%	78 7.04%	64 6.23%	84 7.92%	79 7.08%	77 5.75%	67 4.52%	509 6.04%	
:00 PM to 5:59	56	7.04%	81	87	81	76	83	536	
PM	4.33%	6.50%	7.88%	8.21%	7.26%	5.68%	5.60%	6.36%	
00 PM to 6:59	82	55	70	59	56	73	74	469	
PM	6.34%	4.96%	6.81%	5.57%	5.02%	5.45%	4.99%	5.57%	
:00 PM to 7:59	64	67	53	50	52	61	84	431	
PM	4.95%	6.05%	5.16%	4.72%	4.66%	4.56%	5.67%	5.12%	
:00 PM to 8:59	61	50	48	47	50	68	66	390	
PM	4.72%	4.51%	4.67%	4.43%	4.48%	5.08%	4.45%	4.63%	
00 PM to 9:59 PM	59	38	43	49	54	80	84	407	
	4.56%	3.43%	4.18%	4.62%	4.84%	5.97%	5.67%	4.83%	
00 PM to 10:59 PM	44 3.40%	48 4.33%	28	36	54 4.84%	70 5.23%	76 5.13%	356 4.23%	
	3.40%		2.72%	3.40%					
:00 PM to 11:59 PM	44 3.40%	32 2.89%	34	34	53 4.75%	80 5.97%	75 5.06%	352 4.18%	
	3.40 %	2.09%	2	0	4.75%	5.57%	5.06%	4.10%	
Unknown	0.23%	0.09%	0.19%	0.00%	0.00%	4	0.07%	0.13%	
	1293	1108	1028	1060	1116	1339	1482	8426	
TOTAL	15.35%	13.15%	12.20%	12.58%	13.24%	15.89%	17.59%	100.00%	

## 3.4 Time of Day by Day of the Week: <u>INJURY</u> Unrestrained Causal Drivers

Crosstab analysis of time of day by day of the week for crashes involving injury 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 injury crashes in which the causal driver was not properly restrained.

# 4 Crash Causal Factors

Analysis of crash causal factors determines which factors are the most likely contributors to crashes involving drivers who 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 are not properly restrained.

C/	ARE 10.1.0.19 - [IMPA	CT Results ·	- 2014-20	17 Alaban	na Integrat	ed Crash [	Data - FY201	5-2017 AND D 🗕 🗖 🗙
E E	ile <u>D</u> ashboard <u>F</u> ilters <u>A</u> r	nalysis <u>I</u> mpact	<u>L</u> ocations	<u>T</u> ools <u>W</u> in	ndow <u>H</u> elp			- 8 ×
<b>6</b> 2	2014-2017 Alabama Integrated Cra	sh Data	~	FY2015-2	017 AND Dr Rest	raint Not Used	~ <	💡 🏆 1/ 1/2014 🗸 10/16/2017 🗸 🥘
Order	: Max Gain 🗸 Descer	nding v	Suppress	Zero-Valued Ro	ows		Significance: Over	Representation V Threshold: 2.0
C015	Primary Contributing Circumsta	nce Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain 🔻 ^	C010: Rural or Urban C011: Highway Classifications
	DUI	2596	19.18	7816	2.13	8.996*	2307.429	C012: Controlled Access
	Over Speed Limit	1218	9.00	4623	1.26	7.136*	1047.316	C013: E Highway Side C015: Primary Contributing Circumstance
	E Aggressive Operation	859	6.35	2925	0.80	7.954*	751.007	C016: Primary Contributing Unit Numbe
	E Ran off Road	832	6.15	7690	2.10	2.930*	548.081	C017: First Harmful Event
	E Fatigued/Asleep	696	5.14	6715	1.83	2.807*	448.078	C018: Location First Harmful Event Rel t
	Driving too Fast for Conditions	743	5.49	14787	4.03	1.361*	197.056	C019: E Most Harmful Event
	Unknown	373	2.76	5055	1.38	1.999*	186.367	C020: E Distracted Driving Opinion C021: Distance to Fixed Object
	E Over Correcting/Over Steeri	265	1.96	3670	1.00	1.956*	129.502	C022: E Type of Roadway Junction/Featu
	E Swerved to Avoid Animal	265	1.96	4328	1.18	1.658*	105.208	C023: E Manner of Crash
	E Ran Stop Sign	202	1.49	2801	0.76	1.953*	98.585	C024: School Bus Related
	E Crossed Centerline	208	1.54	3471	0.95	1.623*	79.849	C025: Crash Severity C026: Intersection Related
	Traveling Wrong Way/Wrong	130	0.96	1374	0.37	2.563*	79.271	C027: At Intersection
	E Distracted by Use of Electro	200	1.48	3460	0.94	1.566*	72.255	C028: Mileposted Route
	Improper Parking/Stopped in	44	0.33	608	0.17	1.960*	21.552	C029: Lighting Conditions
	E Improper Crossing	23	0.17	61	0.02	10.212*	20.748	C030: Weather
	E Crossed Median	21	0.16	213	0.06	2.670*	13.136 🗸	C031: Locale Y Sort by Sum of Max Gain
	) @ <i>9</i>							Display Filter Name
				2014-2017 Alat	bama Integrated	Crash Data		
				C015: Primary	Contributing Cire	cumstance		
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	0000000	Mash						الالالالالاله الم
		E Distrac	ted by Fallen Objec	t	Improper o	r No Signal	Right-	E Failed to Yield -of-Way from Yield Sign
				C015: Pr	imary Contributi	ng Circumstance		

