Effect of Abbreviated Injury Scale (AIS) Change on Injury Severity Prediction for Advanced Automatic Crash Notification (AACN)

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Received on October 20, 2016

ABSTRACT: In this paper, two versions of the Abbreviated Injury Scale codes (AIS98 and AIS08) were used to develop Injury Severity Prediction algorithms with the help of NASS-CDS (US) 2009-2012 database. Some severe injuries in the AIS98 are scaled as less severe in the AIS08, especially in head and thorax regions; but in other body regions, there are no significant changes. Changes in AIS severity level will affect the distribution around the Injury Severity Score equal to 15, the threshold level for serious/minor injury judgment and hence leads to change in Injury Severity Prediction (ISP) prediction value related to AACN. The total number of false cases reduced for ISP algorithm formulated with AIS08 code when compared to that of AIS98 code. The proposed modified ISP algorithm is more efficient for both the AIS codes (98 and 08) than the original publicly available Kononen’s algorithm.

KEY WORDS: Safety, AACN, Abbreviated Injury Scale Code, Injury Severity Prediction Algorithm, Accident Analysis,[C1]

1. Introduction

Transmitting crash related information from a crashed vehicle to a Public Service Answering Point (PSAP) via telematics service centers using a more rational triage system based on Advanced Automatic Crash Notification (AACN) could save 1) 2) more lives for occupants involved in severe motor vehicle crashes compared to an ordinary E-call/ACN system. This crash related information is very useful to assess the severity of any occupant within a vehicle utilizing Injury Severity Prediction (ISP) algorithms. Knowing the degree of severity of occupants immediately after the accident is not only helpful for emergency medical services to expedite emergency dispatch services but also very useful for Level-1 trauma centers to make all necessary arrangements before they arrive. The accuracy of the Injury Severity Prediction (ISP) algorithm affects the efficiency of AACN. Many ISP algorithms have been developed in the past, such as Kononen’s ISP algorithm 3) (based on ISS), and Urgency algorithm 4) (based on MAIS3+ severity). Pal, et.al also proposed a new algorithm based on publicly available ISP algorithm developed by Kononen with some modifications. This study is the continuation of author’s previous works published in 2015 5) 6). Injury severity scales are used in three primary applications; (a) triage applications to set priorities for patient treatment, (b) prognostic evaluations to predict or manage injury outcomes, and (c) research applications to compare groups on injury outcomes or treatment effects. AIS is widely used to monitor and evaluate the anatomic injuries of occupants involved in motor-vehicle crashes. AIS was, first developed in 1971 by AAAM 7) (Association for the Advancement of Automotive Medicine) mainly to support the crash investigators. The AIS is primarily an anatomical measure of injury severity. It classifies severity based on the body region injured and the magnitude of the injury in six specified body regions. AIS codes have gone through updates in 1976, 1980, 1990, 1998, 2005 and 2008. However, the principal version was the AIS 1990 code and its update in 1998 with detailed description of injuries. The AIS code set has expanded in size from 1341 codes in AIS98 to 1999 codes in AIS08. Many accident-data collection agencies such as German In-Depth Accident Study (GIDAS), National Automotive Sampling System Crashworthiness Data System (NASS CDS) and Institute for Traffic Accident Research and Data Analysis (ITARDA) are mainly using AIS-1998 until now. However, after introduction of the 2008 update, they have also started coding in both the versions of AIS. Compared to AIS98, AIS08 has newly introduced codes and severity changed from severe to minor for some of the codes. In order to reflect current injury treatment, management and outcome 8) 9) 10), the AIS08 version revised many lower severity injuries. Due to these changes in coding of injuries, AAAM has developed a dictionary to map the codes from AIS98 to AIS08 and vice versa. Because ISS is calculated based on AIS scores, these severity changes will definitely affect the calculation of Injury Severity Score (ISS). The ISS scores range from 1 to 75. ISS is defined mainly to identify the trauma severity (serious: ISS>15; minor: ISS<15). Therefore, a pre-defined ISS cut off 11) value plays a major role in deciding the type of injury (serious/minor). The aim of this study is to find out the effect of Abbreviated Injury Scale (AIS) and its influence on the prediction accuracy of AACN ISP algorithms. ISP uses AIS values and an AIS-derived Injury Severity Score (ISS) for post-crash triage.
2. Data and Methods

