

Geodemographic profile of road traffic collision risk

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Background and Motivation

The Geodemographic Profile of Road Traffic Collision Risk study focuses on understanding the relationship between socio-economic factors and road traffic collisions (RTCs) in the West Midlands, UK. With a growing concern over public safety and urban traffic congestion, this research uses spatial analysis, hierarchical clustering, and regression modelling to identify high-risk areas and demographic groups most vulnerable to RTCs. The motivation behind this study is to provide data-driven insights that inform targeted interventions, such as infrastructure improvements and community safety campaigns, particularly in socio-economically deprived regions, ultimately contributing to road safety policies.

Data and Methods

The data for this research on the Geodemographic Profile of Road Traffic Collision Risk was sourced from the West Midlands Fire Service and STATS19, covering RTC incidents between 2018 and 2022. This data was combined with socio-economic variables from the 2021 Census and the Index of Multiple Deprivation (IMD) 2019. Spatial analysis, hotspot detection, and hierarchical clustering were employed to explore spatial patterns, while a negative binomial regression model was used to identify socio-economic factors influencing RTC risks. Key variables included accident severity, road type, speed limit, and deprivation indices, with R and GIS tools used for data cleaning, mapping, and statistical modelling.

Key Findings

The study reveals a strong link between socio-economic deprivation and road traffic collisions (RTCs) in the West Midlands. High-risk zones are mainly in deprived urban centers with dense traffic. Unemployment is a key predictor of RTC risk, while retired individuals are less likely to be involved. A hierarchical analysis grouped LSOAs by incident frequency, severity, and socio-economic factors, identifying four clusters for

targeted interventions. Road type and environmental factors, like speed limits, also affect RTC severity, with single carriageways seeing more incidents. These findings highlight the need for interventions in deprived areas, improved road design, and stricter traffic enforcement.

Value of the research

This research provides a comprehensive analysis of the geodemographic factors influencing road traffic collisions (RTCs) in the West Midlands. By integrating spatial analysis, clustering, and regression modeling, the study identifies high-risk areas and vulnerable populations, particularly in socio-economically deprived regions. The findings reveal that unemployment and deprivation are significant predictors of RTC risk, while retired individuals are less likely to be involved. It also highlights the influence of road types and environmental factors, with single carriageways showing higher incident rates. These insights offer valuable guidance for policymakers, supporting targeted interventions that address both socio-economic disparities and infrastructure improvements. This research provides critical evidence for more localized road safety policies, with the goal of reducing collisions and saving lives.

Figure 1: Hierarchical Clustering of Road Traffic Incidents by LSOA

