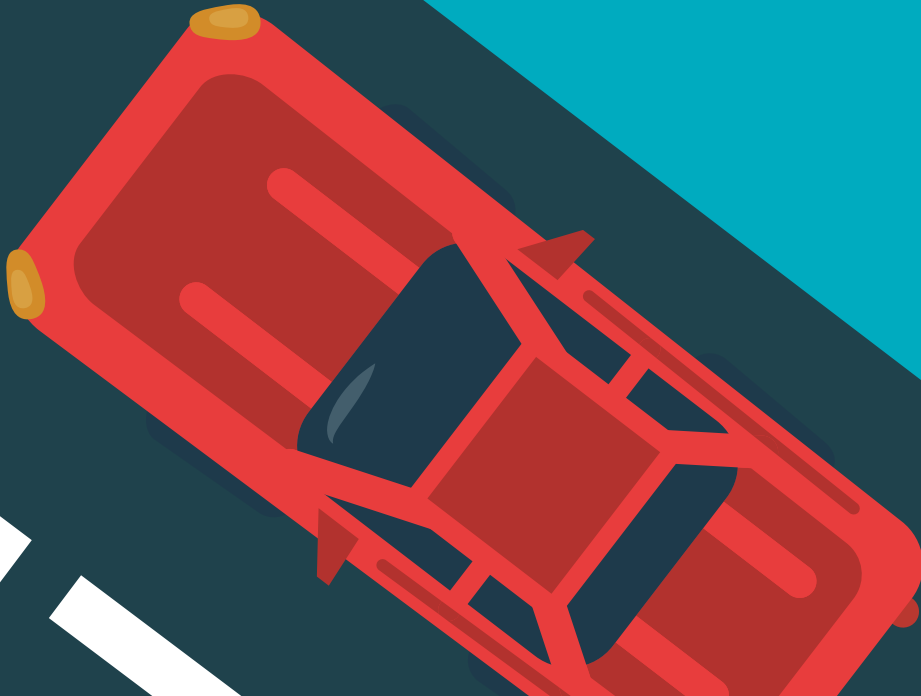


Car Crash Analysis

Strategic First
Response LLC

July 14th 2023



Response Team



Simon Hui
Technical Lead
[LinkedIn](#) / [GitHub](#)



Lillian Lakes
Presentation Lead
[LinkedIn](#) / [GitHub](#)



Sangyun Thom
GitHub Lead
[LinkedIn](#) / [GitHub](#)

