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Analyzing Major Elements of Crash Injury Severity Involving Priority-I Detriments of Vision-Zero Plan

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ABSTRACT

Road traffic crashes result in significant economic losses for individuals, their families, and entire nations. These losses stem from the expenses associated with injury treatment, as well as the productivity lost due to fatalities or disabilities caused by these injuries. The 2030 Agenda for Sustainable Development set an ambitious target of halving the global number of fatalities and injuries from road traffic crashes by 2020 and achieving zero deaths by 2030, commonly referred to as the 'Target Zero Plan.' The Target Zero Plan prioritizes traffic safety issues into three distinct levels. The three priority levels are determined based on the percentage of statewide traffic fatalities and serious injuries associated with each factor. This research primarily focuses on analyzing the first priority level that gives emphasis on young drivers, crashes at intersections, driving under the influence of alcohol, and over-speeding behaviors. Iowa Department of Transportation (IDOT) crash data from 2016 to 2020 was analyzed. Initially, we separated variables of interest from the raw crash data that were pertinent to Priority 1 of the Target Zero Plan. Afterwards, descriptive statistics were performed to identify any trends in crashes (2016-2020) involving young drivers, over speeding, DUI, and intersections. A Multinomial logit model was estimated to find the significant factors associated with higher levels of crash severity. The results obtained from model estimation highlighted that "Y" and "L" type of intersections, driving under the influence, over speeding trends, airbag deployment, road surface condition and distracted driving were significantly impacting crash injury severity. Recommendations are presented that may assist stakeholders in meeting the plan "Target Zero".

Analyzing Major Elements of Crash Injury Severity Involving Priority-I Detriments of Vision-Zero Plan

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1 INTRODUCTION

Traffic crashes impose economic challenges on society due to the resulting injuries, fatalities, vehicle damage, and property loss. In recent years, the World Health Organization (WHO) has been actively raising awareness about the pressing global issue of highway safety, as it leads to approximately 1.25 million fatalities worldwide each year. These crashes have a profound effect on the development of healthcare sectors, hindering growth in public health and causing a significant impact on economic productivity, amounting to nearly 3% of the GDP (WHO 2015). The fatality rate due to crashes has shown a consistent trend since 2007, as projections suggest that road traffic crashes are expected to become the seventh leading cause of death by 2030. In 2005, the combined medical expenses resulting from fatal and non-fatal road crashes surpassed $99 billion. In response to these significant costs, the Centers for Disease Control and Prevention (CDC) has prioritized the reduction of traffic crashes, designating injuries caused by such crashes as a high-priority "winnable battle" (CDC 2014).

Vision Zero is an approach to improving traffic and transportation safety that was first made official by the Swedish Transport Administration in 1997. While Vision Zero is a relatively new concept in the United States, certain jurisdictions have adopted and implemented it to enhance their safety standards, leading to improvements such as reduced fatalities and injuries, decreased events of alcohol-use, and numerous other traffic safety benefits. The 2030 Agenda for Sustainable Development established an ambitious goal of halving the worldwide count of road traffic deaths and injuries by 2020, ultimately aiming for zero deaths by 2030, commonly referred to as the 'Target Zero Plan.' The Target Zero Plan categorizes traffic safety issues into three distinct levels, with prioritization based on the proportion of statewide traffic fatalities and serious injuries associated with each factor. The first-priority level places emphasis on addressing young drivers, crashes at intersections, drunk driving, and over-speeding behaviours as critical areas for intervention (Wismans et al. 2017; STA 2021).

In 2019, the United States witnessed a tragic toll on its teenage population, with nearly 2,500 individuals aged 13–19 losing their lives, and around 285,000 requiring emergency room treatment due to motor vehicle crashes. Shockingly, this meant that approximately seven teenagers aged 13–19 lost their lives in car crashes every day, and hundreds more suffered injuries. Also, it was found that fatal and nonfatal motor vehicle crash injuries among teens aged 13–19 resulted in a staggering $11.8 billion in 2018 in medical and work loss costs. Among all age groups, teenagers aged 16–19 faced the highest risk of being involved in vehicular crashes. Also, teen drivers in this age bracket were nearly three times more likely to be involved in a fatal crash per mile driven compared to drivers aged 20 or older. The risk was especially elevated for males, teens driving with other teen passengers, and newly licensed teens, as they faced a significantly higher likelihood of being involved in car crashes (CDC 2019).

