Longitudinal Evaluation of Recorded Road Collisions During the period of 1994 - 2016: Problem mapping and correction routing

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Abstract

Addressing the long-lasting problem of road collisions, which the Police have been called upon to manage over time, the present study records and evaluates the characteristics of road collisions in Cyprus between the years 1994 and 2016. Quantitative analysis of Cyprus Police raw data on road collisions was conducted, using descriptive and inferential methods, with outcomes being supported by recent literature on road safety. The results yielded substantial findings regarding road collisions at national level, contributing factors, policing and prevention practices as well as shortcomings regarding research on road collisions in Cyprus. Suggestions target both existing and future practices in terms of policing, training, awareness and research.

Keywords: *road collisions, accidents, traffic casualties, police, policing*

Introduction

Road collisions are a major cause of death worldwide. According to the World Health Organization (WHO, 2020), every year, 1,35 million people lose their lives in road collisions, with this being the most frequent cause of death among children between the ages of 5 to 14 and young people between 15 to 29, as well as the primary cause of accidental death in adults (WHO, 2018). Previous research carried out on road safety has also shown

that, despite some recorded progress, the problem remains unresolved (OECD, 2008; Peden et al., 2004). In fact, the World Health Organization estimates that by 2030 road collisions will be ranked fifth among the major causes of death (WHO, 2016). Moreover, according to existing literature, road collisions are the first cause of accidental death or injury worldwide and their causes and consequences are largely attributable to human error, the environment, and the vehicles involved (Pelekis & Skordilakis, 2012). In Cyprus, road collisions are a major socio-economic and public health issue with multiple negative effects and consequences on many levels, including on a personal, family and societal level.

Considering the limited published research on road and traffic safety in Cyprus, the current article analyses and presents important information about the factors that contribute to road collisions in Cyprus and elaborates how these are used in policy planning in order to promote and implement new initiatives in road safety. Specifically, the article explores the longitudinal evolution of the characteristics of road collisions recorded in Cyprus between 1994-2016 in an effort to present new or corrective practices in the field of road safety and the prevention of road collisions. Additionally, it deals with methods of policing, which are assessed in terms of their effectiveness.

Background

Chen et al. (2000), Shope (2006), and Maniati & Pitsikas (2009) view road collisions as an event that can be discussed in terms of three distinct phases: before, during and after the collision. They observed that in each phase, road collisions were mainly attributed to the vehicle, the road environment, and its users. The international literature mainly explores the aetiology of the increased number of road collisions with regard to the first phase (before the collision) and, as stated during the 3rd Road Safety Panhellenic Conference in 2005, human error is considered to be the leading causal factor (Prophilides & Botzoris, 2005). Thus, road safety prevention policies aim at improving driver behaviour and the awareness of road users. As Pelekis and Skordilakis (2012) indicate, in order to achieve a significant fall in road collisions, it is imperative that road safety education and awareness begin from a very young age.

In line with the above, the risk of a road collision increases as a result of drivers' tendency to violate traffic regulations, including speeding and lack of concentration (West et al., 1993; Nabi et al., 2005; Kardara et al., 2009). For example, in a survey by Kardara et al., drivers who had greater involvement in road collisions also reported frequent traffic violations. It should be noted that, in the aforementioned research, "violation acts" are described as the deliberate deviation from safe driving, such as red traffic light violations, and not the accidental failure of, for example not checking the side mirror. Hence, a great

number of collisions is not due to drivers' lack of ability to drive safely, but due to their tendency to violate the traffic code.

Driver behaviour is one of those characteristics that traffic planners cannot control. The geometrical and operational features of a road environment can be designed for the purpose of assisting drivers to use it more efficiently. Yet, driver behaviour is not regulated by these or any other road network attribute (Pelekis & Skordilakis, 2012). Equally, even though enormous amounts of money are spent to construct and repair the road network (Buse et al., 2005) and vehicles are safer than ever, the behaviour of drivers is still far from ideal (Polydoropoulos & Kamargianni, 2010). Nowadays, the road network is more complicated, causing stress and anxiety to drivers. This may in turn lead to aggressive driving behaviour, low levels of concentration and increased collision rates (Christodoulaki & Bakatsaki, 2006).

Consequently, various prevention strategies are employed. Specifically, the police and mainly their traffic departments have a key role in preventing Traffic Code violations. While changing mindsets through traffic education is the long-term goal, organized and systematic policing can be an effective immediate prevention method (Agapakis & Migiakis, 2003).