Agenda

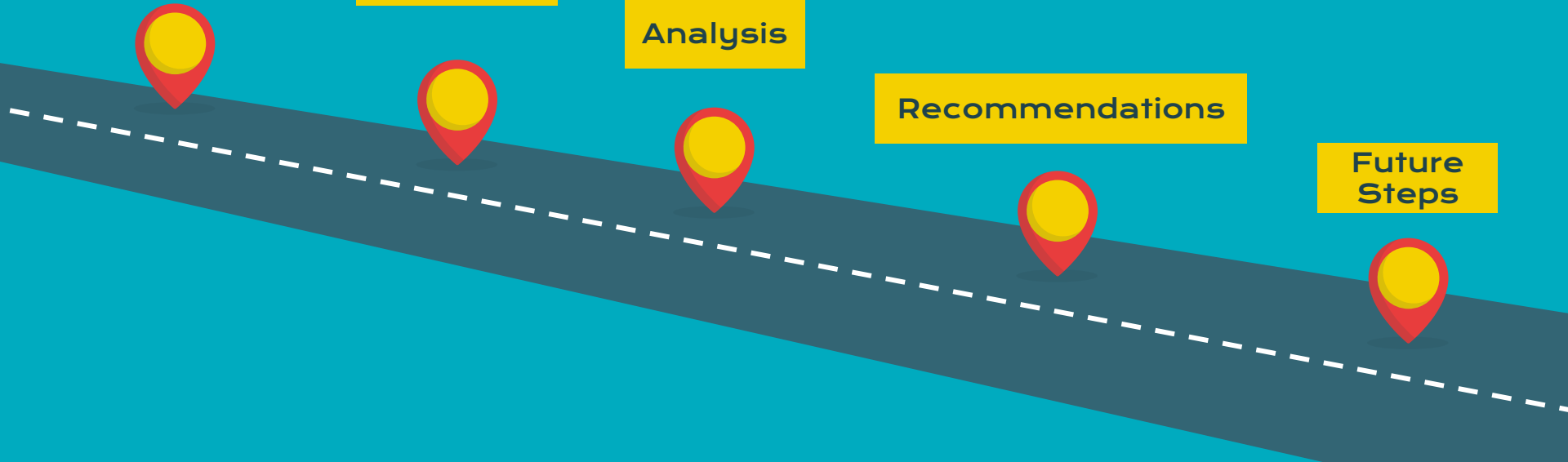
**Business
Problem**

**Data
Overview**

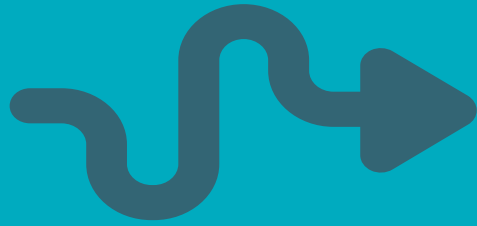
Analysis

Recommendations

**Future
Steps**

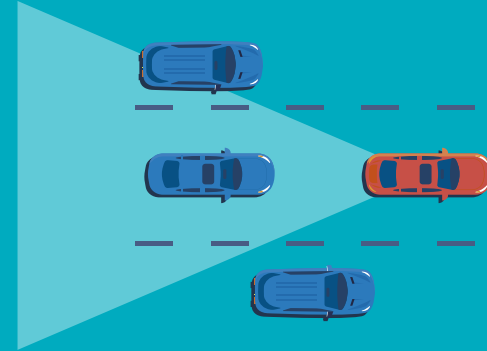


Bottom Line



Driving in rain storms in low light raises the risk of incapacitating injury by up to **23%** in car crashes.

“... **Rain** Likely Cause of 30-Car Crash in Washington State”



SOURCE: Washington State Department of Transportation

“... eight-car pile-up due to **slick roads**...”



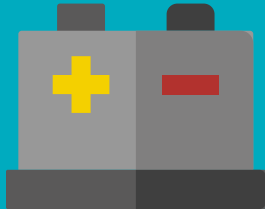
SOURCE: ABC7 Chicago

Business Problem



- 77% decrease in licensed EMTs and paramedics
- No new CFD contract agreement
- Because of this, first responders of Chicago need optimization

Data Overview



- From E-Crash CPD database
- Analyzed 35,000 Chicago car crashes
- 2015 to present day
- Crashes specifically under rainfall
- Analyzed across different lighting conditions

