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# A scientometric analysis and bibliometric review of driver injury severity crash studies

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ABSTRACT

One of the worst epidemics that endangers our life and has an impact on the future is the epidemic of road accidents. The goal of this study is to define traffic accidents, comprehend their causes, pinpoint the key elements that affect the seriousness of driver injuries, and ultimately identify the factors that contribute to accidents, such as excessive speed, alcohol, and drug use, the driver, the road, the vehicle, and environmental factors. Understanding prior research and studies are crucial. In earlier experiments, data visualization was accomplished using the VOS viewer. The Dimension, Web of Science, and Scopus websites were used to download the information for the keywords in Excel format. By country, it lists these terms, authors, and researchers. The researcher was able to conduct a study that was identical to his or her study with the aid of the keywords "driver injury severity," "driver crash," and "crash analysis."



## 1. Introduction

The state and its inhabitants have recently focused their attention on several pressing issues, including traffic crashes. These crashes result in significant loss of life and property, and the resulting economic and social issues have a direct impact on stability and national security. The level of injury severity is discrete and is typically coded using the KABCO injury scale (e.g., K = fatal, A = incapacitating, B = non-incapacitating, C = possible injury, and O = property damage only). This is another complicated issue that develops as a result of the involvement of numerous parties, including the driver, passengers, or both, as well as the technical factors like the road and the vehicles of any kind, the weather, day and night, etc. Each of these parties, which are affected by natural causes, has a part to play in the collision that results in the traffic accident. The aviation sector is now threatened by a global public health issue related to road safety. Globally, 1.35 million fatalities and more than 50 million injuries are anticipated. Regardless of the GDP's growth and rate of mechanization, road traffic accidents (RTA) account for, on average, about 3 of the global total, according to statistics from the World Health Organization (WHO, 2004) and the World Bank.

External factors are linked to extremely high conversion factors. One of the most important causes of the rise in road accident injuries worldwide is the increase in cars. The connection between the number of cars and the number of fatal traffic accidents was originally explained by Smmed (1949). The number of studies is interesting since they have revealed a correlation between the frequency of traffic accidents and injuries, the growth in the number of cars, and the ensuing growth in the number of vehicles and road infrastructure. Without a modern transportation network, Iraq has recently seen a significant increase in the number of vehicles, and this growth has been accompanied by an increase in the number of recorded accidents as well as the high number of fatalities and injuries from accidents in Iraq. Iraq experiences a high incidence of traffic accidents, as do other societies, along with the resulting human and financial loss.

## 2. literature review

Past research has focused on the assessment and modeling of the relationship(s) between total, fatal, and injuries in crashes and the main

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causes of traffic crashes, and the variables that most significantly affect the severity of driver injuries have been discussed in several earlier studies. Numerous studies have examined the consequences of numerous elements, such as traffic offenses, as well as the effects of components like the driver, the road, the vehicle, and the surroundings. Some of these studies (Halim and Abdel- Atty, 2010, Lee and Abdel- Atty, 2005, Moore et al.2011,) concentrate on particular ctakeson types, such as junctions and rollover incidents. 12% to 15% of all road departure accidents and almost 22% of all fatal accidents occurred in Louisiana between 2010 and 2016, according to a study conducted in the United States of America that looked for traffic accidents that resulted in fatalities and significant losses. (Das et al, 2021) . At the unnamed crossings it supervises, research was done to look for collisions. In this investigation, three different logarithmic models were applied: random parameters, random parameters with average heterogeneity, and random parameters with average heterogeneity. In South Australia, crash data was gathered for the years 2015–2018. The results of this study showed that, in collision occurrences, such a the driver's gender, collision time, and rear intervention, there is temporal stability and that it is unstable (Das & Obaid, 2021).Oth er findings showed that the severity of accident injuries, which was divided into serious injury, moderate injury, no injury, and fatal injury, for high-speed head-on collisions involving vehicles entering from the lane, older drivers, and driver disabilities (Sajidur Rahman et al.,2021 ). Others have looked into how drug and alcohol addiction, such as drunk driving, affects the severity of collisions ( Plurad et al . ,2010; Smink et al ).

