

## SOLUTION

### Road Traffic Accident (RTA) Data Analysis Using R Studio and Shiny App

Road traffic accidents are a major public health concern worldwide. Utilizing **data analysis tools and interactive visualization** can provide valuable insights into understanding the factors contributing to accidents, severity patterns, and high-risk groups. This information can inform awareness campaigns, preventive measures, and evidence-based policymaking.

#### Data Collection and Cleaning

The first step in the analysis was to obtain relevant and reliable data. For this project, an RTA dataset containing information such as:

- Area of accident (Urban/Rural/Market/Residential)
- Severity (Minor, Severe, Fatal)
- Vehicle type
- Driver gender and age
- Helmet use
- Driving experience
- Day of the week and time of accident

The dataset was then cleaned to ensure accuracy and consistency:

- Checked for **missing values** and inconsistencies.
- Converted categorical variables (e.g., Area, Severity, Gender) into **factors**.
- Standardized column names to remove spaces or special characters.
- Ensured **no duplicate records** existed.

Cleaning the dataset ensured **reliable analysis** and correct visualization outcomes.

#### Descriptive Data Analysis through R Studio

After cleaning, exploratory data analysis (EDA) was performed to uncover patterns, trends, and relationships between accident severity and contributing factors.

Using **R Studio**:

- Calculated **counts, percentages, and standard errors** for accident severity by Area, Vehicle Type, Helmet Use, and Day of the Week.
- Grouped data to highlight **high-risk categories**.
- Generated **static graphs** (stacked bar charts, grouped bar charts, and line charts) to visualize trends.

#### Examples of Graphs:

- Severity by Area (stacked bar chart)
- Severe Injuries by Day (line plot)
- Vehicle Type vs Severity (grouped bar chart)

- Helmet Use vs Severe Injury by Area (facet chart)

These visualizations provided clear insights into risk patterns and contributing factors.

### Shiny App for Interactive Visualization

Following descriptive analysis, a Shiny App was developed to allow interactive exploration of the dataset:

- **Dynamic filtering:** Users can select **Area, Gender, or Helmet Use** to focus on specific groups.
- **Variable selection:** Users can choose **X-axis and Y-axis variables** to examine relationships.
- **Interactive plots:** Hover tooltips display **exact percentages and counts**.
- **Multi-factor analysis:** Facilitates exploration of **high-risk combinations** (e.g., rural male motorcyclists without helmets).

### Example visualizations in Shiny App:

- Stacked and grouped bar charts for severity by Area, Vehicle Type, and Helmet Use
- Line plots showing trends of severe injuries by day
- Dynamic plots allowing combination of multiple factors

The Shiny App helps stakeholders **explore the data intuitively**, identify high-risk groups, and make **evidence-based decisions**.

### Interpretation and Insights through Shiny App

With the Shiny App, users can interact with visualizations to gain **actionable insights**:

- Rural and market areas show **higher proportions of severe and fatal accidents**.
- **Motorcycles and heavy vehicles** are frequently associated with severe injuries.
- **Helmet use significantly reduces severe injuries**, especially in rural areas.
- Certain days (e.g., weekends) exhibit **higher accident rates**, indicating behavioral or traffic-related risk factors.

These insights enable **stakeholders** such as government authorities, public health services, NGOs, and drivers to **implement targeted interventions**, optimize resource allocation, and design effective awareness campaigns.

### Iterative Analysis and Improvement

Analysis of RTA data is ongoing. When new data becomes available, the process can be repeated and refined:

- Add new variables such as road conditions, weather, or time of day.
- Update the Shiny App for **enhanced filtering and interactivity**.
- Integrate **stakeholder feedback** to make the application more usable and actionable.

Continuous analysis ensures data-driven decision making and improves the effectiveness of interventions.

## **Conclusion**

Using **R Studio and Shiny App** for RTA data analysis provides a **comprehensive pathway** to understand, prevent, and manage road traffic accidents. By collecting, cleaning, analyzing, and visualizing data, stakeholders can:

- Identify **high-risk areas, times, and groups**
- Understand **vehicle- and behavior-related risk factors**
- Implement **targeted safety interventions**
- Make **evidence-based policy decisions**

The integration of **interactive visualizations** with descriptive statistics makes the RTA Shiny App a **powerful tool for road safety awareness, prevention, and planning**.