Distraction poses a detrimental impact on the driving performance of all drivers, but it presents an even greater danger for young and inexperienced drivers. Statistics from the 2019 National Youth Risk Behaviour Survey revealed that 39.0% of high school students in the United States admitted to texting or e-mailing while driving at least once in the 30 days leading up to the survey. For young drivers, several other significant contributing factors to crashes include nighttime and weekend driving, failure to use seatbelts, speeding, and alcohol use (CDC 2019). Furthermore, driving under the influence of alcohol is dangerous; however, it continues to occur across the United States. Tragically, every day, twenty-eight people lose their lives in drunk-driving crashes, which equates to one death every 52 minutes. Although the number of these fatalities in 2019 was the lowest percentage since 1982, when the NHTSA began reporting alcohol data, there were still 10,142 lives lost. Each of these fatalities could have been prevented (NHTSA 2020).

The Federal Highway Administration (FHWA) reports approximately 2.5 million intersection crashes annually, with the majority resulting from left turns. Signalized intersections, which are hazardous locations, contribute significantly to traffic crashes. Understanding the correlation between crash occurrences and risk factors is crucial for developing cost-effective safety measures. Intersections account for 40% of all crashes in the United States, ranking second after rear-end collisions. Moreover, they are responsible for 50% of serious collisions and 20% of fatal collisions

(FHWA 2019). Furthermore, over speeding is a leading cause of fatal crashes in 34 states across the U.S. and is prevalent in all states. Speeding has consistently ranked among the top five factors in fatal crashes, accounting for 22% of all fatal crashes in the country. Daily, around 125,000 people receive speeding tickets, leading to millions of citations each year (NHTSA 2018).

This study aimed to analyse the key crash-contributing factors listed as priority-I detriments in the Target Zero Plan (Wismans et al. 2017; Evenson et al. 2018; Farooq 2023). These factors include young drivers, crashes at intersections, driving under the influence of alcohol, and speeding behaviours. For this work, we have focused on analyzing Iowa crash data as Iowa is one of the leading proponents of the Vision Zero approach and participates in the "Zero Fatalities" program, along with Utah and Nevada (Evenson et al. 2018). The study utilized publicly accessible crash data from the Iowa Department of Transportation (IOWA DOT) spanning five years (2016-2020). The analysis involved a comprehensive examination of the data to identify variables related to the first priority of the Target Zero Plan, which includes aspects such as young drivers, over speeding, DUI, and crashes at intersections. Descriptive statistics are applied to understand crash patterns associated with these factors over the specified period. Additionally, we have utilized a multinomial injury severity model to indicate significant factors influencing the level of injury severity among road users in Iowa. This research aims to gain valuable insights, contributing to the understanding of road safety strategies and their impact on reducing crash fatalities and injuries.

2 LITERATURE REVIEW

Extensive research worldwide has focused on the safety aspects of alcohol-use, prevalence of speeding, drivers' age, and other relevant characteristics. These topics remain critical points of discussion in various countries, despite differences in driving cultures and rules. This section examines common driver errors and characteristics, assessing their impact on injury and fatality severity. The primary variables under consideration include alcohol use, speeding, and young drivers, along with other associated factors.

