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Identification of the Accidents Causes and their Engineering Analysis: The Case of Albania

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ABSTRACT

This paper presents the general characteristics of road transport safety in Albania during the last decade. The main purpose of this study was to investigate the main factors of road accidents in Albania. Furthermore, statistical analysis has been presented regarding the number of perpetrators of accidents by gender and age, as well as other influential or contributing aspects related to vehicles, their age and the experience of drivers in Albania during the last decade. Due to the Covid-19 situation we haven't take into account the year 2020.

Keywords: transport, road vehicle, collision, causes of accidents;

1. INTRODUCTION

According to the World Health Organization, approximately 1.3 million people died in all over the world each year as a result of road traffic collisions [1]. It turns out that over 3,600 road users were killed every day worldwide in road accidents. More than half of those killed were pedestrians, motorcyclists and cyclists [2]. Despite advanced vehicle safety systems, traffic accidents are still causing a high number of casualties, injuries but also material damage. The main causes of traffic accidents can be divided into three risk factors, such as: people, vehicles and road infrastructure [3].

In research [4], the authors identified risk factors before the collision, during the collision and after the collision in relation to the person, vehicle and road infrastructure. The risk factors dependent on driver include speeding, driving under the influence of alcohol and other psychoactive substances, driving without motorcycle helmets, unfastened seat-belts, children transported without child restraints, driver psychological attitude, and distractions during driving (e.g. using mobiles). The driver's experience, skills, observation capabilities, and ability to recognize potential hazards allow to avoid possible traffic incidents. Most of the studied risk factors related to human behavior has been examined in the literature [5, 6]. Authors of the paper [7] distinguished three types of behavior that increase the risks of causing an accident: errors, lapses and violations. Accidents may be caused by perception errors and misjudgment of the driving conditions, for instance hard braking on slippery surface, high speed cornering, or sudden lane change. The misperception may occur due to incomplete processing, neglect of available information or due to receiving incorrect information. They have an impact on driver decision-making, risk tolerance, and behavior. The errors in perception resulting implications for road safety [8, 9].

Carelessness or negligence can refer to attention and memory failures, such as trying to get away from traffic lights with the wrong gear. Releases are usually made by inexperienced executives [10, 11] or senior executives [12, 13].
Violations refer to deviations from official prohibitions and mandatory rules for road users set out in the highway code. Examples are speed or overtaking from the inside. As evidenced by various researches [14-16] the violations seem to have had more to do with the clashes. Studies can also be found devoted to physical or mental factors, which have an impact on driver style causing unusual driving behaviors [17-19].

The vehicle-related risks include the technical condition of main vehicle systems, such as brake system, steering system, lighting system, and safety devices. Correct operation of vehicle systems reduces the traffic safety hazards.

The other risk factor is road infrastructure. Road design and road layout should be highly complex. The interactions between road users requires introduction of appropriate traffic organization, adjusting footpaths, cycling lanes, safe crossing points, and other traffic calming measures to reducing the risk of injury among these road users. According to [20,21] population density is associated with the accident's frequency. The inhabitants of cities are far more exposed to road crashes than population of rural areas. The urban traffic conditions consist in low speed driving, while inter-urban traffic demands higher speeds and continuous flows. The domestic and international roads register higher fatality rates than pure urban roads. This kind of roads is designed exclusively for high-speed vehicular traffic. Study [22] confirmed that traffic casualties are likely to happen on higher speed roads and motorways but not during traffic congestion. The results presented in [23] exhibited that the risk in poor weather and road conditions was higher on motorways compared to two-lane and multiple-lane roads even though the overall risk was low on motorways. According to research [24] the most significant contributors to road accidents at hazardous locations are: average running speed, posted speed, maximum and average degree of horizontal curves, number of vertical curves, median width, type of road surface, time of a day, number of vehicles per hour, number of pedestrian crossing streets and percentage of heavy duty vehicles.

The purpose of this study was to investigate some of the main factors of road accidents in Albania during the last decade. The analysis presented shows the collisions involving driver of different ages and genders, time of day and seasons. This paper also shows the number of injuries and fatalities according to the type of road traffic collisions.