Numerous studies have looked at the impact of various variables (engineering, traffic, etc.) on the frequency of accidents (i.e., the anticipated number of accidents in a given segment) over a specified period (Poch and Mannering, 1996; Abdel-Aty & Radwan, salvation; Tarko, 2005; Anastasopoulos and et al. 2008). Recently, significant efforts have been undertaken to explore traffic safety by including observed and recorded weather and traffic conditions. The most recent research in this area tries to assess the current safety of major roadways using current data ( Ahmed et al . 2011, Yu et al . 2013, Yu and Abdel – Aty 2013 ). This is accomplished by locating collision precursors, like traffic density, the variance in traffic volume, the speed difference between lanes, etc., to foresee the significant effect of a collision.

### 2.1 The primary elements influencing the seriousness of driver injury accidents

Road traffic injuries cause huge economic losses to individuals, their families, and entire countries. These losses result from the cost of treatment as well as the lost productivity of people who die or are incapacitated by their injuries.

The majority of motorists are well aware of the fundamental guidelines and precautions to take when driving. Accidents, however, can only result from road users' inaction. Human mistake is the primary factor in accidents some habits that people have that cause accidents are emerging. Applying the safe system approach that takes human error into account could be beneficial. The safe system approach to road safety aims to ensure that the transport network is safe for all road users. This approach considers the vulnerability of people to serious road traffic injuries and recognizes that the network should be designed with human error in mind. The cornerstones of this approach are safe roads, pavements, speed limits, vehicles, and road users, all of which must be addressed to end fatal accidents and reduce serious injuries. There have been numerous previous studies on the effects of excessive speed, the effect of traffic contraventions on road injury severity, traffic violations, high-speed driving in certain situations, and the effects of alcohol on under-driving which is one of the main offenses that greatly affect the severity of the collision. Significant findings about the effect of traffic violations on crash injury severity are revealed by (Alrejjala et al.,2021). The severity of a driver's injury is influenced by many factors, including:

#### 2.1.1 Speeding

Driving at a high speed significantly contributes to the high rate of car accidents and the increased danger to other drivers and passengers. Every 1 km/h increase in average vehicle speed results in a 4% increase in the risk of a fatal accident and a 3% increase in the risk of a serious accident. The risk of accidents increases when the driver is male and young and under the influence of alcohol. Road accidents remain the number one cause of death among young people between the ages of fifteen and twenty- nine . Improper driving accidents result in more deaths than other types of accidents and can involve more vehicles and lead to road closures . this study used a previous descriptive study of statistical models to identify factors influencing accident injury severity using the R studio program .The results showed that , for high – speed head- on collisions , accidents involving vehicles entering from the lane, older drivers and driver disabilities , the severity of accidents injuries was divided into serious injury , moderate injury , no injury and fatal injury ( Rahman et at .,2021 ). Studies like (Das et al, 2019), (Rahman & Hossain, 2021), (Ehsani & Zhu, 2020), and have considered the fundamental variables that influence the seriousness of a driver's accident injury ( Harbecd & Glendon, 2013).

