Modeling Injuries in Car Accidents

MTH 5387 - Applied Regression Analysis

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Data Exploration

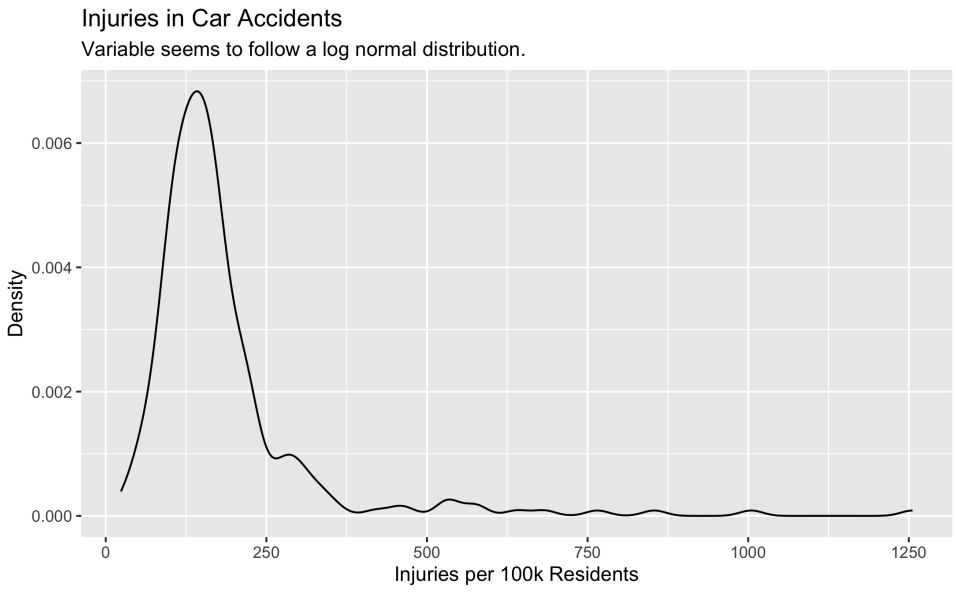
The data taken from the Colorado Department of Transportation has one row per accident, containing 295445 total observations. Heavy aggregation and preprocessing was done to prepare this data for modeling. In particular, these rows ended up being grouped by county and by season bringing the number of observations down to 256. That is 64 counties and 1 row for each season.

Variable	Data Type	Description
County	string	Name of Colorado county
Season	factor	Spring, Summer, Fall, Winter
Deaths	continuous numeric	# of deaths per 100k residents
Injuries	continuous numeric	# of injuries per 100k residents
Bad weather accidents	continuous numeric	# of accidents in poor weather per 100k residents
Median household income	continuous numeric	Median household income for county residents
Mean commuting time	continuous numeric	Mean commuting time for county residents (minutes)

Table 1: Variables Used in the Analysis

Response Variable: Injuries

To start we will look at our response variable which represents the average number of injuries per 100k residents per year.



It seems that, on average, a county in Colorado sees approximately 150 injuries in car accidents on any given season per year per 100 thousand residents. We can also see that the distribution of injuries appears log normal. We see most values hovering between 100 and 200 with a very long right tail. As we need our response variable to be normally distributed this immediately puts a log transformation into consideration. It is worth noting that a log transformation of the response variable does complicate model interpretation slightly and so should not be done without reason.

	Min	1st Quartile	Median	Mean	3rd Quartile	Max
Untransformed	0	116.09	150.63	183.73	197.19	1255.83
Transformed	3.159	4.754	5.015	5.048	5.284	7.136

Table 2: Numerical summary of Injuries, with and without log transformation

Instead of including a plot showing the transformed variable, I feel this numerical summary will suffice. The more extreme values have been pulled inline with the rest of our data which is shown by the mean not being as far from the median. The resulting density plot also does appear far more normal though is not included here. We will look at more evidence in the structural section of this report later.

Predictor Variable Candidates

Predictor	Min	1st Quartile	Median	Mean	3rd Quartile	Max
Deaths	0	2.10	4.19	10.71	9.62	179.40
Bad Weather Accidents	0	28.33	51.37	93.43	97.23	904.07
Income	34578	56303	65976	70543	85228	139010
Commute Time	11.80	17.23	20.05	21.17	23.27	42.40

Table 3: Numerical summary of predictor candidates.