2. DATA ANALYSIS OF ROAD ACCIDENTS IN ALBANIA

Road accidents are a serious problem for modern society, which results from the costs of treating accident victims, as well as economic and property costs. Undoubtedly, the frequency of accidents is related to the skills of drivers and the modern lifestyle in which more and more people travel [25-27]. In addition, it should be noted that the vehicles of that time were equipped with different types of modern equipment, e.g. a screen that lets you watch movies. They are designed to improve travel, but can also distract the driver with a subsequent road accident [28]. It should be noted that not only the interior of the vehicle is able to distract the driver. Billboards, billboards, large screens, illuminated signs, all those elements that force the driver's attention can cause the driver's inattention, and thus cause a road accident [29].

The National Road Network in Albania is about 18,000 km long including about 3,719 km of National Roads: the primary road network is about 1,200 km (the main

corridors), with nine main connections which made up the basis of the network. Total length of the secondary network is about 2,500 km; 10,500 km are interurban roads, and the rest of 4,000 km is under the jurisdiction of autonomous units, enterprises or companies. However, the total number of citizens reaches 2.9 million. The number of vehicles registered in Albania until 2019 is shown in Figure 1 and results in 563106 vehicles.

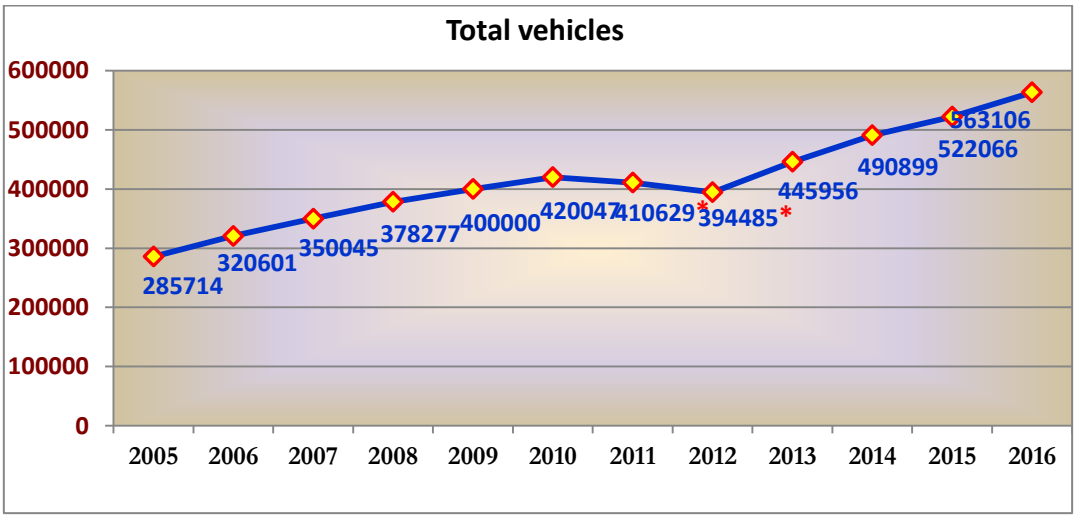


Fig. 1. Number of registered vehicles in Albania 2005-2016

Based on data of the Albanian General Directorate of Road Transport (DPSHTRr) for 2016, it has been said that the average age of vehicles on the roads of Albania was 16 years.

Albanians are increasingly using personal vehicles. A car is definitely an indispensable element of every person's life, it is what most people use to travel to work, to go on vacation or to shop. Public transport or rail transport are not so popular nor extended throughout the Albanian territory.

Road accidents have a very complex cause-and-effect structure, so they are classified as the main problems in the country. The high annual number of road accidents in Albania is not only the basis for the analysis of the current situation, but above all it is a warning to all road users and entities responsible for road safety. Annual Police reports show that the level of road traffic risk in Albania is very high compared to EU Member States. The death rate as a result of road accidents per 1 million inhabitants is an indicator of (un) safety used by the European Union. In Albania, this indicator in 2019 reached 80 deaths per 1 million inhabitants as can be seen in Table 1 and Figure 2 while for the entire European Union it was 51 [30, 33].