Data Limitations



- Reporting discrepancies
- Subjective data recording

Data Analysis



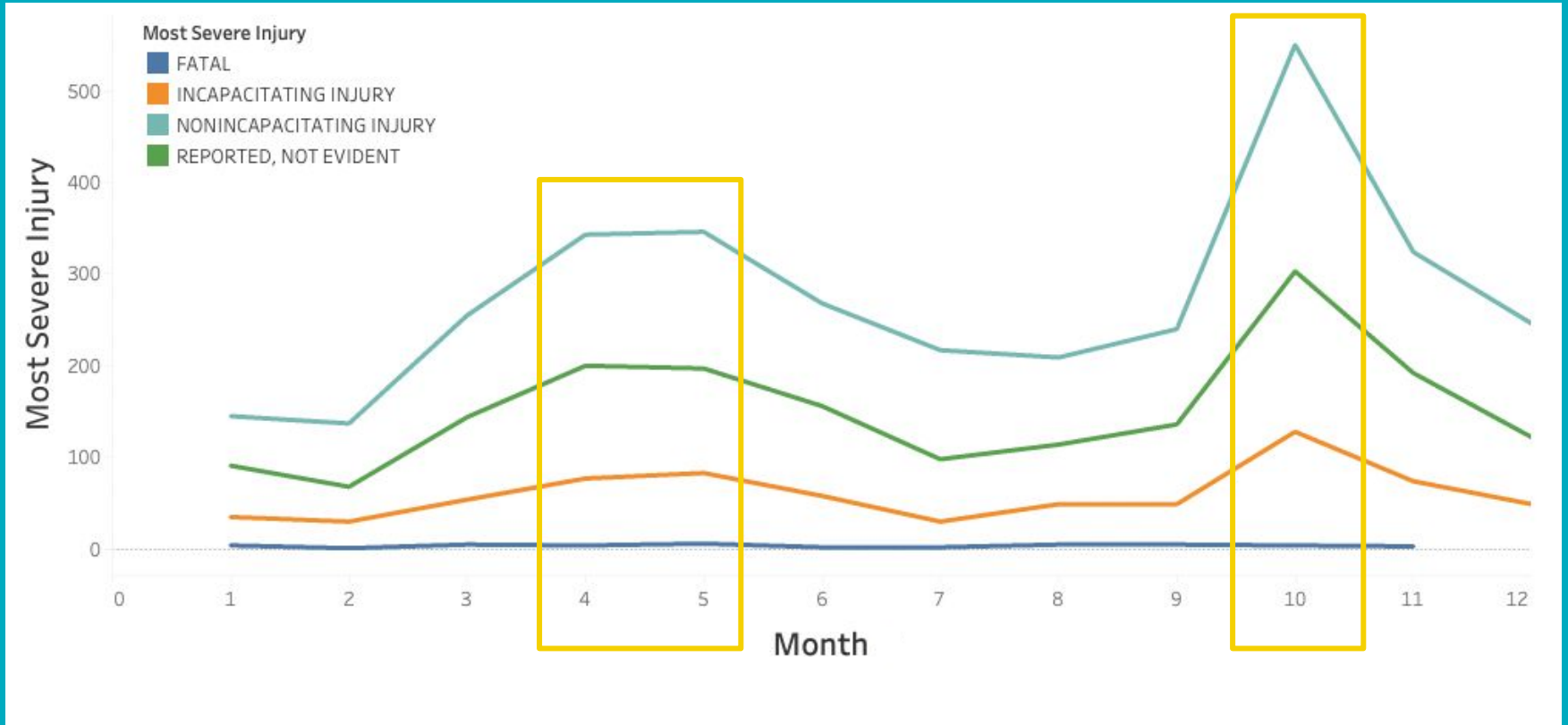
- **Exploratory Data Analysis**

- Injury Severity by Month
- Number of Car Crashes by Lighting Condition

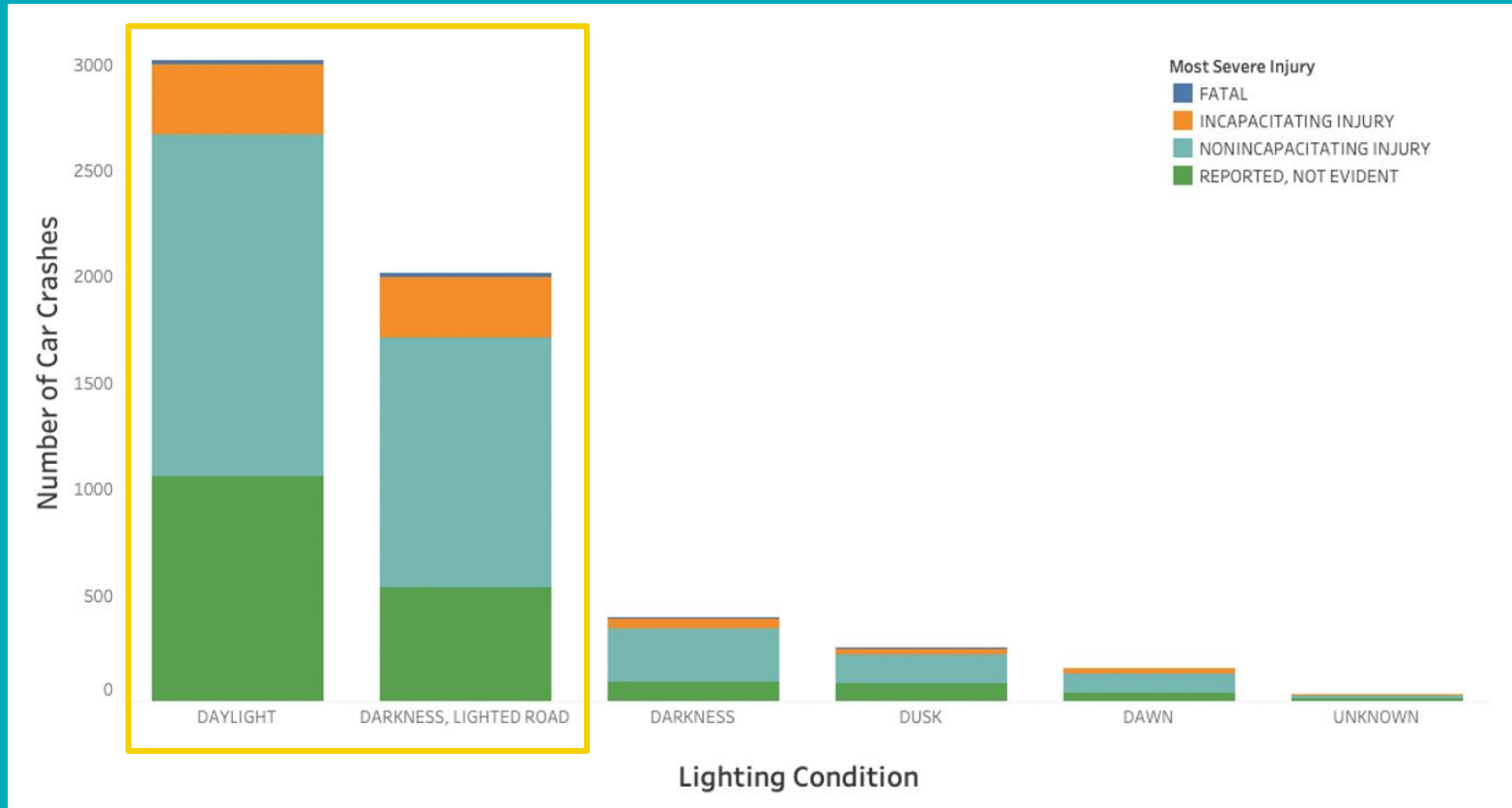
- **Binomial and Multinomial Models**

- Decision Trees
- Logistic Regressions

Number of crashes during rainfall resulting in Injuries **increases** in **April-May** and **October**



Daylight, followed by **lowly lit areas** have high number of car crash injuries during rainfall



Darkness during rainfall is a key determinant of injury -> **Explore more**

- **Binomial Decision Tree**

- Correctly predicts 33.7% of all injuries
- Most important factor: **Darkness** (no/little lighting)

Darkness and month driving during rainfall
are key determinants of **fatalities and**
incapacitating injuries -> **Explore more**

- **Multinomial Decision Tree**

- Correctly predicts 17.7% of the most severe injuries
- Most important factors: **Darkness** (no/little lighting) and **month of crash**

Darkness increases likelihood of injury most during rainfall -> **But we care more about fatalities & incapacitating injuries**

- **Binomial Logistic Regression Model**
 - Correctly predicts 34.1% of all injuries
 - 1.5 times more likely to be injured in darkness with a bit of light (maybe dim street light) during rainfall

Poor lighting condition in rain increases the odds of more severe injuries **1.4X**

- **Multinomial Logistic Regression Model**
 - Correctly predicts 10.2% of the most severe injuries
 - 1.4 times more likely to result in incapacitating injury at darkness with a bit of light (maybe dim street light)

