Teen Drivers: Spatial Pattern of Crashes

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In the United States, the risk of vehicle crashes is higher among teens than among any other age group. Accordingly, in Kansas, teen drivers ages 14 to 19 were one of the primary foci of Kansas Department of Transportation's (KDOT's) Strategic Highway Safety Plan (SHSP) to reduce the number of traffic injuries and fatalities. However, after several years of improving metrics, it appears that overall teen crashes have begun to increase in the past few years and the SHSP goals were not met.

Most previous studies investigated the effects of demographic differences and nonspatial factors associated with crashes such as gender, age, driving under the influence of drugs or alcohol, the presence of passengers, and distractions. Besides these factors, it was necessary to investigate and understand how teen-related crashes are correlated and patterned spatially. However, adopting the spatial analysis methodology to identify the hotspots for teen drivers and factors behind their crashes has been underutilized.

This research was conducted to develop a methodology to identify statistically significant spatial patterns for crashes involving teen drivers. Also, modelling was performed that identified spatial relationships between teen-related crashes and contributed factors that significantly influence the number of these crashes using ordinary linear regression (OLS) model and geographically weighted regression (GWR).
The utilized data were extracted from the KDOT crash database and other resources such as the Fatality Analysis Reporting System (FARS), the US Census Bureau, and the Kansas Department of Education. The analyzed crashes included crashes involving teen drivers aged between 14 and 19. The spatial analysis and modeling were conducted at the state level and Unified School District (USD) level using ArcGIS Pro software (Version 2.3.2).

The spatial analysis tools were used to find statistically significant hotspots and outliers for fatal and non-fatal crashes in the state level, and fatal and severe injuries at the USD level. Most of the statistically significant hotspots and outliers were centered in the most populated counties such as Johnson, Sedgwick, and Wyandotte County. From 18 candidate exploratory variables, two exploratory variables were statistically significant to build a predictive model using OLS and GWR. The two exploratory variables were the miles of non-state roads and the number of passenger cars in counties.

The predictive model showed that the number of crashes involving teen driver was expected to be lower by more than three percent by 2026. The methodology followed in this research was found to be applicable and valuable to spatially analyze teen-related crashes at the state and USD levels. The method was useful for analyzing a subset of crashes involving teen drivers; it can also be used to analyze other subgroups such as alcohol-related crashes, older driver crashes, or commercial vehicle crashes. The model represents useful guidance for the related parties' allocation of limited resource for reducing crashes, and is helpful in predicting future crashes based on historical trends.

Keywords: Geographically Weighted Regression, Modeling, OLS Regression, Ordinary Least Squares, Spatial Analysis, Teen Drivers