#### 2.1.2 Driving while drunk

Driving while intoxicated or under the influence of sedatives is one of the major causes of accidents. This is due to the negative effects that high blood alcohol levels can have on drivers. The detrimental effects on the central nervous system increase as a person's blood alcohol levels rise. Alcohol is directly absorbed via the stomach and small intestine walls. After that, it enters the bloodstream and builds up there before being digested by the liver. The amount of alcohol in a specific volume of blood is used to calculate a person's blood alcohol content. This is referred to as BAC, or blood alcohol concentration. At a blood alcohol concentration (BAC) of.08 grams per deciliter (g/dL), the collision risk increases dramatically. All 50 states, the District of Columbia, and Puerto Rico forbid driving with a BAC of.08 or higher due to the risk involved, with the exception of Utah, where the limit is.05. ( National Highway Traffic Safety Administration (NHTSA). According to a study conducted by (Kim et al,.1995), they recreated the driving experience with a sample of 25 drivers who had taken varying levels of alcohol. Driving under the influence of alcohol impacts cognition, reflexes, vehicle control, and driver awareness, which is the driving process. The study built a structural model connecting the characteristics and behaviors of various drivers using data analytic techniques. Driver drug and alcohol usage, together with not wearing a seat belt, greatly increased the severity of collisions and injuries severity found that driver drug and alcohol use and not using seat belts significantly increased the odds of a more serious accident than an injure. In North America, research was done that looked at accidents involving alcohol. This study's objective was to evaluate the dangers of drunk driving-related accidents. The participants were patients who had been hospitalized following a fatal drunk driving accident. The outcomes were 2088 injured patients, including 312 from accidents involving alcohol. The frequency of drunk driving-related accidents (Manzoor, 2019). Data from traffic breakdowns from 2011 to 2019 were used in a study in Taiwan to assess the impact of drunk driving on fatal injuries. The results of this study showed that drinking and driving is riskier than the death rate among users of thelic roads, and that drinking and driving is more likely to cause an accident with a high risk of fatal injuries. Other contributing elements included a collision at night and a big truck strike

(Hui-An Lin et al., 2022). It included research on alcohol-impaired driving, a significant contributor to traffic accidents. Data were g hered electronically in 32 countries worldwide and 21 European nations. Differences between countries, historical developments, and deciding criteria for driving This study employed descriptive statistics, and the outcomes came from the European Union. 13% of drivers admitted to driving while intoxicated within the previous 30 days. These percentages for driving while intoxicated were similar in the participating African and North American nations (11%, 14%, and 17%) (Goldenbeld et al., 2020).

#### 2.1.3 Neglecting safety and security systems

The use of seat belts and child safety seats in vehicles is one of the most crucial safety precautions. Wearing a seat belt while driving is one of the basics and things that cannot be dispensed with, due to its great role in protecting the driver and preserving life in the event of a collision while driving. Given the unpredictability of everything that will happen while driving, even with a professional and careful driver, the possibility of an accident is always expected, so all drivers must follow the safety guidelines properly for their great role in saving lives and avoiding serious injuries. Some believe that the presence of an effective airbag system prevents accidents and does not require wearing a seat belt. However, this is a misconception that the seat belt must be fastened tightly because failure to do so may cause great harm to the driver in the event of a collision. Seat belts, lower the risk of mortality by 45% to 50% in the front seats, and child safety seats reduce the risk of death by 60%. With a 4% rise over 2019, 51% of the 23,824 passengers murdered in passenger vehicles in 2020 were not wearing seat belts.In 2017 alone, seat belts are projected to have saved 14,955 lives and may have saved an additional 2,549 if they had been buckled up ( National Highway Traffic Safety Administration (NHTSA). A study was done that looked at variables related to the seriousness of driver injuries in motor vehicle collisions. Separate test models were calculated in the study for injuries brought on by collisions with drivers that led to minor, major, or fatal injuries. The results of this study point to the presence and involvement of at-risk road users as more significant factors related to injury severity than passenger behavior. Wearing a seat belt is one of the contributing factors while drinking and drug use are the most prevalent behavioral factors. while tiredness, reckless driving, and not wearing a seat belt are the main contributors to crashes ( Harold B . Weiss et al, 2013).An investigation of the connection between the wearing of seat belts and serious injuries was done as part of a study on road safety. Data were gathered from 2005 to 2018, and I-Squared or Tau-Squared statistics were used to determine the degree of heterogeneity. The findings indicated that the likelihood of any occurrence When the study was based on crash types, the use of the belt greatly decreased the risk of any injury and the use of the seat belt significantly reduced the risks of facial injuries, abdominal injuries, and spinal injuries among crowded passengers compared to unrestrained passengers (Abubakari et al., 2018).

