

K. Borovec, M. Kondor Langer, S. Gluščić\*

# THE CONNECTION OF THE EXPERIENCE OF INVOLVEMENT IN TRAFFIC ACCIDENTS WITH THE PUNISHABLE BEHAVIOR OF TRAFFIC PARTICIPANTS<sup>1</sup>

UDK351.78:614.83

RECEIVED:2022-04-11

ACCEPTED: 2023-10-13

This work is licensed under a Creative Commons Attribution 4.0 International License



*SUMMARY: This paper was written as part of the research project "Research of public opinion on the state of safety, behaviour and habits of participants in road traffic in the Republic of Croatia". The goal of this research is to determine the frequency of violations of traffic regulations related to drivers, pedestrians and passengers in vehicles, and to determine whether there is a connection between the experience of suffering of the aforementioned road users and their punishable behaviour. For this purpose, a quantitative research was conducted in which a multi-method approach was used in field data collection, a combination of telephone research (CATI) - 60% of the sample and online research (CAWI) - 40% of the sample. Respondents from the entire territory of the Republic of Croatia (N=2072) over the age of 16 were included in the research. In general, it can be concluded that the violation of traffic regulations is very frequent and present among the majority of different road users, and that road users who have recently experienced a traffic accident in any capacity, very rarely violate traffic regulations, as car drivers. Conversely, involvement in traffic accidents has not been shown to deter pedestrians and vehicle occupants from repeating traffic violations. The obtained results have a practical value, especially in the context of planning preventive programs and strategies, while the limitations of the research are reflected in the fact that only one independent variable was included in the correlation with committing traffic violations, regardless of other known predictors of punishable behaviour in traffic.*

**Key words:** traffic safety on the roads, violation of traffic regulations, traffic accidents, drivers, passengers, beepers

## INTRODUCTION

Motorized road traffic is an essential feature of the modern way of life, which carries numerous safety risks for people's lives and health, as well as the safety of their property. Unfortunately, every year 1,300,000 people die worldwide in traffic accidents and 50,000,000 are injured, and it is predicted that by 2030 traffic accidents will be-

come the fifth cause of death, that is, 2,400,000 people will die if the current trends continue.

Due to the exceptional importance of this area of safety, the Government of the Republic of Croatia has been implementing the National Road Traffic Safety Program since 1994, which aims to ensure a holistic and continuous approach in the implementation of measures and activities necessary to increase safety and reduce risks in road traffic. The implementation of the National Road Traffic Safety Program of the Republic of Croatia 2011 - 2020 continues to achieve its main goals, the main priority of which is to reduce the number of fatalities by 50 percent by 2020 compared

\*Krunoslav Borovec, Ph. D., (kborovec@mup.hr), Mirjana Kondor Langer, Ph. D., Stjepan Gluščić, Ph. D., (sgluscic@fkz.hr), MUP – Policijska Akademija, Visoka policijska škola, 10000 Zagreb, Hrvatska.

<sup>1</sup>The paper was written as a result of the project "Research of public opinion on the state of safety, behavior and habits of participants in road traffic in the Republic of Croatia". The authors of the paper are researchers on the project.

to 210. In other words, by 2020, Croatia should have approached the number of 213 traffic fatalities. According to data on road traffic safety and its consequences in 2020, Croatia partially came close to that goal, as 237 road users were killed in that year, of which the most were drivers, then passengers, and pedestrians (*Ministry of the Interior, 2021*). The measures to reduce the number of deaths to 213 by 2020 are implemented in the following fields of action:

- changing the behavior of road users;
- better road infrastructure;
- safer vehicles;
- effective medical care after traffic accidents;
- other fields of activity.

Since the behavior of road users is one of the areas through which efforts are made to improve road traffic safety, that area is especially the focus of this research.

When strategic documents in the field of transport policy are analyzed, it can be concluded that the behavior of traffic participants is mainly tried to be influenced through their better education, that is, by influencing their knowledge. So, for example, the European Commission, through its document on road safety for the programming period from 2011 to 2020 (English: Towards a European Road Safety Area: policy orientations on road safety 2011-2020") sets as one of its strategic goals the improvement of education and training of road users (*European Commission 2010*). However, most of the strategic documents in this area adopted at the international level give priority to transport infrastructure (safer roads and surrounding areas), safer vehicles and better medical assistance after an accident (*European Commission, 2019*).

Given that the focus of both, international public transport policies and the road safety policy in the Republic of Croatia, is the reduction of the most serious consequences of suffering, i.e. death and serious injury, it is interesting to observe the factors of traffic accidents and, based on their share, to conclude what is the significance of traffic participants and their behaviours.

There are three basic factors of road safety: (1) the person, (2) the road and (3) the vehicle.

According to recent research, it has been determined that humans are the potential cause of 57% of serious traffic accidents in the Republic of Croatia. In combination with the road, man is the potential cause of 35% of serious traffic accidents, while in combination with a vehicle, he it is the potential cause of 6% of serious traffic accidents (*Ševrović et al., 2020*). So, even this rough data shows that the key factor of road traffic safety is man and his behavior, regardless of the fact that modern infrastructure and vehicles equipped with new safety technologies aim to reduce the impact of human errors on road traffic safety.

As can be seen from the data on the causes of traffic accidents in the Republic of Croatia (*Bulletin on road safety, 2019*), the dominant causes are the behavior of road users, i.e. violations of traffic regulations such as driving at an illegal or inappropriate speed, not respecting the right of way, improper entry into traffic, improper turning and other driver errors. Accordingly, Doecke et al. (2020) believe that the most common causes of road accidents are those related to human error, but, that interventions to prevent or mitigate accidents are most often infrastructural solutions or vehicle technologies that eliminate human error and / or reduce pre-impact vehicle speed in case of human error. Key factors in meeting the safe system targets (zero fatalities and serious injuries) were found to be: interventions at intersections (eg. roundabouts) based on road infrastructure; increased penetration of technology into vehicles (electronic stability control, autonomous emergency braking, emergency braking assistance, lane keeping assistance, intelligent speed - limiting); interventions on the road for vehicles leaving their lane or road (eg. median barriers); speed limit reductions; and reducing driving under the influence of alcohol and/or drugs.

