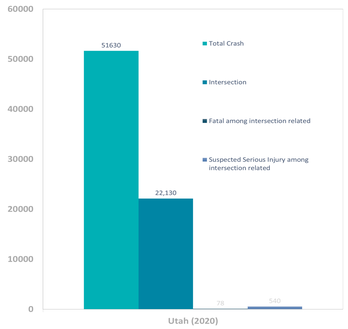
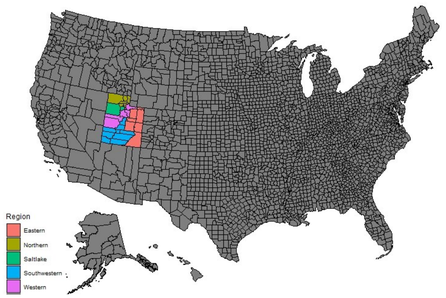
Improving Intersection Safety with Geographically-Targeted Crash Prediction Models in Utah

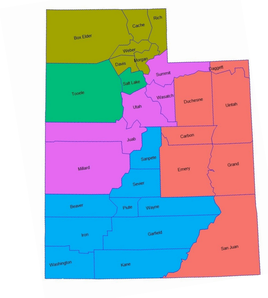
Atul Subedi (atul.subedi@usu.edu)
Patrick Singleton (patrick.singleton@usu.edu)

College of Engineering
UtahStateUniversity

Rationale & Justification







Limited research investigating active mode crashes (KABCO) at signalized intersection based for different geographical regions calls for this study.

Objectives:

⇒ Understand factors (exposure and intersection characteristics) associated with active mode crash frequency at signalized intersection.

Exposure

- *AADT along major road*
- *AADT along minor road*
- *Pedestrian volume*
- *Bicycle volume*

Intersection Level Characteristics

- *Number of legs in an intersection*
- *Presence of street light*
- *Speed limit*
- *Crossing distance*

Data

Secondary dataset which was used for developing improved safety predictive methods for pedestrian crashes at signalized intersection in Utah using push button-based measures of an exposure *(Singleton et al. 2021).*

1606 signalized intersection in Utah

Time period of 10 years from 2010 to 2019

Study Used:
401 signalized intersection of Northern Region,
844 signalized intersection of Salt lake Region
122 signalized intersection of Southwest Region
313 signalized intersection of Western Region
41 signalized intersection of Eastern Region

Methods

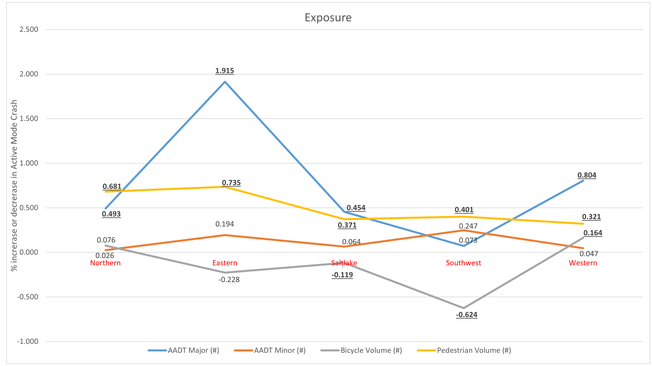
Negative Binomial Regression Model
Accounting, for under dispersion and over dispersion of DV, negative binomial regression model is more appropriate.

The probability that y_i events will occur within a given time period uses the following:

$$P(yi) = \frac{\Gamma(\frac{1}{\alpha}+yi)}{\Gamma(\frac{1}{\alpha})yi!}\left(\frac{\frac{1}{\alpha}}{(\frac{1}{\alpha})+yi}\right)^{\frac{1}{\alpha}}\left(\frac{\lambda_i}{(\frac{1}{\alpha})+yi}\right)^{y_i}$$

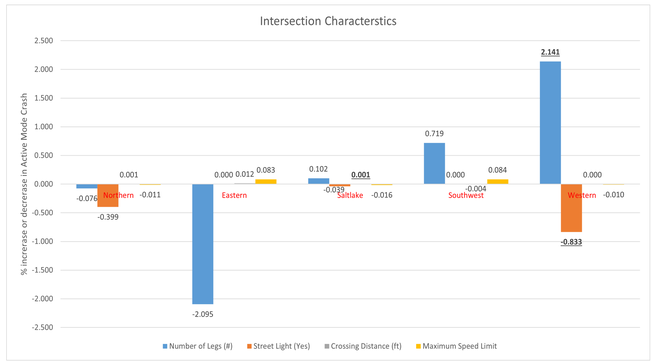
where, $y_i! = 1 * 2 * \ldots * y_i$.

Results



Model Fit statistics and crash prediction accuracy

	Northern	Eastern	Salt Lake	Southwest	Western
McFadden (R2)	0.150	0.399	0.106	0.107	0.193
RMSE	2.392	0.167	5.358	1.020	1.746



Conclusions & Recommendations

- The significant association between crossing distance and active mode crash occurrence in Salt Lake region's signalized intersections may be attributed to the higher exposure of active modes with vehicle traffic.
- The significant positive association between pedestrian volume and active mode crash counts in all geographical regions of Utah's signalized intersections suggests that there may be inadequate pedestrian crossing facilities across the state.
- Effect of AADT along major roadway of intersection on crash occurrence was significantly higher on Eastern region followed by Western, Northern and low on Salt lake region.
- Bicycle volume supported the concept of safety in numbers in Salt lake and Southwest region of Utah.
- It may be useful to conduct further investigations to understand the role of other factors that were not included in the study.
- Regression model do not necessarily imply causation therefore policy preparation should involve careful evaluation of underlying mechanism to ensure effectiveness of treatment.
- Predicted crash could be used to identify vulnerable crash location and proper crash mitigation measures could be adopted for those location to prevent potential crash occurrence.

Acknowledgement

The authors would like to express their gratitude to Patrick Singleton for his valuable feedback and for making the necessary data available for this project. The authors alone are responsible for the preparation and accuracy of the information, data, analysis, discussions, recommendations, and conclusions presented herein. The contents of this poster reflect the views of the authors, who are responsible for the facts and accuracy of the information presented.

References

UDPS. (2021). *Utah Crash Summary—Portals*. https://udps.numetric.net/utah-crash-summary#/

Singleton, P. A., Mekker, M., Islam, A., & Utah State University. Department of Civil and Environmental Engineering. (2021). *Safety in Numbers? Developing Improved Safety Predictive Methods for Pedestrian Crashes at Signalized Intersections in Utah Using Push Button-Based Measures of Exposure* (UT-21.08). https://rosap.ntl.bts.gov/view/dot/56362