#### 2.1.4 Driver distraction is one of the additional elements that influence how serious accidents involving drivers are.

Distraction and inattentiveness while driving are signs of driver inattentiveness. Many types of distractions can cause impaired driving. The distraction caused by the use of mobile phones is a growing concern for road safety. Drivers who use mobile phones are almost four times more likely to crash than drivers who don't use them. Using a mobile phone while driving slows reflexes (particularly the reaction to applying the brakes, but also the reaction to complying with traffic lights), and makes it difficult for the driver to keep the vehicle in the correct lane and to maintain the correct distances between vehicles. Hand-held phones are not much safer than hand-held phones, and text messaging greatly increases the risk of accidents. From the perspective of engineering design, all of these aspects and their effects are taken into consideration, as well as situations involving the driver, such as inattentiveness, improper passing, napping while driving, and so forth. The severity of the driver's injury was determined by a study that looked at the neurocognitive effects of sleep deprivation because they are strongly linked to social, financial, and health costs because they weaken cognitive performance due to an increase in the tendency to sleep and instability and affect neurobehavioral functions that include cognitive functions like sleep loss, speed, alert attention, and cognitive abilities (Goel & Rao, 2009). A temporal evaluation of the severity of distracted driving injuries was part of a study carried out in the state of Kansas. Data on highway crashes was gathered between 2014 and 2017. Driver injury severity was estimated separately year, with outcomes including severe injury, minor injury, and no injury. For the parameters, a polynomial logarithm was employed. The findings demonstrated that time shifts in estimating random parameters are statistically significant, and that these shifts are brought about by modifications in driver behavior, advancements in car and highway safety measures, and modifications in communication technology (Alnawmasi & Management, 2022). More people die in accidents involving reckless driving than in other kinds of accidents, and they can also involve more vehicles and cause road closures.

## 3. Data Collection

A platform of many databases for searching earlier literature called The Web of Science was created to facilitate scholarly and scientific research. 10,000 searches for terms like "driver crashes," "driver injury severity," and "road crashes" were produced over several years using keywords and authors based on crash analysis and driver injury severity. There are three different sorts of characteristics for a given element: standard weight, combination assign, and total link power assign. In the case of co-author binds between researchers, it denotes the number of binds for one of the other parts as well as the total strength of the ties. The quantity of co-authored papers is merely one factor in the strength of the co-authorship relationship between two authors. The power of all n linkages is produced when two authors co-author a manuscript with n authors (1/n). Therefore, n binds have a total power of 1.

## 4. Analytical method

The visual maps were created with the help of the VOS viewer. The software, which primarily serves to improve link analysis, employs a uniform mapping and aggregating approach. Three different visuals can be produced by the VOS viewer: an intensity visualization, a superposition visualization, and a network visualization.

### 4.1 Articles Citations

Citations You can acknowledge the source of certain information in your writing by using citations. Additionally, it directs your readers to the appropriate place on the reference or Works Cited page where they can obtain more details about that source. When using co-authorship or citation links Citation attributes are the number of citations you receive for a paper or the number of citations received for all papers published as a citation, author, organization, or country by source, author, organization, or country, or author citations.