In order to consider the state of traffic safety from a scientific point of view, it is important to investigate various factors that are related to traffic safety. In this sense, studies that deal with the behavior of drivers and other road users and that study the factors that contribute to the violation of traffic regulations or the prevention of punishable behavior are also important. In this sense, numerous studies have dealt with the issue of the contribution of driver education and training to road safety itself.

According to Winfred and Doverspike (2001), efforts to increase safety are typically focused on driver education, that is, on changing knowledge about the rules and regulations of vehicle operation. However, traffic accidents, according to the mentioned authors, are equally related to the driver's personality traits as well as knowledge of vehicle operation, rules and regulations. In a study with 48 licensed drivers, it was found that crashes are significantly correlated with conscientiousness, a personality dimension of the five-factor model, but not with driving test results. Therefore, the authors conclude that prevention efforts should also be aimed at changing behavior related to conscientiousness, including an emphasis on compliance with rules and regulations. Gebers, (1995) found in his research that there is no significant connection between better knowledge of regulations and later participation in traffic accidents, as well as evidence that exposure to a traffic course resulted in a change in attitude towards traffic safety. According to Topolšek, Babić and Fiolić (2019), the impact of education and training programs on traffic safety is still limited. Many other factors such as emotions, motivation, situational factors such as fatigue, time of day, number of passengers in the vehicle, etc. are related to attitudes and the perception of the risk of violating traffic regulations. The role of unconscious norms and habits is also important (Lee and Humphrey, 2011, Yannis and Vardaki, 2013). However, the effect of driver training programs on overall road safety is still not fully known, so conclusions about their actual effectiveness should not be taken lightly. One of the main reasons for this is the variety of used strategies and evaluation methods of these programs. However, recent studies show that with effective educational approaches and evaluation methods, a relatively small but still statistically significant reduction in traffic accidents is possible. Furthermore, in the context of discussing the importance of driver training as a means of improving driver behavior and reducing involvement in traffic accidents, Christie (2001) concludes that there is a need for road safety professionals, as well as the general public, to be well informed about the merits and the effectiveness of such training as a countermeasure to prevent collisions. The author points out that driver training alone cannot be considered an effective countermeasure to traffic accidents.

Other approaches such as increased surveillance and graduated licensing for novice drivers and enforcement of traffic laws for all drivers are likely to make a greater and more lasting contribution to road safety (Christie, 2001).

So, there is still no consensus among researchers about the connection between education and traffic safety, and it is obvious that, in addition to knowledge of traffic rules and vehicle operation, many other significant predictors are also associated with safety, including those that characterize road users. The literature review that follows is a confirmation of such a claim.

Dangerous driving is a social problem that results in serious injuries, fatalities and significant economic costs (Morrison et al., 2020). It is related to the driver's behavior, which in turn is influenced by various factors. Af Wahlberg and Dorn (2012) tested whether knowledge of driving risks is associated with self-reported risky behaviors and outcomes such as involvement in traffic accidents and committing driving violations. Between the knowledge of traffic dangers and any of several possible indicators of dangerous traffic behavior and/or the risk of a traffic accident, no connection was found that would be significant in practice (Af Wahlberg and Dorn, 2012), and authors conclude that it seems to make little sense to use the knowledge about driving as an indicator of safe driving.

Some studies have established a connection between traffic behavior and driving styles. Accordingly, participation in traffic accidents can be predicted from the frequency of speeding and the frequency of violations - characteristics of aggressive and impatient driving styles (Sagberg et al., 2015).

The driver's perception of risks in cases of violations of traffic rules related to accidents is also significant for road traffic safety from the perspective of the participants. Such data can be significant for better driver education. In a study by Penmets and Pulugurth (2020), it was found that the perception of the risk of violating traffic rules increases with the driver's age, except for driving under the influence of alcohol and drugs. This means that older drivers are more aware of the risk of violating certain traffic rules. The most risky

violation of traffic rules consider by drivers over the age of 25 is ignoring traffic signals.

Exceeding the speed limit of up to 20 km/h is considered the least risky among the considered violations of traffic rules, regardless of the driver's age, gender, education and income level. The perception of the risk of ignoring traffic signals is statistically the same for both male and female drivers. For all other violations of traffic rules, the perception of risk among female drivers is higher than the perception of risk among male drivers. Among drivers with a lower level of education, the perception of the risk of violating traffic rules is higher than the average risk for the entire population. Therefore, the previously mentioned authors conclude that dissemination of information on risk perception as well as improved educational programs are necessary to increase awareness of the risk associated with traffic violations that drivers consider low risk.

The risky behavior of drivers in traffic is influenced by their attitudes towards traffic safety, especially towards fast driving, breaking the rules and reckless driving (*Iversen and Rundmo, 2004*). This means that more positive attitudes towards violating traffic rules are associated with both driving errors and intentional violations of traffic rules (*Slavinskiene et al., 2014*).

In the research of Spano et al. (*2019*), it was determined that the risky behavior of drivers, their self-regulation and attitudes towards traffic rules are related to the frequency of crashes. Other studies have also confirmed this. Their results of which show that behavioral components such as attitude towards traffic rules (*Ulleberg and Rundmo, 2003*) and self-regulation in driving (*Owsley et al., 1999*) play an important role in predicting traffic accidents. Spano et al. (*2019*) also proved that self-regulation has a significant impact on the frequency of crashes in drivers who have already had an accident. Data on a sample of older drivers showed that in drivers who have already had an accident, high self-regulation regarding potentially dangerous external situations, such as adverse weather conditions, is associated with a lower frequency of accidents.

In the study by Ulleberg and Rundmo (*2003*), the authors tested the predictors of risky driving behavior: personality traits (aggression, altruism, anxiety, sensation seeking and uselessness), attitudes towards traffic safety and risk perception. The results showed that personality traits influence risk-taking in driving with the influence of attitudes towards traffic safety as a mediator.

