

# What Factors Lead to Serious Motor-Related Accidents?

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## ABSTRACT

**Introduction:** According to the National Safety Council, approximately 46,000 people were killed in motor-related accidents in 2022. This study's goal is to identify variables that could help reduce serious motor-related accidents. We hypothesize that drunk-driving and adverse weather conditions will be the most significant factors contributing to severe accidents.

**Methods:** We analyzed data from ArcGis Hub Crash Data from the Virginia Department of Transportation, detailing over 800,000 crashes in Virginia. A random sample of 200 observations was taken from the dataset. Initially, we chose to look at 6 response variables and 15 predictor variables. Exploratory data analysis was used before conducting factor analysis and structural equation modeling (SEM). In our factor analysis, orthogonal rotation and Kaiser's criterion were used to determine the number of factors used in our SEM. The number of response variables were reduced further allowing our SEM to run. This model was employed to find significant estimates affecting motor-related fatalities and injuries.

**Results:** Response variables included fatality, injury (major or minor), and no injury. Predictor variables encompassed driving conditions such as weather, road conditions, and driver impairment. PCA identified six response and eight predictor variables. Cumulative variability and variance showed no excessive data loss. Our SEM model did not run with six response variables, so we removed two response dimensions: Number\_Injured and Minor\_Injury. The final path diagram contained 93 parameters and was over-identified with 231 data points. Our fit indices indicated the model fits the data. The largest, significant effect was a 1.449 increase in Road\_Type for every one-unit increase in Minor\_Injuries, suggesting that rough and non-straight roads lead to more accidents causing minor injuries.

**Conclusion:** Overall, the largest, significant effect was Road\_Type to Minor\_Injuries. Another large effect was Road\_Type to Major\_Injuries, however this effect was not significant ( $p\text{-value} > 0.05$ ). This study highlights the importance of addressing driving conditions, including road type and driver impairment, to reduce motor-related fatalities and injuries. Focusing especially on improving road infrastructure could contribute to a decrease in serious motor-related accidents. Further research is needed to investigate the impact of other variables and potential preventive measures in-depth.