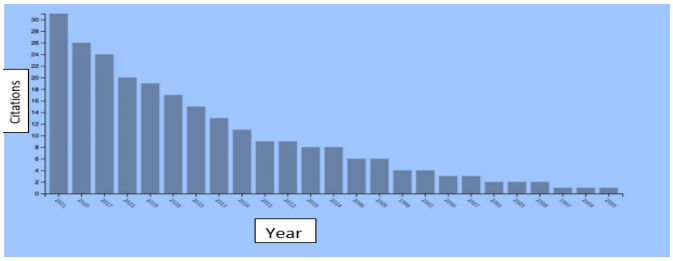


**Figure 1.** Shows yearly scientific production and average article citations.

### 4.2 Top Contributions

The United States is in the lead, followed by People's China, then Canada, in this table of universities, institutes, and writers, or the positions that countries are involved in, when it comes to the total number of publications

**Table 1.** lists the top ten contributions by authors' nations and universities.

| NO | Country | Freq | Citations | Institute | Authors | Freq |
|---|---|---|---|---|---|---|
| **01** | USA | 1285 | 10413 | Univ Washington | Deona, J. | 35 |
| **02** | People's China | 0125 | 1838 | Beijing Jiaotong Univ | Ksaibati, K. | 18 |
| **03** | England | 0048 | 1481 | Monash Univ | Li, X. | 18 |
| **04** | Germany | 0042 | 1321 | Univ Michigan | Lopez, G. | 14 |
| **05** | Australia | 0090 | 1200 | Univ Peen | Mcgwin, G. | 11 |
| **06** | Netherlands | 0016 | 0882 | Univ Sydney | Rue, L. | 11 |
| **07** | Canada | 0047 | 1743 | Univ Florida | Abdel-Aty, M. | 10 |
| **08** | South Korea | 0030 | 0319 | Cent South Univ | Fountas, G. | 10 |
| **09** | Japan | 0017 | 0294 | Univ Colorado | King, M. | 09 |
| **10** | Norway | 0010 | 0360 | Univ Queensland | Lenne, M. | 09 |

### 4.3 Contributions by Author's Country and University

A network depiction of the authors' cooperation is shown in Figure 2. In network visualization, systems are identified and portrayed as circles or rectangles with varying volumes, depending on the quantity of chosen pieces. When elements are included in their group, they are placed on the map; the element's color also relies on the element group. Lines between items in a graphic show the connections between them. The line becomes thicker as the bond becomes stronger. The chart's distances between items also show how linked the elements are to one another. Relationships between authors are based on how many publications they have co-authored. At least four co-authored papers are required for authors to be considered. The creation of a group of 50 authors—20 of them were colored networks and circles based on groups). The author has more sway the larger the knot. Zhang Guohui, Tay Richard, Han Hela, and Lee Jaeyoung are the most important authors.

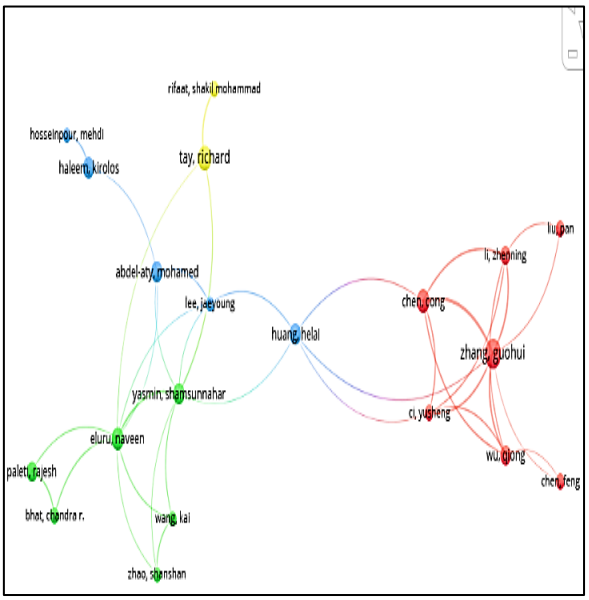


**Figure 2.** Shows the authors' collaboration as a network.

Authors: When processing Web of Science data, only early authors are taken into account when constructing a network of bibliographic citation associations at the aggregate level of sources or authors. The author has more sway the larger the knot. Tay Richard, G. Zhang, M. Abdel-Aty, and H. Huang is the primary author. It is also important to note that H. Huang, who collaborated with a group of writers (indicated by knots and linkages from most research pathways), including Abdel-Ati Mohamed, Huang Helai, and others, are distantly linked to G. Zhang.