Because of stereotypes, women are labeled in the public as worse drivers, even though many statistical indicators related to risky behaviors, the number of traffic accidents and driving styles are on their side. One of the reasons lies in the fact that women show more positive attitudes towards traffic safety than men and commit fewer traffic violations than men (*Laapotti et al., 2003*). *Cordellieri et al. (2016)* found gender differences in road safety attitudes (i.e., "negative attitude toward traffic rules and risky driving"; "negative attitude toward drugs and alcohol" and "tolerance towards speeding") and in driver behavior (i.e. errors due to careless driving and driving offences). The results related to risk perception are particularly important. The results show that the level of risk perception while driving is the same for men and women. However, the two groups differ in their level of concern about this risk, with men being less concerned about the risk of a road accident than women. This suggests that the main difference between the two groups is not strictly related to the likelihood judgment of the perceived risk, but to the level of concern about the consequences of the risk. This difference between risk perception and concern could explain the differences in the frequency of car accidents in the two groups. These results may provide new insights for the development of gender-based prevention programs.

Thus, from the review of the literature, it can be concluded that the focus of research on driver behavior in traffic is mostly represented by questions about the connection between driving education, driver personality traits and attitudes and perception of risk in traffic with safety and the tendency to violate traffic regulations, while the connection between previous experience sufferings investigated to a lesser extent. Therefore, this research makes a contribution to this field.



## RESEARCH OBJECTIVES, HYPOTHESES AND WORKING METHODS

### Research goal

The main goal of this research is to determine the frequency of violations of traffic regulations related to drivers, pedestrians and passengers in vehicles, and to determine whether there is a connection between the experience of suffering of the mentioned traffic participants and their punishable behavior, that is, the violation of certain traffic rules.

### Hypotheses

In relation to the goal of this research, the following hypotheses were set:

H1: There is a statistically significant relationship between the driver's experience of being injured in traffic and the violation of traffic regulations, in such a way that drivers who have had such experience violate traffic regulations less often.

H2: There is a statistically significant relationship between the experience of pedestrians and passengers in vehicles about traffic accidents and violations of traffic regulations, in such a way that pedestrians and passengers who had such an experience violate traffic regulations less often.

### Methodology

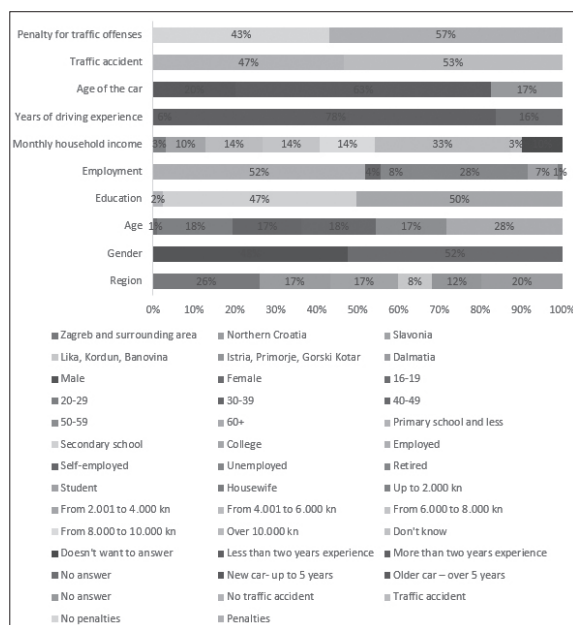
Research on the connection between the experience of injuries of drivers and other road users and their punishable traffic behavior is part of a larger research project "Research of public opinion on the state of safety, behavior and habits of road users in the Republic of Croatia". It is a quantitative research in which a multi-method approach was used in field data collection, a combination of telephone research (CATI) - 60% of the sample and online research (CAWI) - 40% of the sample. Respondents over the age of 16 from all over the Republic of Croatia were included in the research. A survey questionnaire compiled in cooperation between the research team and

the field survey agency was used, based on the previously used survey questionnaire from 2009 (survey of public opinion on the state of safety in road traffic), in order to ensure the comparability of the data collected at two points in time. The data were collected in September and October 2019 on a sample of 2,072 respondents, and were processed in the SPSS statistical program. The field data collection was carried out by the agency Kvaka - Office for Creative Analysis.

### Sample

The research was conducted on a sample of 2,072 respondents over the age of 16. A telephone survey was conducted for 40% of the sample (CATI: n= 800), and an online survey was conducted for 60% (CAWI: n= 1200). The sample was stratified according to the sex and age of the respondents and the region. The following graph shows the structure of the sample according to the variables: gender, age, education, average monthly household income, years of driving experience, work status, punishment, traffic accident experience and region.

The structure of the sample is shown in graph 1.



Graph 1. The structure of the sample

Grafikon 1. Struktura uzorka

## Survey questionnaire

For the purposes of this research, a questionnaire was used, which was compiled in cooperation between the research team and the agency for the implementation of the field test, based on the questionnaire from 2009, in order to ensure the comparability of the data. In addition to questions that collect socio-demographic data, the questionnaire contains questions related to driving experience and the frequency of using certain means of transport. Then follows a series of questions related to the behavior of road users, in which declarations are requested about knowledge of traffic rules and the frequency of violations of certain traffic regulations. Answers are on a Likert-type scale from 1 - never to 4 - always. The questionnaire also contains questions that assess the experience of punishment and the certainty of punishment, as well as the assessment of the danger of certain punishable actions recognized as the "four killers in traffic" - speed, alcohol, distraction and failure to use protective equipment. Part of the question relates to traffic behavior abroad, the experience of traffic accidents, the perception of traffic supervision and the assessment of the responsibility of individual institutions for road traffic safety. The questionnaire contains a total of 36 questions, with a note that under certain questions there are scales with statements in relation to which respondents give their assessments (e.g. the scale of punishable actions in traffic).