Table 1. Road accidents and indicators by years of occurrence

Accidents	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Total	1465	1564	1876	1870	2075	1914	1992	2033	1978	1718	2044
Fatalities	378	352	322	334	295	264	270	269	222	213	227
Injuries	1462	1716	2150	2235	2503	2353	2422	2510	2389	2030	1817
Fatalities / 10,000 vehicle	9.45	8.38	7.84	8.46	6.61	5.38	5	4.78	4.1	3.68	3.62
Fatalities / 10,0000 inhabitants	12.95	12.1	11.09	11.52	10.18	9.15	9.38	9.35	7.73	7.44	7.97

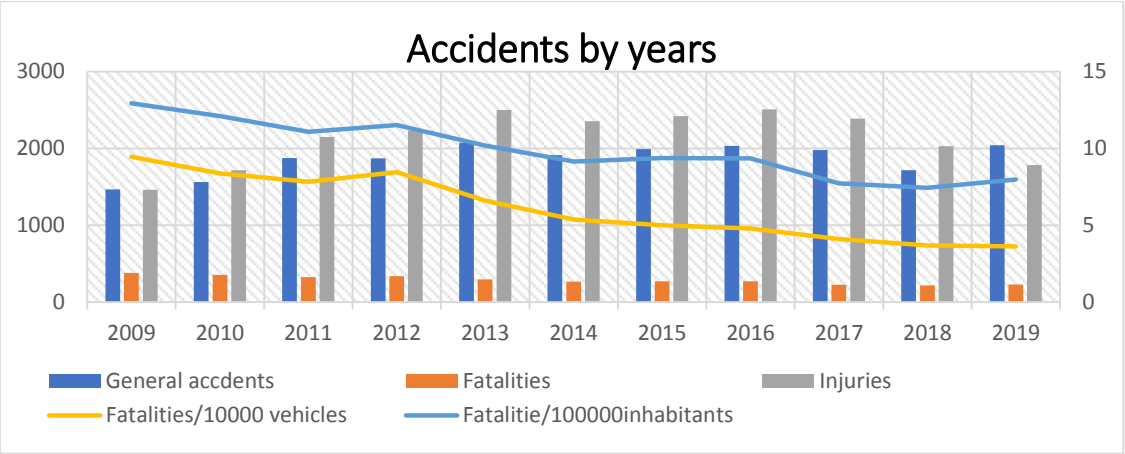


Figure 2. Accidents by years

During the last decade, 20,529 road accidents occurred in Albania, as a result of which 3146 people were killed and 23587 were injured. On average, 286 people die each year on the country roads as a result of accidents. In 2019, the number of accidents increased by 18.9% and injuries decreased by 10% compared to 2018. Unfortunately, the number of victims as a result of a road accident increased by 6%. From 2009 to 2019, there was an increase in the number of vehicle accidents by 39% and a decrease in the number of victims by 40%. When analysing the number of vehicle accidents, attention has been paid to the average number of fatalities per 10,000 vehicles which has decreased by close to 61% when comparing 2009 with 2019, see Table 1.

Based on the type of collision of the Table 2, it should be noted that the number of side accidents is the most common form of accidents between vehicles. Moreover, from 2009 to 2019, their number remains on average close to 500 per year. Also, the number of frontal collisions in 2019 is 329 while rear-end collisions close to 300 per year. It should be noted that deaths in accidents between vehicles resulted in a quarter of fatalities or a third of annual accidents, see Table 2:

Table 2. Types of accidents

Accidents	**Type of injury**				
Types of accidents	**No injury**	**Slight injury**	**Serious injury**	**Fatality**	**∑**
self – collision	60	184	37	27	308
self-falling in water	5	6	1	4	16
overturned vehicle	28	77	21	18	144
frontal collision	125	170	20	14	329
vehicle/vehicle in curve	17	18	2	2	39
vehicle/vehicle during overtaking	27	39	5	4	75
side collision	210	223	22	18	473
rear collision	155	118	7	15	295
vehicle / cyclist	105	71	23	20	219
vehicle / animal	5	4	4	0	13
vehicle / pedestrian	420	341	72	85	918
vehicle / others	176	162	27	14	379
cyclist / pedestrian	4	2	2		8
other, unspecified	90	142	17	6	255
Total	**1427**	**1557**	**260**	**227**	3471