2.1 Approach

In this study, we developed Injury Severity Prediction (ISP) algorithms using two versions of AIS codes (98 and 08): (a) based on Kononen’s Injury Severity Prediction (ISP) algorithm, which is a publicly available, published in 2011, and (b) based on Pal’s ISP algorithm, published in 2015. Pal’s algorithm is a modified version of Kononen’s algorithm by adding new variables and changing some existing variables. In this paper, the original Kononen’s algorithm is called the “base” algorithm whereas Pal’s algorithm is called the “proposed” algorithm. The base algorithm consists of seven important crash variables; Delta-V, Seatbelt usage, Type of vehicle, Number of events, Principal Direction of Force (PDOF), Belt usage, Age and Gender. In addition to the base model variables the proposed model adds; Model year, Nearside presence, Accident time, Interaction terms (multi event x unbelted, nearside presence x unbelted) and uses existing base variables like PDOF, No. of events, Age with some modifications. Logistic regression equation is always between 0 and 1. ISS is considered as the dependent variable (ISS>15:1, ISS<15:0) and the other variables mentioned in the base and proposed models are treated as independent variables. Refer to the Appendix section (Table A1 to A4) for more details about each variable classification and their reference values.

2.2 Data

This study uses National Automotive Sampling System Crashworthiness Data System (NASS-CDS) accident data from calendar year CY 2009-12. Table 1 shows the assumptions used to prepare the input data set in this study. The accident samples are limited to only planar collisions (i.e., excluded crashes with primary general area of damage as top or bottom and rollovers) and values with unknowns have removed. Total 4211 vehicles were extracted from CY 2009-12, to perform the accident analysis and logistic regression. Since the latest version of AIS08 is available only from CY 2010, CY 2009 injury data points have mapped from AIS98 to AIS08 version using available AAAM’s latest AIS98-AIS08 mapping dictionary. Another set of data (n=758) from CY 2013 data was selected to verify and compare the prediction performances of two algorithms in two different versions.

| No. of cases | Assumptions |
|--------------|-------------|
| 1            | Unknown AV removed |
| 2            | Model year < 2000 removed |
| 3            | Vehicle curb weight >4,500 kg removed |
| 4            | Area of damage : top/ bottom and rollovers removed |
| 5            | Unknown age, gender, or belt status removed |
| 6            | ISS=0, MAIS=0 & 7 cases, are removed |
| 7            | No imputations done |

3. Results

This section explains the results of accident analysis as well as logistic regression to highlight the effect of change in AIS coding on the performance of ISP algorithms related to AACN system.

3.1 Overall changes in AIS injuries

Firstly, overall changes to AIS severities for all injuries are studied in this section. Figure 1, shows the percentage of injuries sustained in each AIS severity level of all body regions for both AIS98 and AIS08 codes. It shows that number of AIS1 and AIS2 minor injury levels are increasing. On other hand, AIS3 and AIS4 severe injury levels are decreasing, from AIS98 to AIS08. Figure 2, shows how the AIS injury severities are shifting from serious to minor category as the coding changes from AIS98 to AIS08. The difference in number of injuries are plotted against all AIS injury levels. It shows a negative shift of injuries, when coded from AIS98 to AIS08, on AIS3 and AIS4 serious injuries. It means a portion of them is interpreted as less severe in AIS08 scale due to changes or improvements in current emergency injury treatments.