## RESULTS

### Frequency of violations of traffic regulations by different traffic participants and checking of basic statistical indicators for the tested variables

To examine the predictor properties of the experience of being injured in traffic, the basic statistical indicators of all the variables that define the experience of being injured in traffic and punishable behavior of road users were first calculated. Table 1 shows the basic statistical indicators for the independent (experience of being injured in traffic) and all dependent variables (punishable behavior in the form of violations of certain traffic regulations). The independent variable covers the area of traffic accident experience (Q25A-Have you ever experienced a traffic accident, either as a pedestrian, driver of a car, motorcycle, bicycle, etc.?). This independent variable has the following categories: Q25A (1- yes in the last two years, 2- yes 2-5 years ago, 3- yes more than 5 years ago, 4- no, never).

Dependent variables that define the violation of traffic regulations are: violation of traffic regulations (questions from Q6.1 to Q6.14) and punishable behavior of passengers and pedestrians (from Q9.1 to Q9.5). All these variables are of the Likert type with 4 answer categories: 1-never, 2-sometimes, 3-often, 4-always. Given that the independent (predictor) variable and dependent (criteria) variables are ordinal, the basic statistical parameters arithmetic mean, standard deviation, smallest and largest results were calculated, and the normality of the frequency distributions of independent and dependent variables was tested. Frequencies by category and percentages for the independent and each individual dependent variable were also calculated.

**Table 1. The basic statistical indicators for the independent and all dependent variables****Tablica 1. Osnovni statistički pokazatelji za nezavisne i sve zavisne varijable**

Variables		Frequencies	Percentage	Arithmetic median	Standard deviation	Shapiro-Wilkov significance test
<b>Q25A- Have you ever experienced a traffic accident, either as a pedestrian, driver of a car, motorcycle, bicycle, etc.?</b>						
Yes, in the last two years	1	140	6.8			
Yes, two to five years ago	2	165	8.0			
Yes, five years ago	3	805	38.9	3.25	.867	0.000
No, never	4	962	46.4			
	Total	2072	100.0			
<b>Q6.1. exceeding the speed limit by 20 km/h</b>						
Never	1	369	17.8			
Sometimes	2	1101	53.1			
Frequently	3	232	11.2	1.96	.644	0.000
Always	4	30	1.4			
	Total	1732	83.6			
<b>Q6.2. exceeding the speed limit from 21 to 50 km/h</b>						
Never	1	942	45.5			
Sometimes	2	716	34.6			
Frequently	3	69	3.3	1.50	.589	0.000
Always	4	5	.2			
	Total	1732	83.6			
<b>Q6.3. exceeding the speed limit by more than 50 km/h</b>						
Never	1	1468	70.8			
Sometimes	2	235	11.3			
Frequently	3	24	1.2	1.17	.433	0.000
Always	4	5	.2			
	Total	1732	83.6			
<b>Q6.4. driving a vehicle after previous consumption of alcohol</b>						
Never	1	1296	62.5			
Sometimes	2	418	20.2			
Frequently	3	15	.7	1.26	.471	0.000
Always	4	3	.1			
	Total	1732	83.6			
<b>Q6.5. overtaking other vehicles in a place where this is not allowed</b>						
Never	1	1160	56.0			
Sometimes	2	547	26.4			
Frequently	3	23	1.1	1.35	.510	0.000
Always	4	2	.1			
	Total	1732	83.6			

<b>Q6.6. taking away the right of way for other vehicles to pass</b>						
Never	1	1312	63.3			
Sometimes	2	404	19.5			
Frequently	3	14	.7	1.25	.461	0.000
Always	4	2	.1			
	Total	1732	83.6			
<b>Q6.7. taking away the right of way for pedestrians to pass (not stopping at the pedestrian crossing)</b>						
Never	1	1113	53.7			
Sometimes	2	594	28.7			
Frequently	3	21	1.0	1.37	.522	0.000
Always	4	4	.2			
	Total	1732	83.6			
<b>Q6.8. not using a seat belt while driving</b>						
Never	1	1298	62.6			
Sometimes	2	342	16.5			
Frequently	3	60	2.9	1.32	.631	0.000
Always	4	32	1.5			
	Total	1732	83.6			
<b>Q6.9. driving an unregistered vehicle</b>						
Never	1	1699	82.0			
Sometimes	2	25	1.2			
Frequently	3	6	.3	1.02	.195	0.000
Always	4	2	.1			
	Total	1732	83.6			
<b>Q6.10. driving a vehicle during the ban due to prescribed penalties</b>						
Never	1	1694	81.8			
Sometimes	2	32	1.5			
Frequently	3	4	.2	1.03	.193	0.000
Always	4	2	.1			
	Total	1732	83.6			
<b>Q6.11. passing through a red light at a traffic light</b>						
Never	1	1584	76.4			
Sometimes	2	136	6.6			
Frequently	3	8	.4	1.09	.330	0.000
Always	4	4	.2			
	Total	1732	83.6			
<b>Q6.12. illegal use of mobile phones while driving</b>						
Never	1	931	44.9			
Sometimes	2	712	34.4			
Frequently	3	84	4.1	1.52	.604	0.000
Always	4	5	.2			
	Total	1732	83.6			