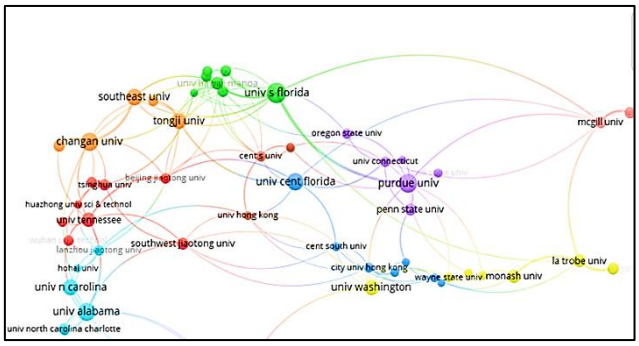


**Figure 3.** A collaboration map of authors by institutions and universities.

### 4.4 Authorships by institutes

A collaboration map of authors by institutions and universities is shown in Figure 3. We take into account authors who have at least two joint publications. The universities with the most nodes are the University of Florida, the University of Central Florida, Mcgill University, the University of North Carolina, and the University of Washington.

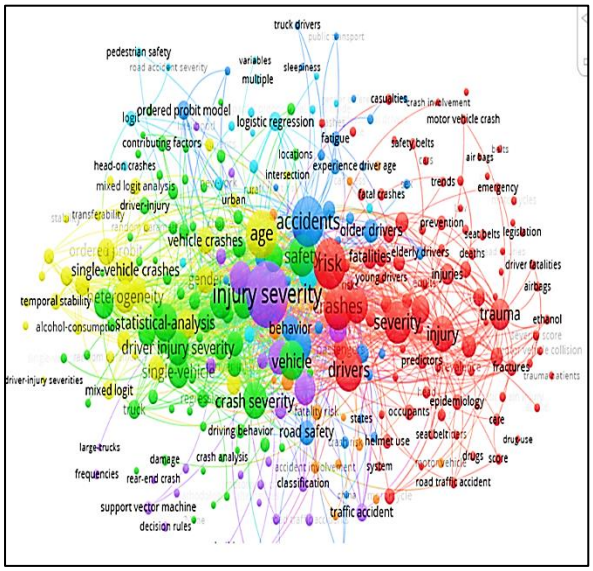


**Figure 4**. Network visualization map of the keywords.

### 4.5 Key words

People serve as references, hence keywords are significant in research. The agreed-upon keywords reveal what is most significant in the image: the greatest number of users, with each limit standing for one item. The Web of Science reports that there are 1285 words in the list of keywords for accidents. The most significant keywords that appeared in earlier research and studies were injury severity, accident, driver injury severity, crash analysis, vehicle crash, safety, and risk. The keywords that were used were the severity of the driver's injury, the driver's accident, and the analysis of accidents. Research from the past has demonstrated how crucial keywords are to research. The investigation revealed that "injury" is the most significant term. It also appeared to have the greatest knot and the most connections compared to other keywords. From the strongest binding strength to the weakest binding strength, each distinct hue denotes a keyword. Finding subjects relating to accidents was simpler in earlier studies.