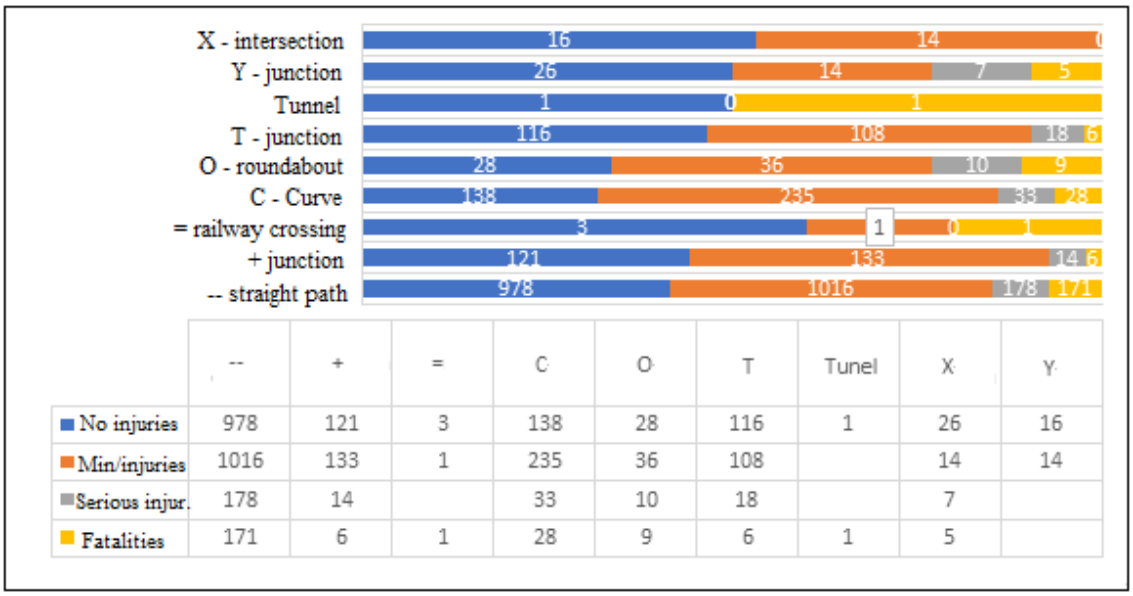
Moreover, rear-end collisions are less often fatal than frontal or lateral collisions. Although, many participants in this type of accident suffer great damage. The vehicle which hits the back accelerates significantly forward. When the driver's seat and the passenger seat are hit, they move forward. In the initial stage, the vehicle user's head moves forward and then returns with greater force to the vehicle seat backrest [34]. This unnaturally rapid movement of the neck in both directions can damage the neck spine. Therefore, rear impacts are very problematic because at a relatively low impact velocity, the neck vertebrae can rupture and a person can die.

In the event of a rear-end collision, passengers and the driver risk being seriously injured by the impact. Rear collisions most often occur as a result of [29, 35]:

- not keeping proper distance from the vehicle driving in the same direction,
- excessive speed,
- lack of attention, e.g. while driving the vehicle in traffic columns,
- bad condition or braking system failure.