![Fig 1. Percentage of injuries sustained in each AIS severity](image)

![Fig 2. Shifting of AIS severity from AIS98 to AIS08 version](image)

3.2 Changes in each body region

Next, the effect of AIS change in specific body regions such as head, face, neck, thorax, abdomen, spine, upper and lower extremities regions are considered in this section. The variation of severities is not uniform in different body regions. There is no considerable changes in severities in case of head, neck, abdomen and extremities. However, there is considerable change in case of head and thorax. Figure 3 and 4 show the percentage of injuries in each AIS severity for head and thorax. Due to reclassification of severity of some specific regions, AIS1 and AIS2 groups have increasing trend and vice-versa for AIS3 and AIS4 with decreasing trend. This may be because of more severe injuries in AIS98 have been coded as less severe in AIS08 version. The variation of percentage of AIS injuries in face, neck, abdomen, spine and lower-upper extremities are plotted in figures 5 to 10. However, there are some changes...
observed in the above body regions but there are not much significant changes when compared from AIS98 to AIS08 version.

Fig 3. Percentage of Head injuries in each AIS severity

Fig 4. Percentage of Thorax injuries in each AIS severity

Fig 5. Percentage of Face injuries in each AIS severity

Fig 6. Percentage of Neck injuries in each AIS severity

Fig 7. Percentage of Abdomen injuries in each AIS severity

Fig 8. Percentage of Spine injuries in each AIS severity

Fig 9. Percentage of Upper extremity injuries in each AIS severity

Fig 10. Percentage of Lower extremity injuries in each AIS severity
3.3 Effect in the neighborhood of the threshold level for serious and minor injury ISS=15

Percentage of AIS injuries are plotted against the ISS of injured occupant in both versions of AIS codes and compared with each other in figure 11. An injured occupant is classified as serious or minor based on the ISS value (ISS>15, serious; ISS<15, Minor). The ISS=15 line is indicated between the minor and serious ISS range. In this study, two specific ISS regions are focused (minor: ISS=9~14 and serious: ISS=16~21) because that is the region where the trauma will change from minor to serious or vice-versa having strong influence on AACN triage performance. Therefore, it is better to study the injuries and its changes in that region. A total of 3699 injuries for occupants with an ISS in the neighborhood of this threshold value of injury classification were considered. It is, observed that a number of serious (on AIS98 scale) are considered as less serious (on AIS08 scale) and minor injuries (on AIS98 scale) are considered as more minor (on AIS08 scale). There is a 5% increment in minor injuries (68%→73%) and 5% decrement (32%→27%) in serious injuries in the AIS08 version of raw/unweighted data for this particular selected dataset. However, it may vary as the dataset changes. These changes in number of injuries around ISS=15 line will definitely have an influence on injury severity prediction in AACN algorithm.

Fig 11. Change in the neighborhood AACN triage decision threshold ISS=15 line due to reclassification of severity

3.4 Development of Injury Severity Prediction algorithms

In order to identify the effect of AIS scale change on injury severity prediction, two logistic regression equations were developed using base and proposed variables in both the versions of AIS codes. All the logistic regression calculations in this study were performed using XLSTAT\textsuperscript{(13)} software. Please refer to Appendix A (A1 to A4) for base and proposed logistic regression equations in two versions. There are n=4211 cases considered to develop logistic regression. AIS98 version has 3844 minor and 367 serious cases. AIS08 version has 3890 minor and 321 serious cases.

Table 2. Comparison of base and proposed models

| Models/Characteristics | Base equation. | Proposed equation. |
|------------------------|----------------|--------------------|
| AIS98 | AIS08 | AIS98 | AIS08 |
| False Cases | 455 | 404 | 421 | 396 |
| AUC | 0.871 | 0.876 | 0.884 | 0.888 |
| Sensitivity | 59% | 56.07% | 62.40% | 58% |
| Specificity | 92% | 93.24% | 92.64% | 93% |
| % Correct (Accuracy) | 89% | 90.41% | 90% | 91% |

The major characteristics of the logistic regression for both the base and proposed models in the two different versions are tabulated in Table 2. They are (a) Number of False Cases (wrongly identified cases; they should be as low as possible), (b) Area under the Curve (AUC: good, if close to 1), (c) Sensitivity (ratio of serious injured cases correctly identified as serious), (d) Specificity (ratio of minor injury cases correctly identified as minor) and (e) the percentage of accuracy (correctness of full model).