# 4.1 Primary Contributing Circumstance

The table listing in the display above includes all of the PCC categories that have a statistically significant over-representations. Over-representation factors indicate that certain risk-taking behaviors are highly correlated with crashes in which causal drivers do not use restraints. In order of maximum potential expected gain (Max Gain), these include: DUI, over the speed limit

(ranked even higher when combined with "Driving too Fast for Conditions"), aggressive operation, ran off the road and fatigued/asleep. DUI for non-restrained drivers was determined to be about nine times (8.996) the proportion that it was for restrained drivers, further reinforcing the findings with regard to impaired driving given above. A recent ID/DUI problem identification for the Impaired Driving Plan revealed that one of the primary reason for fatality in ID crashes is a failure to buckle up. That same study showed that in FY2017 the impact speeds of ID crashes has decreased to a point that a 17% reduction in ID fatalities was observed in FY2017 from the previous year, giving the indication that the behavior of ID drivers is possible.

Other overrepresented contributing circumstances include several things that are correlated with impairment and/or speed: aggressive operation, ran off road, over correcting, swerving, traveling the wrong way for some examples. Aggressive operation is nearly eight times its proportion in comparisons with crashes in which the causal driver is restrained, and over the speed limit is over seven times expectation. Distracted driving is also an issue with the proportion of unrestrained drivers distracted by the use of an electronic device being about 57% higher than that of those properly restrained.

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. It is imperative that countermeasures be developed to convince risk takers that it is almost certain that at some point in time they will be involved in a crash.

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<b>6</b>	2014-2017 Alabama	a Integrat	ed Crash Da	ta	~	FY2015	-2017 AND Dr Rest	raint Not Used	~	<b>?</b> 1/	1/2014 v 10/16/20	017 🗸 🤘
Order:	Max Gain	¥	Descending	¥	Suppress	Zero-Valued	Rows		Significance: Ove	er Representation	✓ Threshold:	2.0
C208:	CU Model Year		Fi	Subset requency	Subset Percent	Other Frequency		Odds Ratio	Max Gain	C208: CU M	odel Year	
	1983			28	0.21	110	6 0.03	6.618*	23.769			
	1984			32	0.24	22	1 0.06	3.970*	23.940			
	1985			37	0.28	307	7 0.08	3.305*	25.803			
	1986			66	0.50	454	4 0.12	3.986*	49.442			
	1987			53	0.40	512	2 0.14	2.838*	34.327			
	1988			67	0.50	723	3 0.20	2.541*	40.631			
	1989			88	0.66	940	0.26	2.567*	53.717			
	1990			87	0.65	994		2.400*	50.748			
	1991			132	0.99	1243		2.912*				
	1992			171	1.29	178		2.633*				
	1993			205	1.54	2442		2.302*	115.937			
	1994			255	1.92	3563		1.962*	125.053			
	1995			328	2.47	472		1.903*	155.673			
	1996			341	2.56	5346		1.749*	146.025	11		
	1997			454	3.41	7584		1.641*	177.402			
	1998			501	3.77	8970		1.531*	173.853			
	1999			671	5.05	11680		1.575*	245.016			
	2000			753	5.66	14597		1.414*	220.629			
	2001			741	5.57	15372		1.322*	180.364			
	2002			847	6.37	17954	_	1.294*	192.195			
	2003			863	6.49	20263	_	1.168*	123.983		(H. C.)	
	2004			887	6.67	21647	7 5.94	1.124*	97.507 🗸	Sort by Sum	of Max Gain	
	S 1										Display Filt	er Name
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							C208: CU Mode	el Year				

## 4.2 Vehicle Age – Model Year

The listing in the display above contains all of the model years that had a statistically significant over-representation. Crashes attributed to drivers who used no restraints are greatly overrepresented in vehicles with model years 1983-2004. This might be attributed to the lack of current safety restraints (or their removal) in the older model vehicles. Vehicles with model years 2007 and later indicates a statistically significant higher proportion involving causal drivers using restraints as compared to those who were not restrained. 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.