<b>Q6.13. not wearing a protective helmet when riding a motorcycle</b>						
Never	1	1061	51.2			
Sometimes	2	91	4.4			
Frequently	3	24	1.2	1.14	.469	0.000
Always	4	11	.5			
	Total	1187	57.3			
<b>Q6.14. failure to maintain a safety distance between vehicles</b>						
Never	1	833	40.2			
Sometimes	2	829	40.0			
Frequently	3	54	2.6	1.57	.603	0.000
Always	4	16	.8			
	Total	1732	83.6			
<b>Q9.1. not using a seat belt while sitting in the passenger seat</b>						
Never	1	1603	77.4			
Sometimes	2	351	16.9			
Frequently	3	57	2.8	1.31	.668	0.000
Always	4	61	2.9			
	Total	2072	100.0			
<b>Q9.2. not using a seat belt while sitting in the back seat</b>						
Never	1	663	32.0			
Sometimes	2	500	24.1			
Frequently	3	342	16.5	2.39	1.194	0.000
Always	4	567	27.4			
	Total	2072	100.0			
<b>Q9.3. not fastening children with seat belts in the car or not using prescribed child seats</b>						
Never	1	1885	91.0			
Sometimes	2	138	6.7			
Frequently	3	15	.7	1.13	.476	0.000
Always	4	34	1.6			
	Total	2072	100.0			
<b>Q9.4. as a pedestrian - crossing the road in an unmarked place (where there is no pedestrian crossing)</b>						
Never	1	348	16.8			
Sometimes	2	1288	62.2			
Frequently	3	386	18.6	2.07	.668	0.000
Always	4	50	2.4			
	Total	2072	100.0			
<b>Q9.5. in the function of pedestrians - crossing the road at the pedestrian crossing when the red light for pedestrians is on</b>						
Never	1	1194	57.6			
Sometimes	2	751	36.2			
Frequently	3	109	5.3	1.49	.638	0.000
Always	4	18	.9			
	Total	2072	100.0			

Table 1 shows that the frequency distributions of none of the variables are normal, as the significance levels are less than 0.05% ( $p=0.000$ ). Since the variables are abnormally distributed, non-parametric methods were used for data processing.

The frequencies of the results and their arithmetic means show that slightly more than half of the respondents have experienced a traffic accident or accident, but most of them had this experience five or more years ago. When it comes to violating traffic regulations, a significant proportion of respondents drive above the permitted speed, with speed exceeding the most common being up to 20 km/h. Two-thirds of respondents do not drive a vehicle after consuming alcohol, but still a significant share of 20.2% of respondents do so sometimes. A quarter of the respondents sometimes overtake vehicles in places where this is not allowed, while a fifth of them sometimes take away the right of way for other vehicles. Taking away the right of way for pedestrians is somewhat more frequent (30% of respondents do it sometimes, often or always). Non-use of seat belts by drivers is still significantly present, as less than two-thirds of respondents use them regularly. Using an unregistered vehicle as well as driving during the ban are among the least frequently committed offenses. In relation to that, the respondents go through a red light at a traffic light somewhat more often, but still significantly less often than other violations. Among the most common violations by drivers is the use of mobile phones while driving, followed by failure to maintain a safe distance between vehicles. When it comes to passengers in vehicles, the dominant offense is not using a seat belt on the back seat, followed by not using a seat belt on the passenger seat. Pedestrians often cross the road at pedestrian crossings while the red light is on, and somewhat less often at unmarked places.

In response to a general question about the extent to which drivers violate traffic regulations, a third of respondents declared that they never vi-

olate them, while around 55% sometimes do so. A little less than half of the respondents never violate traffic regulations related to pedestrians in traffic.

### **The connection between the experience of being injured in traffic and the violation of traffic regulations by the driver**

The main research question in this part of the project was to determine the connection between the experience of being injured in traffic and the violation of traffic regulations by drivers. Namely, the research sought to determine whether traffic drivers who have experienced an accident behave differently from those who have not had such an experience, and in what way.

Given that the connection between only one independent variable (Q25A-Have you ever experienced a traffic accident as a pedestrian, car, motorcycle, bicycle driver, etc.) and dependent variables that form a set of criterion variables, namely Q61-Q614 - violation of traffic regulations, it is not possible to perform Canonical Analysis of Covariance (QCCR) or Regression Analysis. The association between the independent variable Q25A and each of the dependent variables (Q6.1-Q6.14) was therefore examined using correlation coefficients. None of the variables whose correlations should be examined is normally distributed, so to calculate the correlation it was necessary to apply a non-parametric method, namely the Spearman correlation coefficient.

Given that the independent variable (Q25A) and all dependent variables (Q6.1 – Q6.14) are ordinal, with four possible answer categories, Cramer's correlation coefficient was calculated based on the Chi-square test of the association of two nominal or ordinal variables.

The correlation coefficients and their significance and the number of traffic participants are shown in Table 2.

**Table 2. Correlation coefficients and their significance (Spearman's and Cramer's) between the 1st set of dependent variables and the independent variable Q25A****Tablica 2. Koeficijenti korelacije i njihova značajnost (Spearmanov i Cramerov) između 1. skupa zavisnih varijabli i nezavisne varijable Q25A**

Variables	Spearman Test	Significance	N	HI square	Cramer correlation	Significance
Q6.1. exceeding the speed limit by 20 km/h	-.151	<b>0.000</b>	1732	58.93	0.106	<b>0.000</b>
Q6.2. exceeding the speed limit from 21 to 50 km/h	-.112	<b>0.000</b>	1732	36.15	0.083	<b>0.000</b>
Q6.3. exceeding the speed limit by more than 50 km/h	-.064	<b>0.008</b>	1732	16.19	0.056	0.063
Q6.4. driving a vehicle after previous consumption of alcohol	-.129	<b>0.000</b>	1732	34.19	0.081	<b>0.000</b>
Q6.5. overtaking other vehicles in a place where this is not allowed	-.074	<b>0.002</b>	1732	14.30	0.052	0.112
Q6.6. taking away the right of way for other vehicles to pass	-.059	<b>0.014</b>	1732	19.88	0.006	<b>0.019</b>
Q6.7. taking away the right of way for pedestrians to pass (not stopping at the pedestrian crossing)	-.075	<b>0.002</b>	1732	25.54	0.070	<b>0.002</b>
Q6.8. not using a seat belt while driving	-.086	<b>0.000</b>	1732	34.34	0.081	<b>0.000</b>
Q6.9. driving an unregistered vehicle	-.029	0.225	1732	16.24	0.056	0.062
Q6.10. driving a vehicle during the ban due to prescribed penalties	-.059	<b>0.014</b>	1732	24.62	0.069	<b>0.003</b>
Q6.11. passing through a red light at a traffic light	-.002	.0938	1732	11.78	0.048	0.226
Q6.12. illegal use of mobile phones while driving	-.098	<b>0.000</b>	1732	23.67	0.067	<b>0.005</b>
Q6.13. not wearing a protective helmet when riding a motorcycle	.001	0.977	1187	12.75	0.060	0.174
Q6.14. failure to maintain a safety distance between vehicles	-.117	<b>0.000</b>	1732	30.47	0.077	<b>0.000</b>

By examining Table 2, which shows the correlation coefficients and their significance (Spearman's and Cramer's) between the 1st set of dependent variables and the independent variable Q25A, a large number of significant correlation coefficients were observed between the independent variable Q25A (Have you ever experienced a traffic accident either as a pedestrian, driver of a car, motorcycle, bicycle, etc?) and 11 dependent variables representing the area of violation of traffic regulations, namely: (Q6.1-Q6.8, Q6.10, Q6.12, Q6.14).