3.4.1 Base model results

A comparison of the base model results of AIS98 version with those of AIS08 leads to the following major observations:

- Number of false cases decreased from 455 to 404
- Area under the curve (AUC) increased from 0.871 to 0.876
- Accuracy of model increased from 89% to 90.41%

3.4.2 Proposed model results

Similarly, a comparison of the base model results of AIS98 version with those of AIS08 leads to the following major observations:

- Number of false cases decreased from 421 to 396
- Area under the curve (AUC) increased from 0.884 to 0.888
- Accuracy of model increased from 90% to 91%

3.4.3 Comparison of base and proposed model results

When base and proposed model results are compared, the following observation are found:

- Number of false cases decreased from 455 to 421 (AIS98 scale) and 404 to 396 (AIS08 scale)
- Area under the curve (AUC) increased from 0.871 to 0.884 (AIS98 scale) and 0.876 to 0.888 (AIS08 scale)
- Accuracy of model increased from 89% to 90% (AIS98 scale) and 90.41% to 91% (AIS08 scale)

From the above observations, it is clear that the proposed model performs better in both the of AIS codes than the base model. AIS08 based algorithm has improved performance over AIS98 based algorithm when judged by total number of false cases.

3.4.4 Verification with NASS CDS CY 2013 data

A set of 758 cases were selected from NASS CDS CY 2013 data to validate the accuracy of two models. Table 3 summarizes the comparison of false cases for the base and the proposed equations in the two AIS codes. Results show that the number of false cases decreased with the proposed modified ISP prediction equation when compared to that of the base equation in both version of codes. The number of false cases reduced from 98 to 88 with AIS98 scale and 84 to 76 with AIS08 scale.

Table 3. Comparison of false cases when predicting NASS CDS CY 2013 data using base and proposed equation.

| NASS CDS CY 2013 data, n=758 | With Base Eqn. | With Proposed Eqn. |
|-------------------------------|----------------|------------------|
| AIS98                          | 98             | 88               |
| AIS08                          | 84             | 76               |
4. Discussion

The Abbreviated Injury Scale 1998 version was modified in 2005 and a minor update incorporated in 2008. In the AIS 2008 version, a few new codes were added and a few existing codes have been reclassified from more severe to less severe category. This may be due to considerable changes in technology over the decade. One of the main reasons is that the recovery rates of injured occupants increased due to the recent R&D activities in medical treatments, e.g., patient after-care and general surgical procedures. In addition to that, the quality of response in emergency medical services has improved tremendously in recent times because of better communication (through satellite, navigation/mobile information sharing) and good infrastructure development (use of helicopters).

Until now, injury researchers have used Abbreviated Injury Scale 1998 version to find out the injury severity of injured occupant. AIS 2008 version is not of much use in evaluating the injury severity of injured occupant, due to considerable changes in technology over the decade. One of the reasons is that the quality of response in emergency medical services has improved tremendously in recent times because of better communication (through satellite, navigation/mobile information sharing) and good infrastructure development (use of helicopters).

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4.2 Number of AIS code changes in each crash mode

There are n=4211 cases considered to develop logistic regression in this dataset. In which, AIS98 version has 3844 minor, 367 serious cases and AIS08 version has 3890 minor, 321 serious cases. Overall, 92 codes are changing from AIS98 to AIS08.

Table 5 summarizes the number of AIS codes changes for each crash mode within minor and serious scenarios.

| n=4211 cases | Number of cases in codes | Change in (AIS08-AIS98) |
|-------------|---------------------------|-------------------------|
| For Minor cases (ISS<15) | AIS98 | AIS08 | Number | %-age |
| Frontal | 2735 | 2768 | 33 | +1.20 |
| Lateral-left | 399 | 407 | 8 | +2.00 |
| Rear | 348 | 351 | 3 | +0.80 |
| Lateral-right | 362 | 364 | 2 | +0.50 |
| Grand Total | 3844 | 3890 | 46 | +1.20 |
| For Serious cases (ISS>15) | AIS98 | AIS08 | Number | %-age |
| Frontal | 239 | 206 | -33 | -13.80 |
| Lateral-left | 68 | 60 | -8 | -11.70 |
| Rear | 13 | 10 | -3 | -23.07 |
| Lateral-right | 47 | 45 | -2 | -4.26 |
| Grand Total | 367 | 321 | -46 | -12.53 |