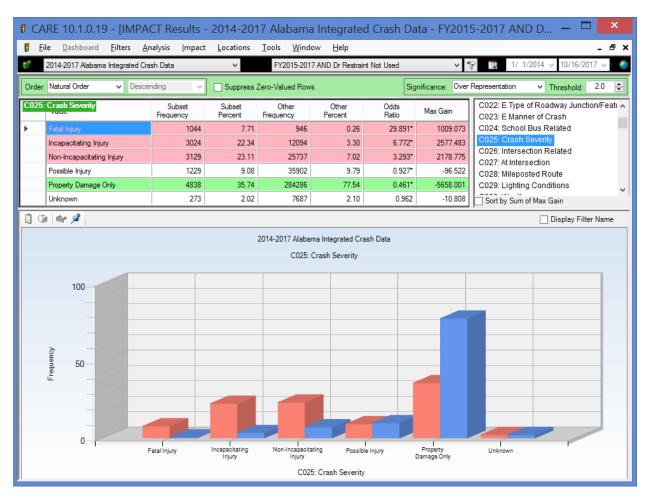
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			ndow <u>H</u> elp ed Causal Driver			1/	1/2012 y 12/31/201	8
2012-2016 Alabama Integrated			ed Causal Driver		· ·	Y 17	1/2012 9 12/31/201	0 🗸
Order: Max Gain V De	scending 🗸 🗹	Suppress Zero-Valued Ro	ows	Sigr	ificance: Over	Representation	✓ Threshold: 2.0	D  \$
C224: CU Estimated Speed at Im	act Subset Sub Frequency Perce		Other Percent	Odds Ratio	Max Gain	C224: CU Esti	mated Speed at Impa	ict
21 to 25 MPH	513	3.66 20126	9.70	0.378*	-845.624			
26 to 30 MPH	558	3.98 21868	10.54	0.378*	-918.219			
31 to 35 MPH	933	6.66 24642	11.87	0.561*	-730.481			
36 to 40 MPH	1044	7.45 22755	10.96	0.680*	-492.097			
41 to 45 MPH	2252	16.07 32904	15.85	1.014	30.785			
46 to 50 MPH	1338	9.55 16621	8.01	1.192*	215.984			
51 to 55 MPH	2372	16.93 25856	12.46	1.359*	626.567			
56 to 60 MPH	1437	10.26 11137	5.37	1.911*	685.187			
61 to 65 MPH	1321	9.43 12503	6.02	1.565*	476.974			
66 to 70 MPH	1070	7.64 13942	6.72	1.137*	128.833			
71 to 75 MPH	361	2.58 2545	1.23	2.101*	189.197			
76 to 80 MPH	341	2.43 1443	0.70	3.501*	243.589			
81 to 85 MPH	152	1.08 464	0.22	4.853*	120.677			
86 to 90 MPH	130	0.93 315	0.15	6.114*	108.736			
91 to 95 MPH	38	0.27 67	0.03	8.402*	33.477			
96 to 100 MPH	103	0.74 250	0.12	6.103*	86.124			
Over 100 MPH	49	0.35 129	0.06	5.627*	40.292	Sort by Sum o	f Max Gain	
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		2012-2016 Alaba	ima Integrated Cra	ish Data				
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	41 to 4	5 MPH	66 to 7	70 MPH		91 to 95 MP	Н	
		C224: CI	U Estimated Speed	d at Impact				

# 4.3 Speed at Impact

The display above gives all of the speeds that can be recorded on the crash report form. Speed at impact for crashes in which drivers failed to use restraints is most highly overrepresented in the range of 76-80 MPH and over. This is the second year that there has been an increase in these higher speeds, perhaps reflecting that additional horsepower in the later model year vehicles. Crashes in which restraints are 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, and since speed is an excellent proxy for risk-taking, shows the correlation between improper restraints and other risk-taking behaviors. It also exacerbates the problem, resulting in greater severity caused by the high-speed, unrestrained driver and passenger situations. Other severity factors are considered immediately below.

# **5** Severity Factors

The sections above generally relate to both crash severity and causation. This section considers crash severity per se. Generally restraints do not prevent crashes, although on some occasions they might help to keep the driver firmly behind the wheel and in a position to avoid or mitigate a crash. But in general occupant restraints serve to reduce the severity of crashes when they occur. Severity factors were analyzed in several different categories to determine to what extent the use of restraints affects the safety of drivers and passengers. 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 extremely overrepresented in crashes that occurred without the use of restraints, as given by the Odds Ratios that show the proportions of fatal, Incapacitation Injury and Non-incapacitating injury were about 30, 7 and 3 times expected, respectively. The first two of these ratios are up considerably from 21 and 6, respectively, found in the previous year study. While overrepresentations in these severity classifications were certainly expected, these results further quantify 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.

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🚦 <u>F</u> ile <u>D</u> ashb	oard <u>F</u> ilters <u>/</u>	<u>A</u> nalysis <u>C</u> rosstal	b <u>L</u> ocations <u>T</u>	ools <u>W</u> indow	<u>H</u> elp			_ 8 %
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Suppress Zero Va	lues: None	✓ Select	Cells: 🔳 🕶 🔀	9		Column: C	rash Severity ; Row:	Highway Classifications [ 没
	Fatal Injury	Incapacitating Injury	Non- Incapacitating Inju	Possible Injury	Property Damage Only	Unknown	TOTAL	
Interstate	98	220	262	89	325	8	1002	
Interstate	9.39%	7.28%	8.37%	7.24%	6.72%	2.93%	7.40%	
Federal	154	373	354	165	494	28	1568	
reueral	14.75%	12.33%	11.31%	13.43%	10.21%	10.26%	11.58%	
State	277	690	612	281	868	52	2780	
Sidle	26.53%	22.82%	19.56%	22.86%	17.94%	19.05%	20.54%	
County	390	1319	1265	304	1657	78	5013	
County	37.36%	43.62%	40.43%	24.74%	34.25%	28.57%	37.03%	
Municipal	121	412	607	362	1356	101	2959	
Municipal	11.59%	13.62%	19.40%	29.45%	28.03%	37.00%	21.86%	
Private Property	4	10	29	28	138	6	215	
Private Property	0.38%	0.33%	0.93%	2.28%	2.85%	2.20%	1.59%	
P Other*	0	0	0	0	0	0	0	
r Other	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	
TOTAL	1044	3024	3129	1229	4838	273	13537	
TOTAL	7.71%	22.34%	23.11%	9.08%	35.74%	2.02%	100.00%	

#### 5.2 Crash Severity by Highway Classification for Driver Not Restrained

Analysis of crash severity by highway classification for crashes in which the causal driver did not use restraints shows that fatal injuries were overrepresented by greater than 10% higher proportions on Interstate, Federal and State roadways. While fatality crashes are also over-represented on County roads, the proportion of fatal crashes there (39.65%) is only about 1% higher than its overall crash proportion (38.81%). The other higher severity classifications generally follow this, but their over-representations are all less than 10% increase in the proportion as compared to their totals in the TOTAL column. Possible injuries and Property Damage Only were highly overrepresented on municipal highways and private property.