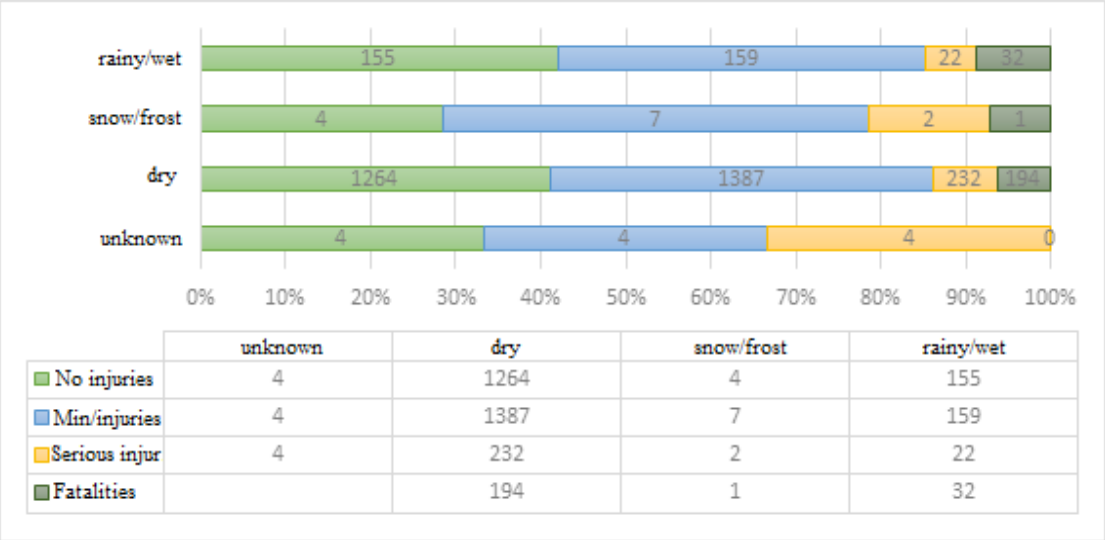
3. REVIEW OF DETERMINANTS OF VEHICLE ACCIDENTS IN ALBANIA

The causes of road accidents vary widely, but their occurrence is related to variables such as road geometry, driver age, driving experience, vehicle age, location, etc. Figure 3 presents the characteristics of vehicle accidents in 2019, according to the geometry of the road while in Figure 4 are given the accidents according to the weather conditions.



	--	+	=	C	O	T	Tunel	X	Y
No injuries	978	121	3	138	28	116	1	26	16
Min/injuries	1016	133	1	235	36	108		14	14
Serious injur.	178	14		33	10	18		7	
Fatalities	171	6	1	28	9	6	1	5	

Figure 3. Characteristics of vehicle accidents according to geometry of the road



	unknown	dry	snow/frost	rainy/wet
No injuries	4	1264	4	155
Min/injuries	4	1387	7	159
Serious injur	4	232	2	22
Fatalities		194	1	32

Figure 4. Accidents according to the weather conditions

The figure shows that fatal road accidents during 2019, occurred on the right road and in good condition occurred 171 or 77.4%. This finding leads us to the reasoning that the excessive speed of the vehicle and the manoeuvre or negligence of the driver were the main causes of these fatalities.

Based on data from police reports from 2019, it can be seen that the largest group of perpetrators of car accidents in Albania are people from 25 to 44 years old as can be seen in Figure 5. On average, they account for 49% of all road accident perpetrators. People aged 18 to 24 on average make up about 18% of accident perpetrators [29, 33].

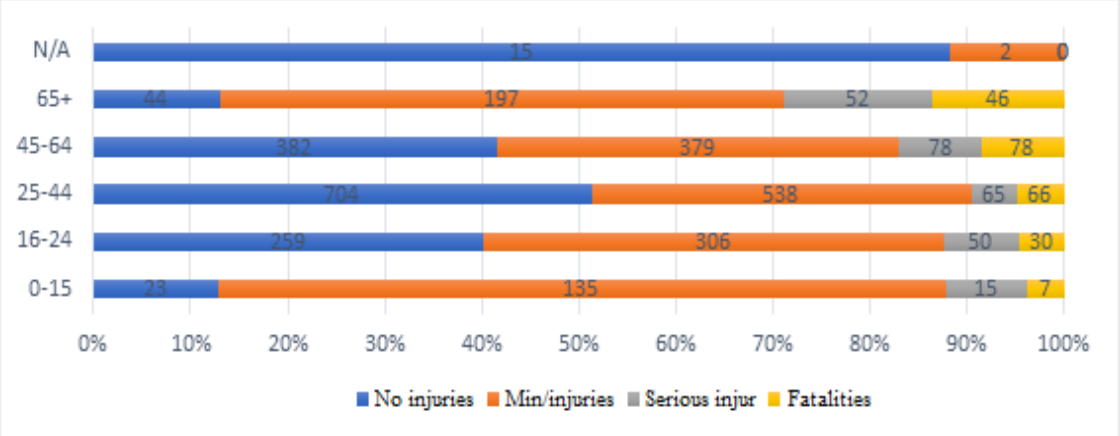


Figure 5. Ages of perpetrators of car accidents in Albania

The most common causes of vehicle accidents as a cause of driver behaviour in Albania include [35, 36]:

- excessive speed,
- sudden change of direction of movement
- non-granting of the right of way of the vehicle,
- non-placement of pedestrians at the pedestrian crossing,
- ignoring traffic signs
- not maintaining a safe distance between vehicles,

Figure 6. depicts the characteristics of the causes of road accidents in Albania in 2009 and 2019. It can be noticed that in case of reasons such as speed mismatch or non-compliance with priority, there was a decrease of over 15%. However, in case of not adjusting the safe distance between vehicles, it increased slightly in 2019 than in 2009. This is confirmed by the fact that rear-end collisions have the lowest downward trend among all types of collisions.