All correlation coefficients whose significance is less than 5% (0.05) are statistically significant

at the  $p < 5\%$  significance level. It is also evident that all statistically significant correlations are negative. This means that those road users who recently experienced a traffic accident as pedestrians or drivers only sometimes or even never violate traffic regulations.

Cramer's correlation coefficient between the variable Q25A (Have you ever had a traffic accident as a pedestrian, car driver, motorcycle, bicycle, etc.) and each of the variables of traffic violations is statistically significant at a significance level of  $p < 0.05$  to  $p > 1.95\%$ . Independent or criterion variables that statistically significantly correlate with variable Q25A are: Q6.1 (speeding

up to 20 km/h above the permitted speed limit), Q6.2 (speed exceeding 21 to 50 km/h above the permitted speed limit), Q6.4 (driving vehicle after previous consumption of alcohol), Q6.6 taking away the right of way for other vehicles, Q6.7 (taking away the right of way for pedestrians), Q6.8 (not using a seat belt while driving), Q6.10 (driving a vehicle during a ban due to prescribed penalties), Q6.12 (illegal use of mobile phones while driving) and Q6.14 (failure to maintain a safe distance between vehicles).

Two dependent variables, namely Q6.3 (exceeding the speed limit by more than 50 km/h) and Q6.5 (overtaking other vehicles in a place where this is not allowed) are significantly related to the independent variable Q25 based on Spearman's correlation coefficient, while according to Cramer's according to the correlation coefficient, they are not statistically significantly related to this independent variable.

It can be concluded that traffic participants who have recently experienced a traffic accident in any capacity, as car drivers, very rarely violate traffic regulations and that their experience is associated with traffic behavior that has changed in a positive direction. Based on the obtained results, it can be concluded that the H1 hypothesis has been confirmed.

### The connection between the experience of being injured in traffic and the punishable behaviour of passengers and pedestrians

In order to examine the relationship between only one independent variable (Q25A-Have you ever experienced a traffic accident, either as a pedestrian, driver of a car, motorcycle, bicycle, etc.) and dependent variables that form a set of criterion variables, namely Q9.1-Q9.5 - punishable behaviours of passengers and pedestrians, it is not possible to perform Canonical Analysis of Covariance (QCCR) or Regression Analysis. The association between the independent variable Q25A and each of the dependent variables (Q9.1-Q9.5) was therefore examined using correlation coefficients. None of the variables whose correlations should be examined is normally distributed, so to calculate the correlation it is necessary to apply a non-parametric method, namely Spearman's correlation coefficient.

Given that the independent variable (Q25A) and all dependent variables (Q9.1 – Q9.5) are ordinal, with four possible answer categories, Cramer's correlation coefficient was also calculated based on the Chi-square test of the connection between two nominal or ordinal variables.

The correlation coefficients and their significance and the number of road users are shown in Table 3.

**Table 3. Correlation coefficients and their significance (Spearman's and Cramer's) between the 1st set of dependent variables and the independent variable Q25A**

**Tablica 3. Koeficijenti korelacije i njihova značajnost (Spearmanov i Cramerov) između 1. skupa zavisnih varijabli i nezavisne varijable Q25A**

Variables	Spearman Test	Significance	N	Hi-square		Significance
Q9.1. not using a seat belt while sitting in the passenger seat	0.073	<b>0.001</b>	2072	25.50		<b>0.011</b>
Q9.2. not using a seat belt while sitting in the back seat	0.018	0.406	2072	11.97	0.044	<b>0.215</b>
Q9.3. not fastening children with seat belts in the car or not using prescribed child seats	0.023	0.290	2072	7.51	0.035	0.585
Q9.4. as a pedestrian - crossing the road in an unmarked place (where there is no pedestrian crossing)	0.084	<b>0.000</b>	2072	33.77	0.074	<b>0.000</b>
Q9.5. in the function of pedestrians - crossing the road at the pedestrian crossing when the red light for pedestrians is on	0.028	0.202	2072	17.41	0.053	<b>0.043</b>

A review of Table 3 shows significant correlation coefficients between the independent variable Q25A (Have you ever had a traffic accident as a pedestrian, driver of a car, motorcycle, bicycle, etc.) and two dependent variables that represent the area of punishable behaviour of passengers and pedestrians, namely: Q9. 1 (not using a seat belt while sitting in the passenger seat) and Q9.4 (as a pedestrian - crossing the road in an unmarked place where there is no pedestrian crossing).

All correlation coefficients whose significance is less than 5% (0.05) are statistically significant at the  $p < 0.05$  significance level. It is observed that all statistically significant correlations are positive. This means that those road users who have recently experienced a traffic accident as pedestrians or drivers often do not use a seat belt while sitting in the passenger seat and often cross the road as a pedestrian in an unmarked place. With this, hypothesis H2 is only partially confirmed, as a statistically significant connection with only two variables was proven, and the expected negative direction of the relationship was not proven.