5.3	Number	Injured
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¢°	2014-2017 Alabama Integrated Cr	ash Data	~	FY2015-201	7 AND Dr Restrair	nt Not Used	¥ 1	〒 1/ 1/2014 ∨ 10/16/2017 ∨
Orde	er: Natural Order V Desce	ending 🗸 🗸	Suppress 2	Zero-Valued Row	s	Sig	gnificance: Over	Representation V Threshold: 2.0
C05	9: Number Injured (Includes Fata	lities) Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain	C054: Number of Motorists Recorded C055: Number of Non-Motorists Record
•	No Injuries	5086	37.57	291449	79.49	0.473*	-5674.463	C056: Number of Pedestrians
	1 Injury	6015	44.43	54397	14.84	2.995*	4006.632	C057: Number of Pedacyclists C058: Number Injured (Non-Fatal)
	2 Injuries	1565	11.56	14450	3.94	2.933*	1031.498	C058: Number Injured (Non-Fatal) C059: Number Injured (Includes Fatalitie
	3 Injuries	539	3.98	4154	1.13	3.514*	385.632	C060: Number Killed
	4 Injuries	194	1.43	1377	0.38	3.816*	143.160	C061: Number of Railroad Trains
	5 Injuries	85	0.63	505	0.14	4.559*	66.355	C062: Has Railroad Crossing Number
	6 Injuries	33	0.24	175	0.05	5.107*	26.539	C080: CMV Involved C081: E Has Truck Bus Supplement
	7 Injuries	12	0.09	79	0.02	4.114	9.083	C101: Causal Unit (CU) Type
	8 Injuries	2	0.01	33	0.01	1.642	0.782	C102: CU Non-Motorist Indicator
	9 Injuries	5	0.04	10	0.00	13.543	4.631	C103: CU Commercial Motor Vehicle Inc
	11 Injuries	1	0.01	2	0.00	13.543	0.926	Sort by Sum of Max Gain
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		ringury	Shiju		er Injured (Include		gunes	o injuneo

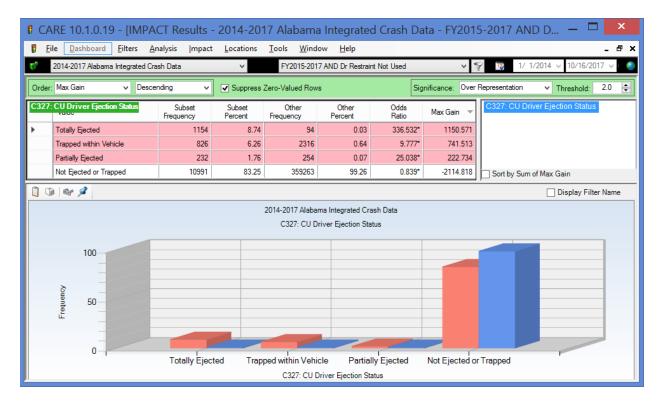
All of the multiple injury categories are given above along with the No Injuries and the 1 Injury classifications. The fact that all multiple injury classifications are over-represented is a good indication that the use of the unrestrained driver is an excellent proxy for any of the passengers in that vehicle also being unrestrained. Track down the Odds Ratio column and see how the multiple injuries increase in their over-representations right up to 7 and 8 injuries, and then they are dramatically over-represented in the 9 and 11 injuries categories. No statistical tests are done if either of the attributes being tested has a frequency of less than 20 since this would require a different statistical test than the one programmed into CARE. So while any hard conclusions regarding crashes above 6 injuries should be avoided, no doubt these high-injury crashes are greatly over-represented when considered collectively. 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 and not just the causal driver. The overrepresentation of multiple injuries in the causal vehicle might also indicate a tendency of unrestrained drivers to travel with multiple individuals in the vehicle.