Table 5 summarizes the number of AIS codes changes for each crash mode (frontal, lateral-left, rear, lateral-right side) within minor (ISS<15) and serious (ISS>15) scenario. It is observed that when comparing AIS98 with AIS08 the number of cases increased for ISS<15 scenario and reduced for ISS>15 scenario. However, the change in percentage of cases is more (12.53%) in ISS>15 scenario. This is the reason why the specificity (the ratio of minor injury cases correctly identified as minor) increases and sensitivity (the ratio of serious injury cases correctly identified as serious) decreases in the respective models as given in Table 2. Another observation is that the number of cases with change of codes is less when the direction of impact is right (opposite side of the driver) in both the scenarios. In the current dataset, 77% of vehicle crashes are driver alone involved cases (one occupant present). Therefore, when the impact direction is right side, the chances of getting driver
injury is less when compared to other directions. This may be because of the lower number of injuries in head and thorax regions in right side impact or far side impact. Since the majority of codes are affected only in the head and thorax regions, the percentage of change in injury cases is less when the direction of impact is right.

5. Summary and Conclusion

In this paper, a detailed analysis was carried out to study the effect of AIS code changes on AACN injury prediction. Two versions of AIS (98 and 08) coding were used to develop Injury Severity Prediction (ISP) algorithms based on NASS-CDS (US) 2009-2012 database. The CY2013 database was used for validation. A summary of the present study is as follows:

- There are many changes regarding the severity of AIS injuries when one compares the AIS98 version with that of AIS08. Some severe injuries in AIS98 scale are coded as less severe in the AIS08 scale, especially in the head and thorax regions; but in other body regions, there are no significant changes.

- The number of injuries around the threshold ISS=15 line vary due to reclassification of severe injuries (on AIS98 scale) as minor injuries (on AIS08 scale). This will definitely influence the triage decision based on AACN ISP algorithm.

- The proposed ISP model performs well when compared with the base model in both the versions of AIS codes (98 and 08).

- Results based on the AIS08 code perform better than that of AIS98 code. However, it is better to have injury severity equations in both versions of AIS code to use accordingly depending on existing Emergency Medical Unit (EMU) operational practice, which may vary depending on location. It will also be helpful to make a gradual shift from existing AIS98 system to the newer one based on AIS08.

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### Appendix A

#### Table A1. Base model logistic regression eqn. based on AIS98

| Base Model, n=4211 (ISS98 used as response variable) | Value | Pr. > Chi² | Odds ratio (95% Conf. Int) |
|------------------------------------------------------|-------|------------|---------------------------|
| Intercept                                            | 11.792| -          | -                         |
| Ln Delta-V                                           | 3.000 | < 0.0001   | 20.09 (14.86, 27.14)      |
| Rear                                                 | 0.000 | reference  | -                         |
| Left                                                 | 1.765 | < 0.0001   | 5.843 (2.97, 11.49)       |
| Front                                                | 0.612 | 0.053      | 1.845 (0.99, 3.43)        |
| Right                                                | 1.358 | < 0.0001   | 3.890 (1.93, 7.82)        |
| If occupants unbelted                                | 0.000 | reference  | -                         |
| All occupant belted                                  | -1.180| < 0.0001   | 0.307 (0.23, 0.40)        |
| Car                                                  | 0.000 | reference  | -                         |
| Pickup                                               | -0.213| 0.394      | 0.808 (0.49, 1.32)        |
| Utility                                              | -0.436| 0.013      | 0.646 (0.45, 0.91)        |
| Van                                                  | -0.028| 0.932      | 0.972 (0.51, 1.85)        |
| Single event                                         | 0.000 | reference  | -                         |
| Multiple Events                                      | 0.575 | < 0.0001   | 1.776 (1.37, 2.29)        |
| Age<55                                               | 0.000 | reference  | -                         |
| Occupant Age>=55                                     | 0.966 | < 0.0001   | 2.627 (1.99, 3.46)        |
| No female present                                    | 0.000 | reference  | -                         |
| If any female Present                                | 0.078 | 0.552      | 1.081 (0.83, 1.4)         |