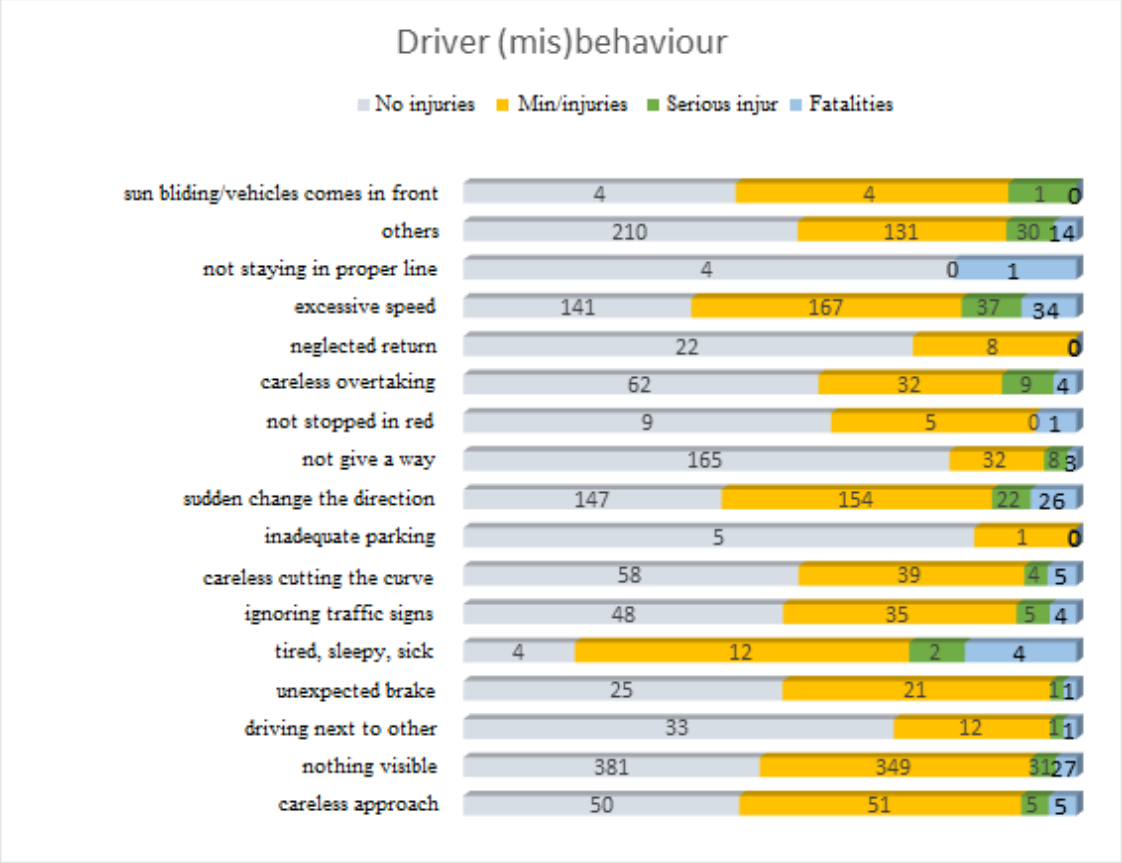


Figure 6. Accidents as result of driver (mis)behaviour

4. CONCLUSIONS

The article objective was to present road safety issues in Albania during the years 2009-2019 by identifying the most common causes and review of data on vehicle-vehicle accidents with its lateral forms, before and after, as well as characteristics of perpetrators of road accidents in terms of gender and age of drivers, their behaviour and weather conditions. The analysis shows that the number of accidents in during the last decade has been increased but the number of fatalities has been decreased significantly. Rear collisions are a problematic type of road accidents and they remain almost the same every year in Albania. The development of road infrastructure through the expansion of the highway network contributes to reducing the number of road accidents in terms of side and frontal collisions. Moving vehicles in one direction only increases the likelihood of rear-end collisions. During the years 2009-2019, 2172 people died due to rear-end collisions on Albanian roads. Therefore, it should be noted that an inconspicuous rear collision vehicle carries a high risk of damage to the upper cervical

spine. Even at low speeds of 20 km/h, such a collision may cause irreversible health effects, leading to disability.

CONFLICT OF INTEREST

The authors confirm that there is no conflict of interests associated with this publication and there is no financial fund for this work that can affect the research outcomes.

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