## 5.4 Number Killed

CARE 10.1.0.19 - [IM	PACT Resul	ts - 2014-	2017 Alak	oama Inte	grated Cr	ash Data -	FY2015-2017 🗖 🗙
<u>File</u> <u>D</u> ashboard <u>Filters</u>	<u>A</u> nalysis <u>I</u> m	pact <u>L</u> ocatio	ons <u>T</u> ools	<u>W</u> indow <u>H</u>	elp		_ 8 ×
2014-2017 Alabama Integrate	d Crash Data	~	FY20	15-2017 AND D	r Restraint Not	Used	✓ ♥ 1/ 1/2014 ∨ 10/16/201
Order: Max Gain 🗸 D	escending	Y Supp	ress Zero-Value	ed Rows	Sigr	nificance: Over	Representation V Threshold: 2.0
C060: Number Killed	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain	C058: Number Injured (Non-Fatal) C059: Number Injured (Includes Fatalitie
No Fatalities	12491	92.27	365702	99.74	0.925*	-1010.925	C060: Number Killed
1 Fatality	961	7.10	857	0.23	30.372*	929.359	C061: Number of Railroad Trains C062: Has Railroad Crossing Number
2 Fatalities	65	0.48	76	0.02	23.165*	62.194	C080: CMV Involved
3 Fatalities	12	0.09	13	0.00	25.002	11.520	C081: E Has Truck Bus Supplement
4 Fatalities	6	0.04	4	0.00	40.628	5.852	C101: Causal Unit (CU) Type
5 Fatalities	2	0.01	0	0.00	0.000	2.000	Sort by Sum of Max Gain
📋 🕼 🞯 🖉							Display Filter
2014-2017 A	abama Integrated	Crash Data - Fi		017 AND Dr Res ): Number Killed		d vs. FY2015-20	17 AND Dr Restraint Used
100 Source 50							
0	vo Fatalities	1 Fatality	2 Fatali CC	ties 3 Fa	atalities	4 Fatalities	5 Fatalities

The proportion of fatalities in general as well as the proportion of multiple fatality crashes is dramatically overrepresented when restraints are not used by drivers (and inferred most other passengers) in the causal vehicle. Multiple fatality crashes were found to be a large factor in the increase of unrestrained fatalities in CY2016, and it is gratifying to see their reduction from 132 in 2016 to 85 in FY2017. The largest decrease was in the single fatality crashes, which went from 1510 in CY2016 to 961 in FY2017, a reduction of 36%.

# **5.5 Driver Ejection Status**



Driver Totally Ejected is overrepresented by a factor of over 337 owing to the fact that only 94 (0.03%) of the crashes where the causal driver was restrained resulted in the driver being totally ejected. This compares to 1154 total ejections (8.74%) of the cases in which the causal driver was not properly restrained. This is one of the highest over-representations that we have ever seen, and it speaks to the effectiveness of seatbelts in preventing one of the most lethal events that can occur in a crash – being ejected from the vehicle. See the next section on the severity increases when ejection is involved. Partial ejection and entrapment in the vehicle are also greatly over-represented (about 25 and 10, respectively), which is also expected in crashes in which safety equipment is not properly utilized.

<u>F</u> ile <u>D</u> ashb	oard <u>Filters 4</u>	<u>A</u> nalysis <u>C</u> rossta	b <u>L</u> ocations <u>T</u>	ools <u>W</u> indow	<u>H</u> elp			
2014-2017	Nabama Integrated C	rash Data	~	FY2015-2017 AND [	Or Restraint Not Used	~	See 1/ 1.	/2014 v 10/16/
Suppress Zero Val	ues: None	✓ Select	Cells: 🔳 🛛 🛞	9		Column: Cra	ash Severity ; Row: 0	U Driver Ejection
	Fatal Injury	Incapacitating Injury	Non- Incapacitating Inju	Possible Injury	Property Damage Only	Unknown	TOTAL	
Not Ejected or	373	1932	2667	1098	4698	223	10991	
Trapped	35.73%	63.89%	85.23%	89.34%	97.11%	81.68%	81.19%	
Partially Ejected	91	92	30	10	7	2	232	
artially Ljected	8.72%	3.04%	0.96%	0.81%	0.14%	0.73%	1.71%	
Totally Ejected	327	541	212	36	27	11	1154	
rotally Ejected	31.32%	17.89%	6.78%	2.93%	0.56%	4.03%	8.52%	
Trapped within	226	395	125	48	15	17	826	
Vehicle	21.65%	13.06%	3.99%	3.91%	0.31%	6.23%	6.10%	
Unknown	4	22	21	6	23	13	89	
UNKIOWI	0.38%	0.73%	0.67%	0.49%	0.48%	4.76%	0.66%	
Not Applicable	6	27	52	27	62	7	181	
Not Applicable	0.57%	0.89%	1.66%	2.20%	1.28%	2.56%	1.34%	
CU is Not a	17	15	22	4	6	0	64	
Vehicle	1.63%	0.50%	0.70%	0.33%	0.12%	0.00%	0.47%	
CU is Unknown	0	0	0	0	0	0	0	
CO IS ORKHOWN	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	
ECU Driver Not	0	0	0	0	0	0	0	
Recorded	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	
TOTAL	1044	3024	3129	1229	4838	273	13537	
TOTAL	7.71%	22.34%	23.11%	9.08%	35.74%	2.02%	100.00%	

# 5.6 Ejection Status by Severity

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 a dramatic increase in the severity of injuries in those crashes. The table given above quantifies this increase in severity. The probability of any given crash being fatal over the three years (FY2015-FY2017) of the study was 0.57% (including all crashes whether the driver/passengers were restrained or not). The following table give the multipliers to this probability (0.59%) of a crash being a fatal crash for the various ejection conditions.

<b>Ejection Status</b>	<b>Probability of Fatality</b>	Multiplier from All Crashes	All=1 in 175
Not Ejected	3.40%	5.95	1 in 29.47
Partially Ejected	39.22%	68.82	1 in 2.55
Totally Ejected	28.34%	49.71	1 in 3.53
Trapped in Vehicle	27.36%	48.00	1 in 3.66

**Fatality Multipliers for Unrestrained Driver Persons Involved** 

The non-ejection has a multiplier of 5.95 because it is being compared to all crashes, of which a large number (over 90% of passengers) are restrained. Partial ejection is the worst case scenario with a multiplier of over 68. For totally ejected or trapped causal vehicle drivers this is in the 48-50 range, but is still dramatically worse than not being ejected even if unrestrained.