Statistically significant if p<=0.05

#### Table A2. Base model logistic regression eqn. based on AIS08

| Base Model, n=4211 (ISS08 used as response variable) | Value | Pr. > Chi² | Odds ratio (95% Conf. Int) |
|------------------------------------------------------|-------|------------|---------------------------|
| Intercept                                            | -12.326| -          | -                         |
| Ln Delta-V                                           | 3.069 | < 0.0001   | 21.51 (15.64, 29.64)      |
| Rear                                                 | 0.000 | reference  | -                         |
| Left                                                 | 1.882 | < 0.0001   | 6.56 (3.01, 13.90)        |
| Front                                                | 0.714 | 0.0441     | 2.04 (1.019, 4.09)        |
| Right                                                | 1.606 | < 0.0001   | 4.98 (2.31, 10.74)        |
| If occupants unbelted                                | 0.000 | reference  | -                         |
| All occupant belted                                  | -1.161| < 0.0001   | 0.313 (0.23, 0.41)        |
| Car                                                  | 0.000 | reference  | -                         |
| Pickup                                               | -0.267| 0.320      | 0.766 (0.45, 1.29)        |
| Utility                                              | -0.483| 0.010      | 0.616 (0.425, 0.89)       |
| Van                                                  | -0.46 | 0.236      | 0.631 (0.294, 1.352)      |
| Single event                                         | 0.000 | reference  | -                         |
| Multiple Events                                      | 0.581 | < 0.0001   | 1.776 (1.37, 2.29)        |
| Age<55                                               | 0.000 | reference  | -                         |
| Occupant Age>=55                                     | 0.968 | < 0.0001   | 2.635 (1.96, 3.53)        |
| No female present                                    | 0.000 | reference  | -                         |
| If any female Present                                | 0.098 | 0.480      | 1.104 (0.83, 1.45)        |
### Table A3. Proposed model logistic regression eqn. based on AIS98

| Proposed Model, no=4211, (ISS98 used as response variable) | Value | Pr. > Chi² | Odds ratio (95% Conf. Int) |
|-------------------------------------------------------------|-------|------------|---------------------------|
| Intercept                                                  | -12.380 | -          | -                         |
| LN Delta-V                                                 | 3.041  | < 0.0001   | 20.92 (15.2, 28.6)         |
| Model Year (MY)                                            | -0.108 | < 0.0001   | 0.898 (0.85, 0.93)         |
| Age Modified                                               | 1.055  | < 0.0001   | 2.872 (2.20, 3.73)         |
| Rear                                                       | 0.000  | reference  |                           |
| Left                                                       | 1.277  | 0.004      | 3.587 (1.50, 8.54)         |
| Front-left                                                 | 0.472  | 0.303      | 1.603 (0.65, 3.93)         |
| Front                                                      | 0.003  | 0.994      | 1.003 (0.44, 2.26)         |
| Front-right                                                | 0.496  | 0.258      | 1.643 (0.69, 3.88)         |
| right                                                      | 1.475  | 0.000      | 4.372 (1.97, 9.67)         |
| Any one of the occupants unbelted                          | 0.000  | reference  |                           |
| All occupants belted                                       | -1.721 | 0.000      | 0.179 (0.07, 0.44)         |
| Car                                                        | 0.000  | reference  |                           |
| Pickup                                                     | -0.298 | 0.250      | 0.743 (0.44, 1.23)         |
| Utility                                                    | -0.449 | 0.012      | 0.638 (0.44, 0.90)         |
| Van                                                        | -0.176 | 0.603      | 0.839 (0.43, 1.62)         |
| Single Event                                               | 0.000  | reference  |                           |
| Multi-impact 2 Events                                      | 0.206  | 0.257      | 1.228 (0.86, 1.75)         |
| Multi-impact 3+                                            | 0.531  | 0.005      | 1.700 (1.17, 2.45)         |
| No female Present                                          | 0.000  | reference  |                           |
| If any female Present                                      | 0.116  | 0.393      | 1.122 (0.86, 1.46)         |
| Time of accident (6-24hr)                                 | 0.000  | reference  |                           |
| Time of accident (0-6hr)                                  | 0.530  | 0.003      | 1.698 (1.2, 2.4)           |
| None of them Present nearside                              | 0.000  | reference  |                           |
| If anyone Present nearside                                 | 1.107  | 0.001      | 3.026 (1.54, 5.94)         |
| In case of Multi-impact, if anyone unbelted                | 0.000  | reference  |                           |
| In case of Multi-impact, all occ. belted                   | 0.593  | 0.033      | 1.809 (1.05, 3.11)         |
| Presence of Nearside occupant unbelted                     | 0.000  | reference  |                           |
| Presence of Nearside occupant belted                       | -1.039 | 0.019      | 2.827 (1.18, 6.75)         |