Recommendations

&

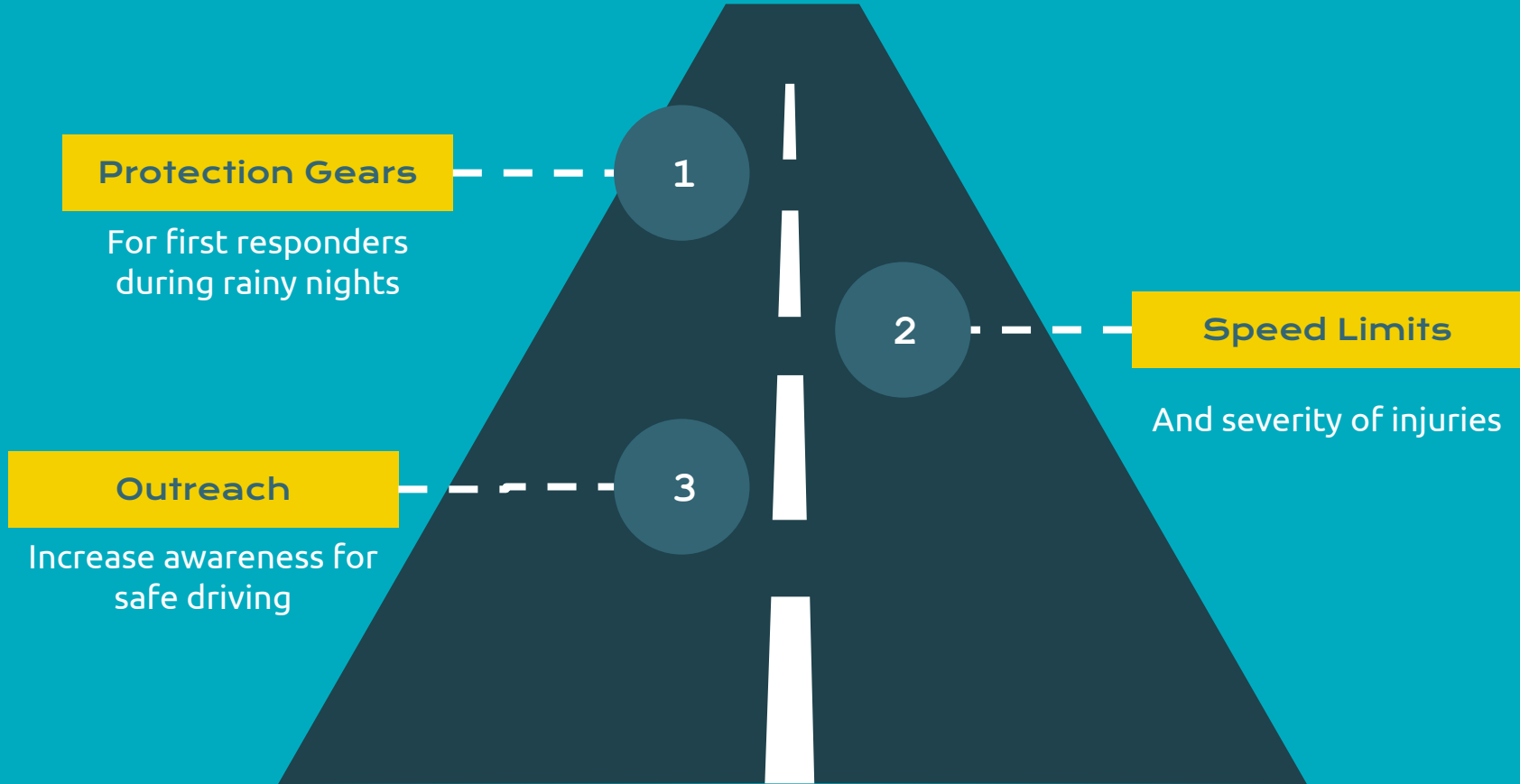
Future Directions

Recommendations



- Install **safety measures** to poorly lit area
- **Proactive weather monitoring** focusing on these areas
- Optimize **personnel** being dispatched

Future Steps and Insights



Questions?



Simon Hui
Technical Lead
[LinkedIn](#) / [GitHub](#)



Lillian Lakes
Presentation Lead
[LinkedIn](#) / [GitHub](#)



Sangyun Thom
GitHub Lead
[LinkedIn](#) / [GitHub](#)

Thanks!



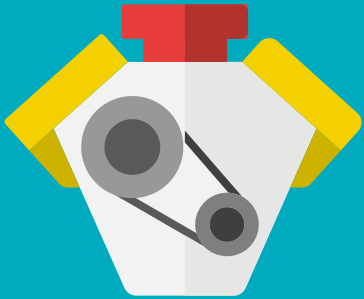
Appendix

- **Confusion Matrices & Recall Rates**

- Dummy Classifier (0%)
- Binomial Decision Tree (33.7%)
- Multinomial Decision Tree (17.7%)
- Binomial Logistic Regression Model (34.1%)
- Multinomial Logistic Regression Model (10.2%)