Several past studies have employed different statistical models to assess the severity of crash injuries. Among the commonly used models are the multinomial model, ordered probit model, ordered logit model, mixed logit model, nested logit model, and their respective variations (Hosseinzadeh & Kluger 2021; Khorashadi et al. 2005; Abdel-Aty 2003; Farooq & Khattak 2023; Farooq et al. 2021; Khattak & Farooq 2023; Khattak et al. 2023). These models have been utilized to predict the injury severity of crashes and estimate the effects of different factors influencing the intensity of injury severities. A few researchers argue that categorical models, such as the multinomial logit model, might offer advantages over ordered logit and ordered probit models. This contention arises because the ordered models tend to restrict the effect of variables across outcomes (Hosseinzadeh & Kluger 2021; Khorashadi et al. 2005; Abdel-Aty 2003; Khattak et al. 2002; Khattak et al. 2003). Table 1 presents a compilation of pivotal past studies that have analyzed crash injury severity, providing comprehensive descriptions of the data utilized, methods employed, and the results obtained from each study.

Table 1. Relevant Studies in the Past on Crash Injury Severity

No.	Authors	Year	Study	Data	Method	Results
1	Zichu et al.	2021	Investigating the uniqueness of crash injury severity in freeway tunnels	Crash data on Tunnels from Guizhou, China	Two-level binary logistic approach	Major significant factors were speed limit, tunnel length, truck involvement, rear end crashes and foggy weather.
2	Li et al.	2021	A spatiotemporal analysis of motorcyclist injury severity	20 years crash data (N=50,823) from Pennsylvania	Integrated spatiotemporal analytical approach and Use of Non-stationarity tests to examine the significance of variations in spatially and temporally local correlations	Factors, such as helmet, engine size, vehicle age, pillion passenger, at-fault striking, and speeding, hold significant non-stationary relationships with motorcyclist injury severity.

3	Myhrmann et al.	2021	Factors influencing the injury severity of single-bicycle crashes	2010-2015 Combined crash and maintenance data	Latent class ordered probit model	Road geometry, maintenance level and relationship between both are major factors of crash injury severity of single-bicycle crashes.
4	Li et al.	2021	A Motorcyclist-Injury Severity Analysis: A Comparison of Single-, Two-, and Multi-Vehicle Crashes	Crash data used was obtained through a comprehensive Motorcycle Crash Causation Study (MCCS) by the Federal Highway Administration	Latent class ordered probit model	In most types of crashes, the motorcycle's pre-speed is found to be a major factor associated with serious and critical injuries.
5	Molan & Ksaibati	2021	Factors impacting injury severity of crashes involving traffic barrier end treatments	Crash Data and field inventory study in Wyoming to collect the type, system height (from the ground to the top), lateral offset (from the edge of the pavement), and side-slope of over 11,000 end treatments.	Use of Critical Analysis Reporting Environment (CARE) software and estimating severity model (random-parameters ordered logit model)	The end anchorage type A-FLEAT 350 was the least likely to cause serious injuries in crashes and turned-down end terminals. The end anchorage WY-BET, on the other hand, was involved in crashes with higher injury severity.
6	Adanu et al.	2021	Injury-severity analysis of lane change crashes involving commercial motor vehicles on interstate highways	2009-2016 Crash data from Alabama	Mixed (random parameters) logit model	High likelihood of severe injuries when lane change crashes occurred on dark unlit portions of interstates and involved older drivers, at-fault commercial vehicle drivers, and female drivers.
7	Al-Bdairi et al.	2021	Injury Severity Analysis of Drivers of Large Trucks at Unsignilized Intersections	Crash data for large trucks at un-signalized intersections (2007-2013)	Mixed logit model	Wet roadway surfaces, left turning movements, and drivers who were sober at the time of the crash were randomly associated with crash injury severity.
8	Pervez et al.	2021	Identifying Factors Contributing to the Motorcycle	Data collected through the road traffic injuries surveillance	Random parameter logit model	Summer season, weekends, nighttime, elderly riders, heavy

	Crash Severity in Pakistan	system from Karachi city (2014–2015)		vehicle, and single-vehicle collisions were positively associated with fatalities, while the presence of pillion passengers and motorcycle-to-motorcycle crashes were negatively associated with fatalities.

3 DATA AND METHODOLOGY

To gain deeper insights into crash dynamics, descriptive statistics were performed using the crash data from the past five years (2016-2020). The analysis revealed that the highest number of crash fatalities was recorded in 2016; however, the lowest number of recorded fatalities occurred in 2018 (Table 2). Notably, a fatality is considered "crash-related" if it happens within 30 days of the crash, according to the National Highway Traffic Safety Administration (NHTSA 2019).