### Table A4. Proposed model logistic regression eqn. based on AIS08

| Proposed Model, no=4211, (ISS08 used as response variable) | Value | Pr. > Chi² | Odds ratio (95% Conf. Int) |
|-------------------------------------------------------------|-------|------------|---------------------------|
| Intercept                                                  | -11.869 | -          | -                         |
| LN Delta-V                                                 | 3.127  | < 0.0001   | 22.80 (16.3, 31.8)         |
| Model Year (MY)                                            | -0.113 | < 0.0001   | 0.898 (0.85, 0.93)         |
| Age Modified                                               | 1.051  | < 0.0001   | 2.861 (2.16, 3.78)         |
| Rear                                                       | 0.000  | reference  |                           |
| Left                                                       | 1.648  | 0.007      | 5.20 (2.00, 13.51)         |
| Front-left                                                 | 0.877  | 0.081      | 2.40 (0.89, 6.45)          |
| Front                                                      | 0.370  | 0.421      | 1.44 (0.58, 3.56)          |
| Front-right                                                | 0.833  | 0.083      | 2.30 (0.89, 5.92)          |
| right                                                      | 1.813  | < 0.0001   | 6.13 (2.55, 14.74)         |
| Any one of the occupants unbelted                          | 0.000  | reference  |                           |
| All occupants belted                                       | -1.713 | 0.0028     | 0.18 (0.07, 0.45)          |
| Car                                                        | 0.000  | reference  |                           |
| Pickup                                                     | -0.366 | 0.187      | 0.693 (0.40, 1.195)        |
| Utility                                                    | -0.496 | 0.0098     | 0.608 (0.41, 0.88)         |
| Van                                                        | -0.631 | 0.111      | 0.53 (0.24, 1.15)          |
| Single Event                                               | 0.000  | reference  |                           |
| Multi-impact 2 Events                                      | 0.201  | 0.294      | 1.22 (0.83, 1.78)          |
| Multi-impact 3+                                            | 0.451  | 0.0243     | 1.57 (1.06, 2.32)          |
| No female Present                                          | 0.000  | reference  |                           |
| If any female Present                                      | 0.144  | 0.312      | 1.155 (0.87, 1.53)         |
| Time of accident (6-24hr)                                 | 0.000  | reference  |                           |
| Time of accident (0-6hr)                                  | 0.445  | 0.017      | 1.561 (1.08, 2.25)         |
| None of them Present nearside                              | 0.000  | reference  |                           |
| If anyone Present nearside                                 | 0.861  | 0.016      | 2.36 (1.17, 4.76)          |
| In case of Multi-impact, if anyone unbelted                | 0.000  | reference  |                           |
| In case of Multi-impact, all occ. belted                   | 0.721  | 0.014      | 2.05 (1.15, 3.67)          |
| Presence of Nearside occupant unbelted                     | 0.000  | reference  |                           |
| Presence of Nearside occupant belted                       | -1.140 | 0.012      | 0.319 (0.13, 0.77)         |

Statistically significant if Pr<0.05.