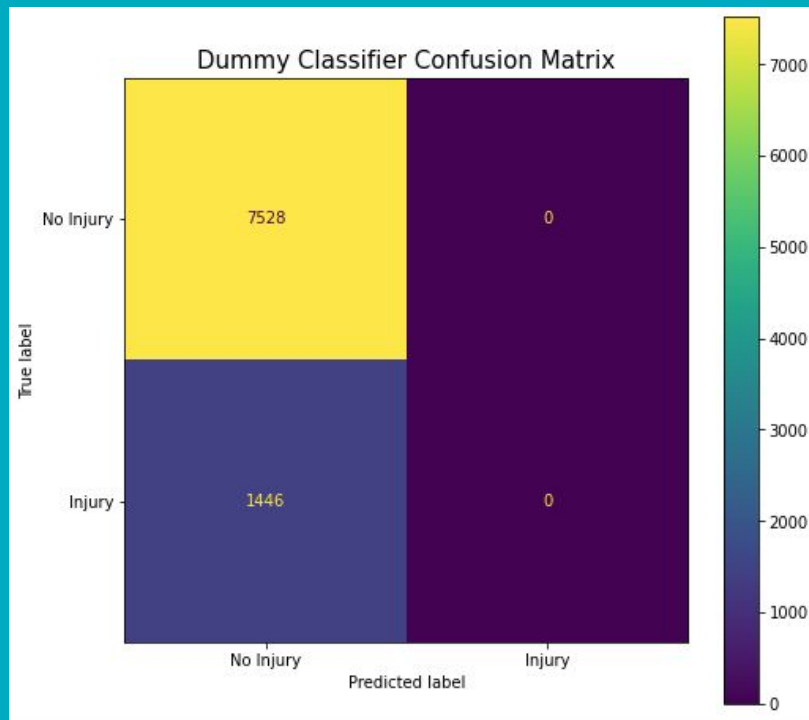
- **Decision Tree Visualizations**

- Binomial
- Multinomial



Dummy Classifier

correctly identifies 0% of injuries



Recall Rate

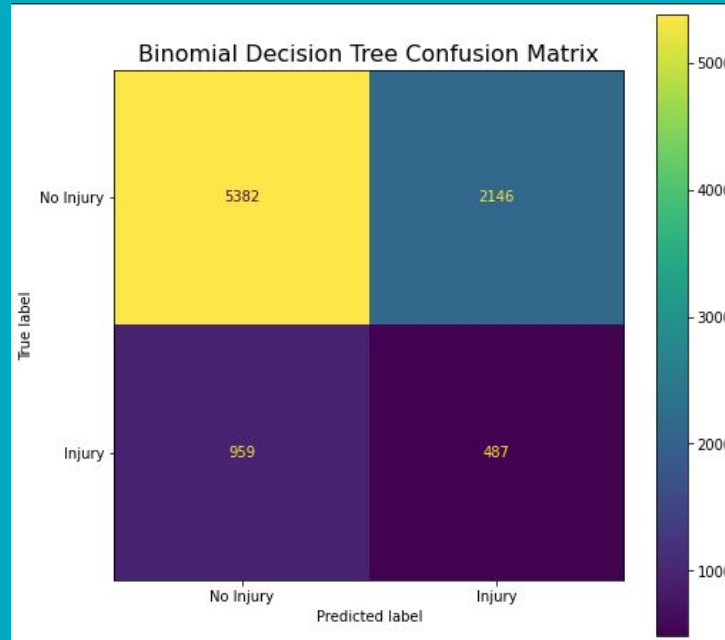
$$= TP / (TP + FN)$$

$$= 0 / 1446$$

$$= 0\%$$

Binomial Decision Tree