Table 2. Annual Recorded Fatalities (2016-2020)

Year	Fatalities
2016	402
2017	331
2018	318
2019	336
2020	338

Based on the five-year crash data, it is evident that the months of April, May, and June had the highest number of recorded fatalities in comparison to the winter months (December-February). This pattern could be attributed to the increased traffic on the roads during the summer, as people tend to be more active and venture out more frequently during this season. Data analysis revealed a total of 413,297 crashes, with the highest percentage (64.83%) being property damage only crashes. Since our primary focus was on crash injuries and fatalities, the property damage only crashes were excluded from the model calculation; dataset was furthers reduced as a result, leaving 145,350 crashes for analysis.

Table 3. Monthly Recorded Fatalities (2016-2020)

Month	2016	2017	2018	2019	2020
January	28	20	25	21	24
February	19	20	25	20	17
March	25	23	12	22	14
April	33	26	28	22	17
May	39	23	23	30	21
June	40	30	29	35	22
July	38	33	32	32	44
August	38	36	31	31	52
September	31	45	25	39	41
October	39	34	24	21	25
November	35	15	29	35	25
December	37	26	26	28	36
Total	402	331	318	336	338

Subsequently, the data were filtered again to encompass only crashes that were recorded at intersections or were due to driving under the influence or over speeding. This filtering process reduced the total number of crashes to 15,361, spanning a five-year period.

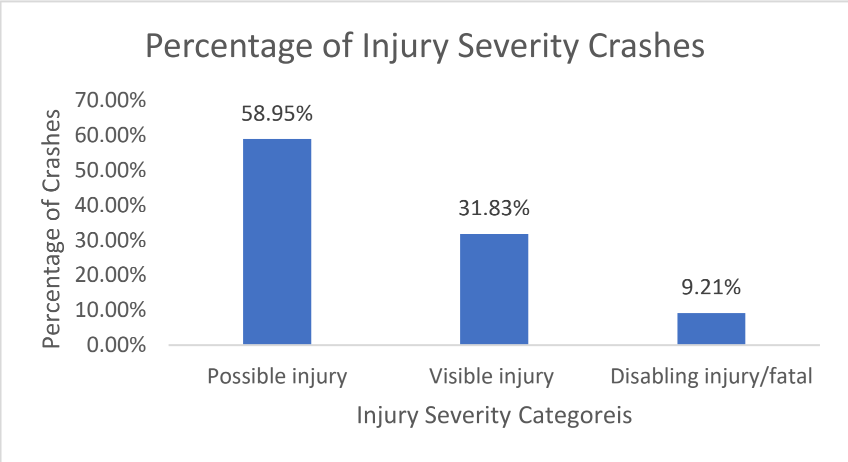

Figure 1. Percentage of Different Categories of Injury Severity

The crash dataset was further investigated to identify the most prevalent causes of crashes. As per the data statistics, the leading cause of injury crashes was determined to be "following too closely" (13.86%), followed by "lost control" (6.02%), and over speeding (5.87%). Additional causes of injury crashes are detailed in Table 4.

Table 4. Descriptive Statistics on Reported Causes of Crashes (N= 15,361)