Cramer's correlation coefficient between the Q25A variable and each of the punishable behaviour variables of passengers and pedestrians is statistically significant if the significance level is  $p < 0.05$ . Independent or criterion variables that statistically significantly correlate with variable Q25A are: Q9.1 (not using a seat belt while sitting in the passenger seat), Q9.4 (as a pedestrian - crossing the road in an unmarked place where there is no crosswalk) and Q9.5 (the function of pedestrians - crossing the road at the pedestrian crossing when the red light for pedestrians is lit).

One dependent variable, namely Q9.5, is not significantly related to the independent variable Q25 based on Spearman's correlation coefficient, while according to Cramer's correlation coefficient, it is statistically significantly related to this independent variable, because the significance of  $p < 4.35\%$  is less than the allowed 5%. Drivers who have recently been involved in a traffic accident will often cross the road in the role of a pedestrian at a pedestrian crossing when the red light for pedestrians is on.

It can be concluded that traffic participants who have recently experienced a traffic accident

as pedestrians or drivers of cars, motorcycles or bicycles very often behave punishably as passengers or pedestrians, i.e. that this previous experience has not changed their behavior when they participate in traffic as passengers or pedestrians.

## CONCLUSION

The results of the research carried out as part of the project "Research of public opinion on the state of safety, behaviour and habits of road traffic participants in the Republic of Croatia" provide good insight into certain predictors on the basis of which conclusions can be drawn about the behaviour of different road traffic participants. First of all, the results that speak about the frequency of violations of certain traffic regulations are a good indicator for traffic safety policy makers, especially in the context of monitoring planning and penal policy. In general, it can be concluded that the violation of traffic regulations is very frequent and present among the majority of different participants (drivers, passengers and pedestrians). Equally, it can be stated that there is a need for improvements in all the key factors that contribute to the occurrence of traffic accidents, and are the result of the behaviour of road users. Namely, according to the self-report of traffic participants, illegal speed, distraction, failure to use protective equipment and driving after consuming alcohol are still significantly present in the Croatian population.

The main goal of this research was to determine whether there is a connection between the experience of being injured in traffic and subsequent violations of traffic regulations, that is, whether road users refrain from violating traffic rules due to the fact that they have participated in traffic accidents or accidents. The obtained results provide evidence that road users who have recently experienced a traffic accident in any capacity, as car drivers, very rarely violate traffic regulations and that their experience is related to traffic behaviour that has changed in a positive direction. In a certain way, the results of some earlier research (*Spano et al., 2019*) were confirmed, so that based on their conclusions, it can be concluded that the lived experience increases the driver's self-regulation and awareness of the



danger of violating traffic regulations, which ultimately results in refraining from violating traffic rules. However, regardless of the proven connection, for a more complete conclusion, other variables that may appear as mediators between the connection between the experience of being injured in traffic and compliance/violation of traffic regulations should be included in the analyses. In any case, this result can be significant for the creators of future prevention programs in a way to adequately position learning about traffic accidents, which is not necessarily based on personal experience, but can be based on vicarious experience, that is, learning.

Contrary to the hypothesis, the research did not prove the connection between the experience of being injured in traffic and subsequent refraining from violating traffic regulations by vehicle passengers and pedestrians.

Although this research provides valuable results, it is still necessary to include a wider spectrum of independent (predictor) variables in the analyses in order to ultimately get a more complete insight into all the important factors that are related to the behaviour of road users and to more precisely define the directions of connection between them key factors.

## LITERATURE

Af Wählberg, A. E., Dorn, L.: Knowledge of traffic hazards – does it make a difference for safety? U: Sullman, M. i Dorn, L. (Ur.). (2012). *Traffic and Transport Psychology*. Ashgate: Aldershot.

*European Commission*. Towards a European road safety area, Doi: COM (2010) 389 final.

*European Commission (2010)*. EU Road Safety Policy Framework 2021.2030. – Next step towards „Vision Zero“ (SWD(2019) 283 final). [www.etsc.eu/PIN](http://www.etsc.eu/PIN).

Christie, R.: The effectiveness of driver training as a road safety measure: an international review of the literature. *Road Safety Research, Policing and Education Conference*, 2001, Melbourne, Victoria, Australia.

Cordellieri, P., Baralla, F., Ferlazzo, F., Sgalla, R., Piccardi, L., Giannini, A. M.: Gender Effects in

Young Road Users on Road Safety Attitudes, Behaviors and Risk Perception., *Frontiers in Psychology*, 7, 2016, 1-11. doi: 10.3389/fpsyg.2016.01412

Doecke, S., Thompson, J., Stokes, C.: “How do we prevent and mitigate crashes? Evidence from Australian at-scene in-depth crash investigations”, *Journal of Road Safety*, 31, 2020, 2, 35-43. <https://doi.org/10.33492/JRS-D-19-00254>.

Gebers, M. A.: *Knowledge and Attitude Change and the Relationship to Driving Performance among Drivers Attending California Traffic Violator School*. RSS-95-147. California Department of Motor Vehicles, 1995.

Iversen, H. i Rundmo, T.: Attitudes towards traffic safety, driving behaviour and accidents involvement among the Norwegian public, *Ergonomics*, 47, 2004, 555-572.

Laapotti, S., Kaskinen, E., Rajalin, S.: Comparison of young male and female drivers' attitude and self-reported traffic behaviour in Finland in 1978 and 2001, *Journal of Safety Research*, 35, 2004, 579-587.

Lee, L., i Humphrey, A.: *Attitudes to Road Safety: Analysis of Driver Behaviour Module, 2010 NatCen Omnibus Survey*. Department for Transport. London, 2011.

Ministarstvo unutarnjih poslova (2021). *Statistički pregled temeljnih sigurnosnih pokazatelja i rezultata rada u 2020. godini*. Accessible at: [https://mup.gov.hr/UserDocsImages/statistika/2021/Statisticki\\_pregled\\_2020\\_web.pdf](https://mup.gov.hr/UserDocsImages/statistika/2021/Statisticki_pregled_2020_web.pdf) Accessed: 20. 6. 2021.