# **5.7 Driver Injury Type**

201	4-2017 Alabama Integrated Crash Data		~	FY2015-2017 A	ND Dr Restraint I	Not Used	~ ~ *	I/ 1/2014 ∨ 10/16/2017 ∨
rder: Od		✓ □:	Suppress Zero-'	Valued Rows		Signifi	icance: Over F	Representation V Threshold: 2.0
328: CU	I Driver/Non-Motorist Injury Type	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain	C324: CU Driver Airbag Status C325: CU Driver/Non-Motorist Age
Fat	tal Injury	844	6.23	494	0.13	46.275*	825.761	C326: CU Driver/Non-Motorist Gender
Inc	capacitating	2800	20.68	7274	1.98	10.426*	2531.440	C327: CU Driver Ejection Status
Nor	on-Incapacitating	2937	21.70	15863	4.33	5.015*	2351.329	C328: CU Driver/Non-Motorist Injury Type C329: CU Driver/Non-Motorist First Aid B
ΕU	Unknown Injury	121	0.89	1265	0.35	2.591*	74.295	C330: CU Driver/Non-Motorist Transport
Not	t Visible but Complains of Pain	994	7.34	14601	3.98	1.844*	454.923	C331: E CU Driver/Non-Motorist Transpo
CU	J Driver/Non-Motorist was Not a Victim	5841	43.15	327155	89.23	0.484*	-6237.748	C401: E CU Involved Road/Bridge
CU	J is Unknown		0.00	0	0.00	0.000		C402 <sup>-</sup> E CU Road Surface Type
1		0	2014-2	2017 Alabama I	integrated Crash		0.000	Sort by Sum of Max Gain
1			2014-2	2017 Alabama I	Integrated Crash	Data	0.000	Sort by Sum of Max Gain
1	er \$		2014-2	2017 Alabama I	Integrated Crash	Data	0.000	<u> </u>
1			2014-2	2017 Alabama I	Integrated Crash	Data	0.000	<u> </u>
1	er \$		2014-2	2017 Alabama I	Integrated Crash	Data	0.000	<u> </u>
1	er \$		2014-2	2017 Alabama I	Integrated Crash	Data	0.000	
	100		2014-2	2017 Alabama I	Integrated Crash	Data	0.000	
	100		2014-2	2017 Alabama I	Integrated Crash	Data	0.000	
1	100		2014-2	2017 Alabama I	Integrated Crash	Data	0.000	
	100		2014-2	2017 Alabama I	Integrated Crash	Data		
	100		2014-2	2017 Alabama I	Integrated Crash	Data		
	100		2014-2	2017 Alabama I	Integrated Crash	Data		
	100		2014-2	2017 Alabama I	Integrated Crash	Data	0.000	

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 46.275. In crashes in which safety restraints were used, drivers and non-motorists were far less likely to be injured. All three non-fatal injury classifications were also significantly over-represented at about 10, 5 and 3 times their expectations, respectively.

# 5.8 Fatality Probability by Restraint Use

The following is for all crashes over the FY2014-FY2017 time frame.

8	CAR	E 10.1.0.19 -	[Crosstab Re	sults - 2014-	2017 Alabam	a Integrated	Crash Data]	_ 🗆 🗙
🚦 <u>F</u> ile <u>D</u> ash	board <u>F</u> ilters	<u>A</u> nalysis <u>C</u> rosstal	b <u>L</u> ocations <u>T</u>	ools <u>W</u> indow	<u>H</u> elp			_ & ×
2014-2017	Alabama Integrated (	Crash Data	~	All records (do not a	pply a filter)	~	🌍 🕎 1/ 1	/2014 🗸 10/16/2017 🗸 🎒
Suppress Zero Va	alues: None	✓ Select	Cells: 🔳 🗸 🌃	9	Column:	Crash Severity ; Rov	v: CU Driver/Non-Mo	otorist Safety Equipment 🔃
	Fatal Injury	Incapacitating Injury	Non- Incapacitating Inju	Possible Injury	Property Damage Only	Unknown	TOTAL	^
None Used -	1290	3748	3844	1501	5991	350	16724	
Motor Vehicle Oc	40.68%	16.53%	9.20%	2.89%	1.42%	2.22%	3.00%	
Shoulder and Lap	1130	15154	31612	43679	348362	9835	449772	
Belt Used	35.64%	66.85%	75.69%	84.06%	82.63%	62.48%	80.77%	· ·

The probability that any given crash will be classified as a fatal crash is calculated by the number in any specific category divided by the total number in that general category. From the above, the probability of a fatality of those who are properly restrained is given by:

1130 Fatal Crashes/449,772 Total Restraint Used Crashes = 0.25% (about 1 in every 400 crashes).

The same calculation for the None Used row is:

1290 Fatal Crashes/16,724 Total None Used Crashes = 7.71% = (about 1 in every 13 crashes).

These figures show that the probability of being killed in a crash goes up by a factor of about 31 times the probability of being killed given proper restraints.