Cause of Crashes	Percentage	Cause of Crashes	Percentage
Aggressive driving/road rage	0.319%	FTYROW: To pedestrian	0.885%
Animal	1.386%	Illegally parked/unattended	0.039%
Cargo/equipment loss or shift	0.052%	Improper backing	0.273%
Crossed centerline (undivided)	1.621%	Improper or erratic lane changing	1.100%
Crossed median (divided)	0.214%	Improper starting	0.009%
Disregarded RR Signal	0.032%	Lost control	5.995%
Downhill runaway	0.010%	Made improper turn	1.725%
Driver Distraction: Adjusting devices (radio etc.)	0.410%	Operating vehicle in a reckless, or careless manner	3.079%
Driver Distraction: Exterior distraction	0.943%	Operator inexperience	0.143%
Driver Distraction: Inattentive/lost in thought	1.158%	Other	5.058%
Driver Distraction: Manual operation of an elect.	0.345%	Other: Disregarded signs/road markings	0.052%
Driver Distraction: Other electronic device activity	0.247%	Other: Disregarded warning sign	0.013%
Driver Distraction: Other interior distraction	2.298%	Other: Getting off/out of vehicle	0.013%
Driver Distraction: Passenger	0.442%	Other: Illegal off-road driving	0.000%
Driver Distraction: Reaching for object(s)/fallen	0.533%	Other: Improper operation	0.078%
Driver Distraction: Talking on a hand-held device	0.143%	Other: No improper action	1.204%
Driver Distraction: Talking on a hands-free device	0.019%	Other: Vision obstructed	0.273%
Driver Distraction: Unrestrained animal	0.052%	Over correcting/over steering	0.045%
Driving less than the posted speed limit	0.019%	Oversized load/vehicle	0.009%
Driving too fast for conditions (Over speeding)	5.872%	Passing: On wrong side	0.039%
Drove around RR grade crossing gates	0.010%	Passing: Other passing	0.312%
Equipment failure	0.104%	Passing: Through/around barrier	0.143%
Exceeded authorized speed	1.861%	Passing: Where prohibited by signs/markings	0.097%
Failed to keep in proper lane	0.514%	Passing: With insufficient distance/inadequate vi	0.156%
Failed to yield to emergency vehicle	0.221%	Ran off road - left	3.294%
Failure to dim lights/have lights on	0.019%	Ran off road - right	5.891%
Failure to signal intentions	0.045%	Ran off road - straight	0.455%
Followed too close	13.859%	Ran stop sign	4.934%
FTYROW: At uncontrolled intersection	1.126%	Ran traffic signal	5.859%
FTYROW: From driveway	1.282%	Separation of units	0.019%
FTYROW: From parked position	0.175%	Swerving/Evasive Action	1.002%
FTYROW: From stop sign	7.336%	Towing improperly	0.019%
FTYROW: From yield sign	0.774%	Traveling on prohibited traffic way	0.019%
FTYROW: Making left turn	6.816%	Traveling wrong way or on wrong side of road	0.488%
FTYROW: Making right turn on red signal	0.175%	Unknown	5.195%
FTYROW: Other	1.093%	Vehicle stopped on railroad tracks	0.000%

In previous studies, alcohol-related crashes were excluded from the dataset utilized to perform crash-modelling due to the predominant influence of alcohol as the primary cause of crashes (Anderson et al. 2020; Al-Bdairi et al. 2021). However, in our analysis, we have intentionally included alcohol-related crashes to gain a detailed understanding of factors associated with higher injury severity beyond the influence of alcohol use in drivers. Our approach recognizes that certain crash-cases may involve a combination of factors, such as alcohol use and extreme weather conditions. Additionally, with alcohol use, varying road surface conditions or the absence of sufficient lighting might have also played a role in certain crash events (Anderson et al. 2020). By considering these additional factors, our analysis aims to provide a more informative perspective on crash dynamics and their impact on injury severity. Data statistics indicates that alcohol or drug use was not documented in 93.32% of the recorded crashes. However, in 1.18% of overall crashes, drivers declined to undergo a drug or alcohol breathalyser test. Moreover, 1.66% of crashes were reported involved drivers with influence of medications or narcotics.