Ministarstvo unutarnjih poslova (2020). *Bilten o sigurnosti cestovnog prometa 2019*. Accessible at: [https://mup.gov.hr/UserDocsImages/statistika/2020/Pokazatelj%20javne%20sigurnosti/bilten\\_promet\\_2019.pdf](https://mup.gov.hr/UserDocsImages/statistika/2020/Pokazatelj%20javne%20sigurnosti/bilten_promet_2019.pdf) Accessed: 13. 3. 2021. g.

Morrison, B.W., Sasaki, M. i Morrison, N. M. V.: The relative efficacy of positively and negatively valenced road safety campaign messages in improving dangerous driving attitudes, *Journal of Road Safety*, 31, 2020, 4, 13-25. <https://doi.org/10.33492/JRS-D-19-00230>

Owsley, C., Stalvey, B., Wells, J., and Sloane, M. E.: Older drivers and cataract: driving habits

and crash risk, *J. Gerontol, Series A*, 54, 1999, 203–211. doi: 10.1093/gerona/54.4.M203

Penmetsa, P., Pulugurtha, S. S.: Risk Perceptions of Crash Related Traffic Rule Violations, *Journal of Road Safety*, 31, 2020, 4, 4-12. <https://doi.org/10.33492/JRS-D-19-00231>.

Sagberg, F., Selpi, C., Piccinini, G. F. i Engström, J.: A Review of Research on Driving Styles and Road Safety, *Human Factors*, 57, 2015, 7, 1248-75.

Slavinskiene, J., Žardeckite-Matulaitiene, K., Markšaityte, R., Pranckevičiene, A., Šeibokaite, L. i Endriulaitiene, A.: Relations between Traffic Safety Attitudes and Self-Reported Risky Driving in a Sample of Young Traffic Offenders. Kaunas: Transport Means 2014, *Proceedings of the 18th International Conference*, 2014.

Spano, G., Caffò, A. O., Lopez, A., Mallia, L., Gormley, M., Innamorati, M., Lucidi, F., Bosco, A.: Validating Driver Behavior and Attitude Measure for Older Italian Drivers and Investigating Their Link to Rare Collision Events, *Frontiers in Psychology*, 10, 2019, 1-11. doi: 10.3389/fpsyg.2019.00368.

Ševrović, M., Šoštarić, M., Horvat, R., Jakovljević, M., Krmpotić, I., Švajda, M., Perković Blašković, A., Uravić, M., Leš, S.: *Analiza kritičnih čimbenika nastanka prometnih nesreća*. Zavod za

prometno planiranje, Fakultet prometnih znanosti, Sveučilište u Zagrebu, Zagreb, 2020.

Topolšek, D., Babić, D., Fiolić, M.: The effect of road safety education on the relationship between Driver's errors, violations and accidents: Slovenian case study, *European Transport Research Review*, 2019, 11:18. <https://doi.org/10.1186/s12544-019-0351-y>

Ulleberg, P., Rundmo, T.: Personality, attitudes and risk perception as predictors of risky driving behaviour among young drivers, *Safety Sci*, 41, 2003, 427–443. doi: 10.1016/S0925-7535(01)00077-7

WHO (2017). *Road safety: basic facts*, Fact sheet #1. Dostupno na: [https://www.who.int/violence\\_injury\\_prevention/publications/road\\_traffic/Media\\_brief\\_all\\_factsheets\\_web\\_rev\\_nov\\_2017.pdf?ua=1](https://www.who.int/violence_injury_prevention/publications/road_traffic/Media_brief_all_factsheets_web_rev_nov_2017.pdf?ua=1) accessed 24. 6. 2021.

Winfred, A. Jr., Doverspike, D.: Predicting motor vehicle crash involvement from a personality measure and a driving knowledge test, *Journal of Prevention & Intervention in the Community*, 22, 2001, 1, 35-42.

Yannis, G., Vardaki, S.: Investigating the self-reported behavior of drivers and their attitudes to traffic violations, *Journal of Safety Research*, 46, 2013, 1-11.

## **POVEZANOST ISKUSTVA SUDIONIŠTVA U PROMETNOJ NESREĆI I KAŽNJIVOG PONAŠANJA SUDIONIKA U PROMETU**

*SAŽETAK: Članak je dio istraživačkog projekta nazvanog "Istraživanje javnog mišljenja o stanju sigurnosti, ponašanju i navikama sudionika u cestovnom prometu u Republici Hrvatskoj". Cilj istraživanja jest utvrditi učestalost kršenja prometnih pravila od strane vozača, pješaka i putnika u vozilima i utvrditi postoji li povezanost između iskustva patnje spomenutih korisnika cesta i njihova kažnjivog ponašanja. U tu svrhu, provedeno je kvantitativno istraživanje korištenjem više metoda prikupljanja podataka, tj. kombiniranim telefonskim istraživanjem (CATI) – 60 % uzorka i online istraživanja (CAVI) – 40 % uzorka. Sudionici istraživanja stariji od 16 godina bili su iz cijele Hrvatske (N=2027). Općenito se može reći da je kršenje prometnih pravila vrlo učestalo i prisutno kod većine pojedinih korisnika cesta te da oni koji su nedavno bili u prometnoj nezgodi u bilo kojem svojstvu vrlo rijetko kao vozači automobila krše prometna pravila. Nasuprot tome, pokazalo se da samo iskustvo uključenosti u prometnoj nezgodi nije odvrćalo pješake i suvozače od ponavljanja prometnih prekršaja. Dobiveni rezultati imaju praktičnu vrijednost, posebno u planiranju preventivnih programa i strategija, dok su ograničenja istraživanja u činjenici da je korištena samo jedna varijabla za koreliranje počinjenja prometnih prekršaja, bez uzimanja u obzir drugih poznatih prediktora kažnjivog ponašanja u prometu.*

**Ključne riječi:** sigurnost cestovnog prometa, kršenje prometnih pravila, prometne nesreće, vozači, putnici, biper (dojavljivač)

*Izvorni znanstveni rad  
Primljeno: 11.4.2022.  
Prihvaćeno: 13.10.2023.*