correctly identifies 33.7% of injuries



Recall Rate

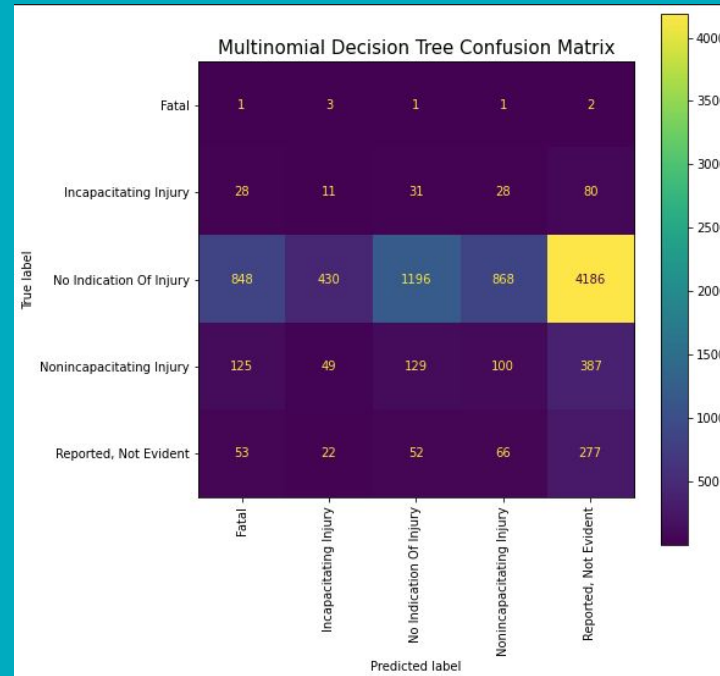
$$= TP / (TP + FN)$$

$$= 487 / 1446$$

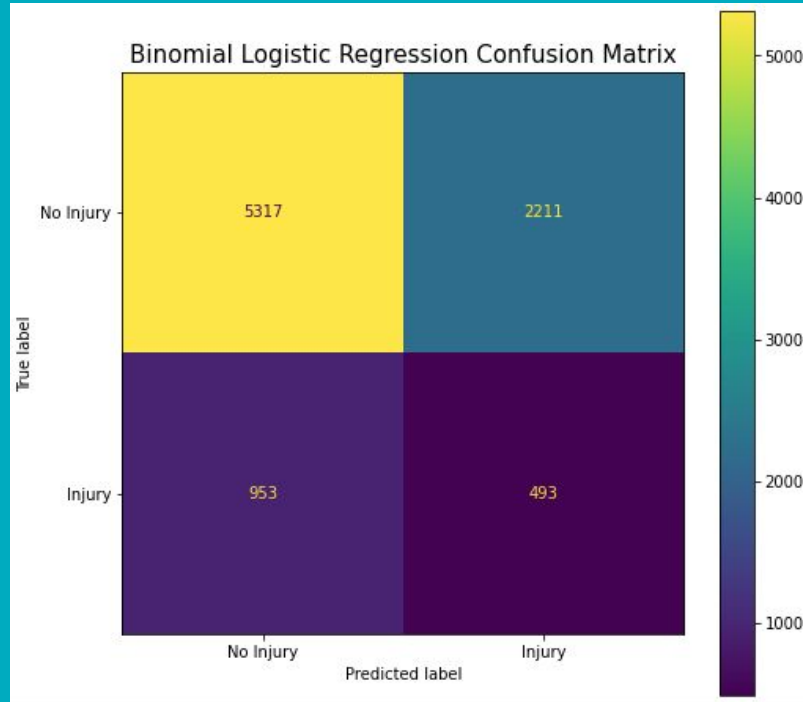
$$= 33.7\%$$

Multinomial Decision Tree

correctly identifies 17.7% of injuries



Binomial Logistic Regression Model correctly identifies 34.1% of injuries