Table 5. Percentage of Drug or Alcohol-related Crashes (N= 15,361)

Variable	**Percentage**
Alcohol (< Statutory)	0.490%
Alcohol (>Statutory)	3.351%
None Indicated	93.321%
Refused	1.181%
Under Influence of Drugs/Medications	1.661%

In this research, we employed Multinomial Logit (MNL) model to investigate factors potentially influencing the severity of crash injuries, particularly those associated with priority-I aspects of plan "version zero", encompassing driving under the influence of alcohol, over-speeding, young drivers, and crashes at intersections. To predict the severity of each individual crash from the given levels of severity, the severity likelihood function with the highest value for that specific severity is identified. The crash severity likelihood function is a dimensionless measure of crash likelihood, contains both a deterministic component and an error or random component (Ulfarsson & Mannering 2004; Shankar & Mannering 1996). While the deterministic part is presumed to involve variables that can be quantified, the random component represents unaccounted-for factors that influence injury severity. The deterministic part of the crash severity likelihood was specifically characterized as a linear function of driver, roadway, vehicle, environmental, and weather characteristics.

$$V_{ij} = \mathrm{ASC}_j + \sum_{k=0}^{E} \alpha_{kj} X_{ki} \quad (1)$$

where

$V_{ij} =$ systematic component of crash severity likelihood for segment i and crash severity j

$\mathrm{ASC}_j =$ alternative-specific constant for crash severity j;

$\alpha_{ij} =$ coefficient (to be estimated) for crash severity j and variable k; $k = 1, \ldots, K$; and

$X_{ki} =$ independent variable k for observation i.

The logit model was derived by assuming that the error components are extreme value (or Gumbel) distributed and the probability of a discrete event (severity of crash) is given by

$$P_{ij} = \frac{e^{V_j}}{\sum_{j=1}^{f} e^{v_i}} \quad (2)$$

where P_{ij} is the probability of the occurrence of crash severity j for segment i, and J is the total number of crash severities to be modeled. While this assumption simplifies the probability equation in the MNL model, it introduces the property of Independence from Irrelevant Alternatives (IIA). The IIA property in the MNL model constrains the ratio of probabilities for any two crash severities to be unaffected by the presence and attributes of other crash severities within the considered set. Consequently, the introduction of a new crash severity type in the set will proportionately impact all other severities.

NLOGIT (Version 5.0) was used for model estimation in this research. The categories of crash severity were: possible injury (coded as 0), visible injury (coded as 1), and disabling injury/fatality (coded as 2). Tables 6 and 7 present the description on categories of crash injury severity and coding of candidate variables. Table 8 presents the estimated models' results for predicting crash injury severities relevant to priority-I aspects of Vision Zero.

Table 6. Injury severity categories (dependent variable)

Injury Severity	**Number of Observations**	**Percentage of Observations**
Possible injury	9056	58.95%
Visible injury	4890	31.83%
Disabling injury/fatal	1415	9.211%
Total	15361	100%

Table 7. Descriptions and coding of Candidate Variables

Candidate Variables and Description	Mean	Standard Deviation
Dry indicator (1 if road surface condition is dry, 0 otherwise)	0.474	0.499
Over speeding indicator (1 if driver was over speeding, 0 otherwise)	0.002	0.049
L intersection indicator (1 if crash occurred at L intersection, 0 otherwise)	0.038	0.192
Y intersection indicator (1 if crash occurred at Y intersection, 0 otherwise)	0.012	0.111
Truck/trailer/tractor indicator (1 if truck/trailer/tractor were involved in a crash, 0 otherwise)	0.055	0.229
Motorcycle indicator (1 if motorcycle was involved in a crash, 0 otherwise)	0.003	0.059
Distracted driving indicator (1 if driver was reportedly distracted before the crash, 0 otherwise)	0.439	0.496
Alcohol indicator (1 if there was a reported DUI, 0 otherwise)	1.633	0.930
Airbag indicator (1 if airbags not deployed, 0 otherwise)	0.144	0.351
Ran off the road (1 if the vehicle ran off the road due to a crash, 0 otherwise)	0.431	0.340