# **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

C/	ARE 10.1.0.19 - [IMPA	ACT Results	- 2014-20	)17 Alabar	na Integra	ted Crash	Data - FY20	015-2017 AND 🗕 🗖 🗙
💀 <u>F</u>	ile <u>D</u> ashboard <u>F</u> ilters <u>/</u>	<u>A</u> nalysis <u>I</u> mpac	t <u>L</u> ocations	<u>T</u> ools <u>W</u> i	ndow <u>H</u> elp			_ 8 ×
5	2014-2017 Alabama Integrated C	ìrash Data	~	FY2015-2	2017 AND Dr Res	straint Not Used	~	
							or	
		cending v	Suppres:	s Zero-Valued R	ows	-	Significance: Ove	er Representation V Threshold: 2.0
C107	: CU Driver Raw Age	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain	C107: CU Driver Raw Age
	15	44	0.34	670	0.18	1.833*	20.000	
	16	292	2.24	11289	3.10	0.722*	-112.390	
	17	408	3.13	12200	3.35	0.934	-29.024	
	18	544	4.17	14289	3.92	1.063	32.145	
	19	549	4.21	14340	3.94	1.069	35.318	
	20	443	3.40	13440	3.69	0.920	-38.442	11
	21	544	4.17	12726	3.50	1.193*	88.134	
	22	483	3.70	11892	3.27	1.134*	57.009	
	23	472	3.62	11295	3.10	1.167*	67.395	
	24	457	3.50	10553	2.90	1.209*	78.975	
	25	462	3.54	9925	2.73	1.299*	106.471	
	26	428	3.28	9169	2.52	1.303*	99.552	
	27	385	2.95	8415	2.31	1.277*	83.561	
	28	383	2.94	7936	2.18	1.347*	98.720	
	29	341	2.61	7555	2.08	1.260*	70.368	
	30	330	2.53	7217	1.98	1.276*	71.475	
	31	303	2.32	7019	1.93	1.205*	51.568	
	32	264	2.02	6714	1.84	1.098	23.494	
	33	266	2.04	6694	1.84	1.109	26.210	
	34	241	1.85	6291	1.73	1.069	15.646	
	35	305	2.34	6135	1.69	1.388*	85.234	
	36	259	1.99	6088	1.67	1.188*	40.918 🗸	Sort by Sum of Max Gain
	) 😪 🖉	· · · · ·						Display Filter Name
				2014-2017 Ala	bama Integrated	Crash Data		
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			34		54			74
				(	C107: CU Driver	Raw Age		

Analysis of individual driver ages indicates that crashes involving no restraints are overrepresented in the years above the teen-drivers (age range 21-36, all of which are shown in the table above the chart). 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, for crashes in general, they are at least twice the average of the other ages). The tendency toward risk-taking is generally thought to end at age 25. This distribution correlates very strongly with crashes in which the causal driver was impaired by drugs (including alcohol), in the significant over-representations being in the ages above 20.

## 6.2 Driver Gender

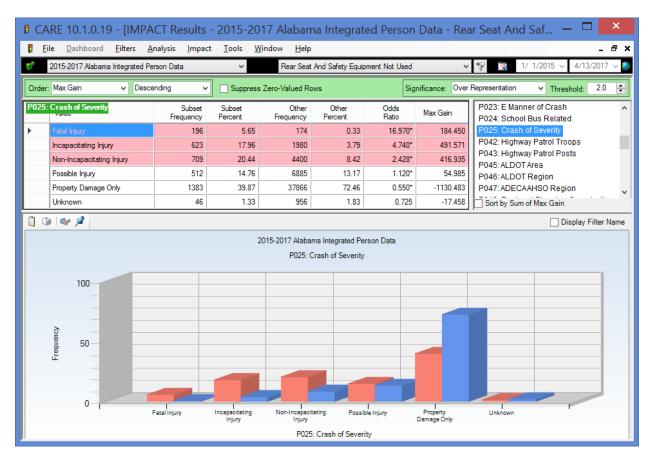
₿ C.	ARE 10	).1.0.19 -	IMPA	CT Results	- 2014-20	17 Alabam	a Integrate	ed Crash D	ata - FY20	15-2017 AN	ND 🗕 🗖 🗙
8	<u>F</u> ile <u>D</u> a	shboard <u>F</u>	ilters <u>A</u> n	ialysis <u>I</u> mpac	t <u>L</u> ocations	<u>T</u> ools <u>W</u> ine	dow <u>H</u> elp				_ @ ×
<b>\$</b>	2014-20	17 Alabama Int	tegrated Cra	sh Data	~	FY2015-20	17 AND Dr Restra	aint Not Used	~	9 1/	1/2014 🗸 10/16/2017 🗸 🅙
Orde	er: Max Ga	iin	✓ Descer	nding v	Suppress	Zero-Valued Ro	WS	Sig	nificance: Over	Representation	✓ Threshold: 2.0 ♀
C32	6: CU Dri	ver/Non-Moto	orist Gender	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain	C326: CU Dri	ver/Non-Motorist Gender
	Male			9350	70.42	198611	54.34	1.296*	2134.629		
	Female			3927	29.58	166853	45.66	0.648*	-2134.629	Sort by Sum	of Max Gain
	۰	<i>s</i>									Display Filter Name
	Frequency	100 50 0					ma Integrated Cr rer/Non-Motorist (	Gender			
					Male			Female			
					C	326: CU Driver/I	Non-Motorist Ger	nder			

Males account for 70.42% of crashes in which restraints are not used, and they are overrepresented by a factor of 1.296. Since males also do the majority of the driving, they become a clear target for restraint countermeasures.