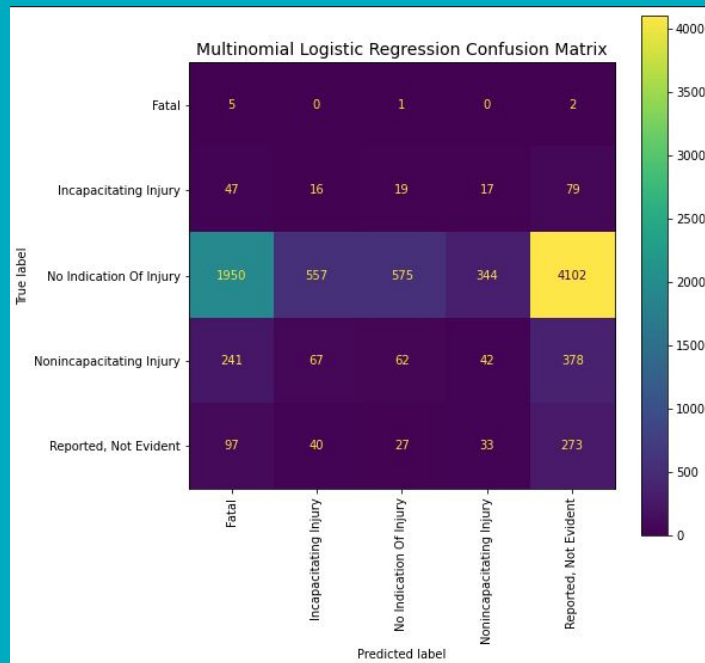
Recall Rate

$$= TP / (TP + FN)$$

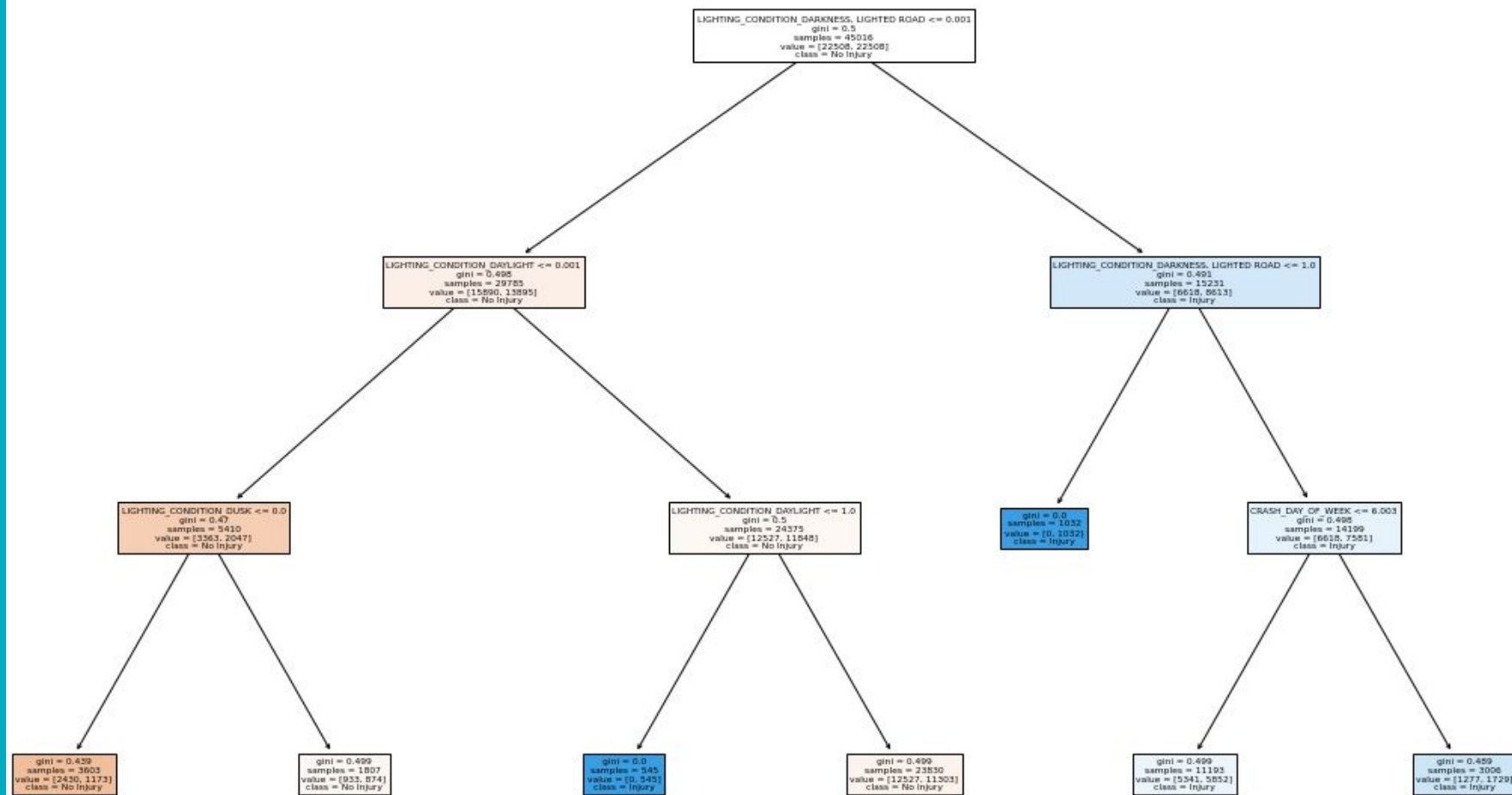
$$= 493 / 1446$$

$$= 34.1\%$$

Multinomial Logistic Regression Model correctly identifies 10.2% of injuries



Binomial Decision Tree



Multinomial Decision Tree