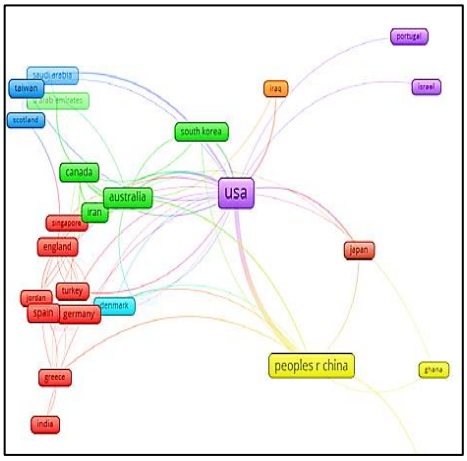


**Figure 5.** Network visualization map of the countries.

### 4.6 A network visualization map of the countries

A web visualization layout of the nations it operates in is shown in figure 4 below. The network for the nation with the most articles is represented, and the bigger the node size, the more significant that nation is in this perception. The USA, China, South Korea, and Australia are the nations with the most articles published. Additionally, compared to the aforementioned nations, the size of the knot in Iraq is smaller.

## 5. Density visualization

Similar to the connection visualization and the superposition visualization, the item intensity visualization represents things by their label. The color at each point in the item intensity visualization represents the intensity of the objects there. Default color schemes include blue, green, and yellow. The color of the point is more similar to yellow as the number of things in a point's block increases and as the weights of the blocking items increase. The opposite is also true: the closer a point's color is to blue, the fewer objects it has in its block and the lighter the weights of these items. The item intensity visualization is demonstrated by an example

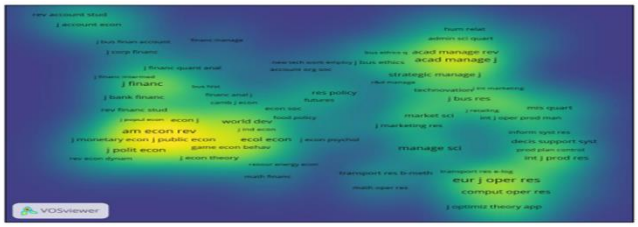

**Figure 6.** Item density visualization.

### 5.1 Create Map

Summary of the prime options provided by the Create Map wizard for creating a new map. Table2 provides a summary of the first options the map wizard offers when building a new map using the VOS viewer. Links are co-authorship, which includes authors and organizations, and co-occurrence, which includes keywords and nations, and are taken from bibliographic database files or reference manager files.

## 6. Summary

The VOS viewer program was used to determine the most crucial factors where many prior studies and research were presented that clarify the main factors, causes, or risks that increase the accidents and the severity of the driver's injury. The status of traffic accidents and the main factors that affect the severity of the driver's injury are among the main factors that increase accidents and their severity. Zhang Guohui, Tay Richard, Han Hela, Lee Jaeyoung, and Abdel Aty Mohammed were among the researchers who reported on the elements that caused accidents, their connections to the seriousness of the driver's injury and its dangers, and the level of collaboration between them. The researchers above mentioned clarified that If the traffic laws on drunk driving, wearing seat belts, complying with speed limits, wearing helmets, and child restraints are not carefully enforced, they cannot lead to the expected reduction in traffic deaths and injuries due to specific behaviors. Thus, if traffic laws are not enforced or are considered unenforceable, they are likely not to be complied with and therefore offer very little opportunity to influence behavior. The most significant nations in this study's subject have also. identified, particularly the USA, China, England, and Germany, that have greater influence in publishing than other nations. The University of Florida, the University of Central Florida, Mcgill University, the University of North Carolina, and the University of Washington are among the universities and cooperating institutes involved in research on safety and accidents. Injuries from traffic

accidents can be prevented. Governments need to take action to address road safety comprehensively. This entails the involvement of multiple sectors, such as transport, police, health, and education, and actions that address road safety, vehicles, and road users. Effective interventions include designing safer infrastructure, incorporating road safety features into land use and transport planning, improving vehicle safety features, and improving post-traffic care for crash victims, developing and enforcing laws on major hazards, and raising public awareness. Because of the relationship between the elements that determine the severity of injuries received by drivers in traffic accidents, this research provides a road map for future research as well as knowledge of the research foundations in this area.

**Authors' contribution**

All authors contributed equally to the preparation of this article.

**Declaration of competing interest**

The authors declare no conflicts of interest.

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