2014-2017 A	Nabama Integrated C	irash Data	~	FY2015-2017 AND [	Or Restraint Not Used	Ý	Se 😨 1/
Suppress Zero Val	ues: Rows and Col	umns 🗸 Select	Cells: 🔳 🛛 🔀	9	Column: C	U Driver Gender ; R	low: Crash Severity
	Male	Female	Unknown	Not Applicable	CU is Not a Vehicle	TOTAL	1
Fatal Injury	812	215	0	0	17	1044	1
Fatal injury	8.73%	5.50%	0.00%	0.00%	26.56%	7.71%	
Incapacitating	2104	901	3	1	15	3024	
Injury	22.62%	23.07%	1.17%	11.11%	23.44%	22.34%	
Non-	2136	962	9	0	22	3129	
ncapacitating Inju	22.96%	24.63%	3.52%	0.00%	34.38%	23.11%	
Possible Injury	773	443	9	0	4	1229	
Fossible injury	8.31%	11.34%	3.52%	0.00%	6.25%	9.08%	
Property Damage [	3314	1300	211	7	6	4838	1
Only	35.63%	33.28%	82.42%	77.78%	9.38%	35.74%	
Unknown	163	85	24	1	0	273	1
Unknown	1.75%	2.18%	9.38%	11.11%	0.00%	2.02%	
TOTAL	9302	3906	256	9	64	13537	
TOTAL	68.72%	28.85%	1.89%	0.07%	0.47%	100.00%	

# 6.3 Driver Gender by Severity for Unrestrained Causal Drivers

The only injury proportion that deviated by more that 10% of its expected value for all drivers of all genders was the 443 (11.34%) for Female drivers who sustained Possible Injuries. Generally, the distribution of severity is skewed toward more severe injuries for unrestrained male drivers in the Fatal and Incapacitating Injury categories. The probability that any of these (unrestrained driver) crashes resulted in a fatality was 8.73% for male drivers and 5.50% for female drivers.



# 7 Analysis of Back Seat Occupants

Back seat occupants who are not properly restrained have close to 17 times the probability of being killed as do those who are properly restrained. The other highest two severity classifications are also very highly significant in their over-representations, having Odds Ratio multipliers of 4.740 for Incapacitating Injury and 2.428 for Non-Incapacitating Injury.

Looking at the numbers, over the three year period, there were 196 back seat occupants killed, which is about 65 per year. Question: how many of these would have been saved had they been properly restrained? Applying the 0.33% (probability of being killed if restrained) to the total unrestrained (sum of the Subset Frequency column, which is 3,469) yields 11.45 total fatalities expected in any event from the 3,469 unrestrained victims. This means that the total fatality savings over the five years would have been 196-11=185 fatalities, or saving about 62 lives per year.

# **8** 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, Talladega, Jackson, DeKalb, Monroe and Cullman,
  - 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 about 2.5 times that of what would be expected if rural and urban restraint use were the same.
  - The most overrepresented (worst) areas are the rural county areas in Walker, Talladega, Mobile, Tuscaloosa and Cullman Counties.
  - The most underrepresented (best) cities are Birmingham, Mobile, Montgomery, and Huntsville.
  - Crash incidents with no driver restraints being used are greatly overrepresented on county highways, with 2.75 times the expected number of crashes. County and State were the only roadway classification that were overrepresented. Federal, Interstate and Municipal roads were significantly under-represented.
  - In the analysis of locale, crashes involving no restraints are most commonly overrepresented in Open Country areas, and Shopping or Business locales are the most significantly under-represented.
- 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, overrepresentations peak during the 7 PM to 6 AM time periods and then taper off, falling back below crashes involving causal drivers who use restraints in the 7 AM to 7 PM time periods. Additional crosstabulations were performed for crashes involving injury.
- 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. Two analyses were performed and compared for all crashes with restraint deficiencies and injury crashes for restraint deficiencies. The late night and early morning over-representations were largely on the weekend days starting on Friday night and ending on Sunday morning.

- The cross-tabulation of time of day by day of the week that was restricted to injury crashes showed a very high resemblance to the same analysis for impaired driving (alcohol and other drugs involvement).
- 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 1960-2004, 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 restraint-deficient crashes is significantly overrepresented in all of the categories above 45 MPH, indicating that these crashes consistently occur at higher speeds than crashes in which restraints were used by the causal driver. This is highly correlated with rural driving and risk taking.
- 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 highly overrepresented on interstate, federal and state roadways. "Possible Injuries and Property Damage Only were highly overrepresented on municipal highways.
  - Analysis of number injuried 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 19-39).

- Male drivers account for a majority of crashes in which restraints are not used, and they are overrepresented by a factor of 1.296.
- Ejection and Back Seat Analysis
  - The non-restrained person is over 300 times more likely to be totally ejected than those who are properly restrained.
  - Being ejected results in a probability of death about 50 times that of those not ejected.
  - If all back-seat occupants were properly restrained it would result in an estimated saving of 62 lives per year.

For general information on restraints from NHTSA and other sources, please see "Restraints" in: <u>http://www.safehomealabama.gov/safety-topics/</u>