To maintain the inclusion of as many intuitive variables as possible in the estimated model, we retained those with 95% statistical significance, even though the predicted model contained additional variables with a p-value less than 0.05 ($\alpha = 5\%$). The modeling outcomes presented in Table 8 indicate that dry road surface conditions significantly reduced crash injury severities when compared to wet or icy road surfaces. The estimated coefficients indicate a higher likelihood of disabling injury/fatality, followed by visible injury, for crashes attributed to over speeding. Furthermore, crashes occurring at L and Y intersections exhibited greater severity when compared to those reported at T intersections. Involvement of trucks, trailers, or tractors in crashes led to higher severity levels than passenger car crashes, whereas crashes involving motorhomes or RVs did not show statistical significance in their severity. Furthermore, motorcycle crashes were associated with an increased likelihood of visible injuries as well as disabling injury/fatality, in comparison to the base category of possible injury. On the other hand, instances of distracted driving showed a lower likelihood of disabling injury crashes but a higher likelihood of visible injury. The estimated model revealed that cases where airbags were not deployed had a higher likelihood of resulting in fatal/serious injuries as compared to visible injuries. The model estimation included numerous other significant factors related to crash occurrences, such as equipment failure, vehicle running off the road, running traffic signs, collision with animals, inexperienced operator, and losing control of the vehicle. However, their effects were not found to be statistically significant, leading to their exclusion from the final model specification. While the dataset included young drivers, a priority-I element of vision zero, none of the demographic variables related to them yielded statistically significant estimates.

Table 8 also provides a summary of model statistics. The log-likelihood and restricted log-likelihood values are presented, especially in the context of maximum likelihood estimation (MLE), to assess the goodness-of-fit of the estimated statistical model to the crash data. It is worth noting that an alternative model was also estimated, and their respective log-likelihood values were compared. The results indicated that the final model in Table 8 offered a better fit to the data, by utilizing the Likelihood Ratio (LR) test.

Table 8. Multinomial Logit Regression Results

Injury Category (Base: Possible Injury) Variables	Visible Injury Coefficient	P- value	Disabling Injury/Fatality Coefficient	P- value
Intercept	-0.87461	0.000	-2.48194	0.000
Dry as a road surface condition	-0.20968	0.0001	-	-
Reported over speeding	0.57492	0.000	1.55874	0.000
Crash occurred at L intersection	0.76480	0.000	0.58287	0.0132
Crash occurred at Y intersection	0.25278	0.0219	-	-
Truck/trailer/tractor involved in a crash	0.51299	0.000	0.90296	0.0004
Motorcycle involved in a crash	-1.51397	0.000	2.71395	0.0557
Reported distracted driving	-0.29624	0.001	-0.34758	0.0314
Reported DUI	0.88837	0.000	1.84065	0.000
Airbags not deployed	0.70730	0.000	1.03344	0.000
Vehicle Ran off the road	0.43337	0.000	0.96306	0.000
Model Summary Statistics				
Number of observations		15,361		
Log- likelihood		-12990.76791		
Restricted log-likelihood		-13756.87045		
Chi-square (20 d.f.)		1532.20509		
P-value		0.00000		
McFadden pseudo R-squared		0.0556887		

4. CONCLUSION

The Target Zero Plan categorizes traffic safety issues into three distinct levels. The three priority levels are determined by the percentage of statewide traffic fatalities and serious injuries associated with each factor. In this project we analyzed the first priority level that emphasizes crashes at intersections, alcohol-related crashes, and speeding behaviors. Data analysis was performed by using five-year crash data (2016-2020) from Iowa and a Multinomial logit model was estimated to find significant factors associated with higher levels of crash severity. The results indicated that there exists a likelihood of a higher level of crash injury severity in crashes that occur on L and Y intersection. Also, there exists a higher likelihood of severe injury and fatality for cases where air bags are not deployed, and where drivers are involved in over speeding and driving under the influence. The finding also indicated that motorcycle crashes are likely to have severe injuries or fatalities.

To deal with over speeding and DUI among drivers, the reinforcing agency is suggested to increase penalties and actively arrange public outreach programs to emphasize the need on avoiding over speeding and drunk driving. To decrease fatalities due to motorcycle crashes, it is suggested that new motorcyclists should undergo mandatory motorcycle safety courses. Also, already enforced safety protocols should be improved for Y and L intersections and it is suggested that the stakeholders at IDOT critically evaluate, strategize, plan and implement research programs to appraise hidden safety issues on intersections to continually further agency’s target zero plan in reduction of crashes, injuries and fatalities.

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