In the case of Cyprus, the aetiology of road collisions is constantly under investigation. Police gather data in connection with each road collision under their jurisdiction. Non-serious or damage only road collisions are dealt with by insurance companies, whereas police mainly investigate those involving fatalities or serious injuries. They prepare descriptive reports on the number, type and causes of these collisions, which include data regarding the time that accidents occur, the persons involved, and the consequences (fatal, seriously or slightly injured and damage only). Nevertheless, factors relating to road collisions need to be thoroughly examined and substantiated correlations between the parameters involved and their effects must be established.

In view of the data relating to road collisions, the deficiencies, as well as the constraints arising highlighted in previous paragraphs, the following analysis was carried out.

Methodology

A literature review was initially conducted with regard to the theoretical background of road safety and its developments. Following this, a quantitative analysis of Cyprus Police raw data on road collisions between 1994 and 2016 was conducted.

Specifically, for each road collision reported and dealt with by the police, a specific printed form is used by the police officer visiting the scene to record all information, concerning the road collision, as well as the people and vehicles involved. All data recorded on these forms is then recorded electronically. Therefore, the statistical analysis conducted for this study was based on the main variables recorded on the relevant police printed form.

However, it should be pointed out that there were some gaps in the recorded data, particularly for the early years of the period 1994 to 2016, due to the absence of a digital data recording system. This has led to restrictions regarding the analysis of additional variables and levels. Nevertheless, the following analysis presents the most important attributes of road collisions in Cyprus.

Besides the descriptive statistics used for understanding and reporting the main variables and factors in road collisions, inferential statistical analysis such as the Pearson chi-square test ($\chi 2$) was applied using SPSS software, to further explore the relationship between dependent and independent variables. For simplicity purposes, only statistically significant results are presented, whereas other non-significant outcomes are omitted. Finally, the graphs and tables presented in this study were created using Microsoft Excel.

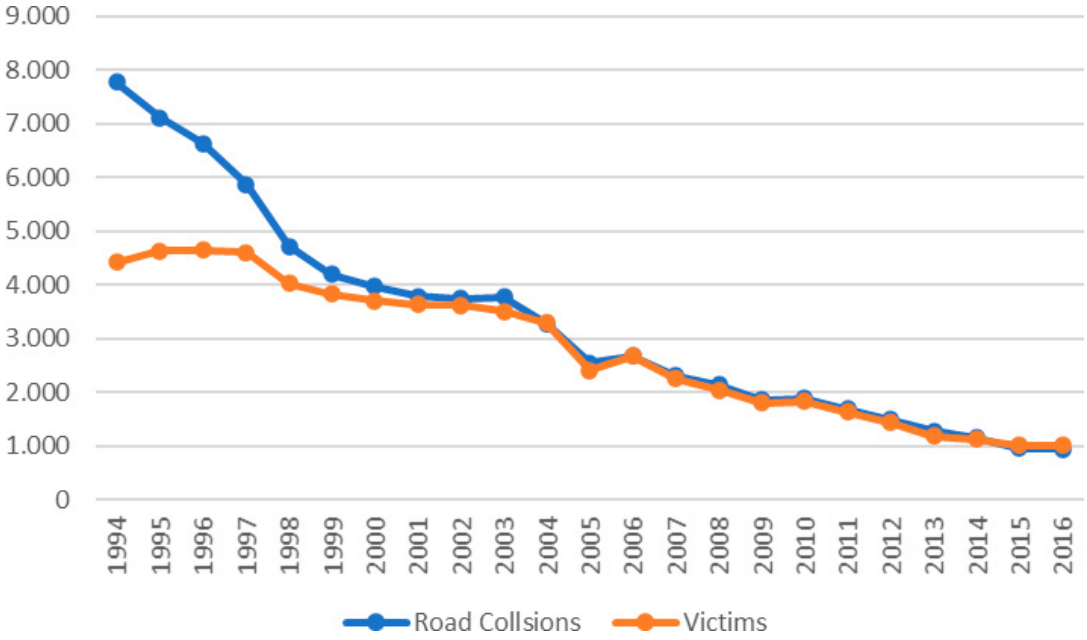
Data Analysis and Results

Various variables relating to road collisions were identified and examined within the framework of the study, including the following:

Trend over time

The analysis of the data collected revealed a decrease, both in the total number of road collisions and the number of fatally, seriously or slightly injured victims for the period 1994-2016. In particular, as shown in Figure 1, a total of 7,774 road collisions with 4,425 victims were recorded in 1994, while a total of 942 road collisions with 1,010 victims were recorded in 2016. A noteworthy reduction of 88% in road collisions and 77% in the number of victims is therefore observed.

Figure 1. Road Collisions and Victims (1994-2016).



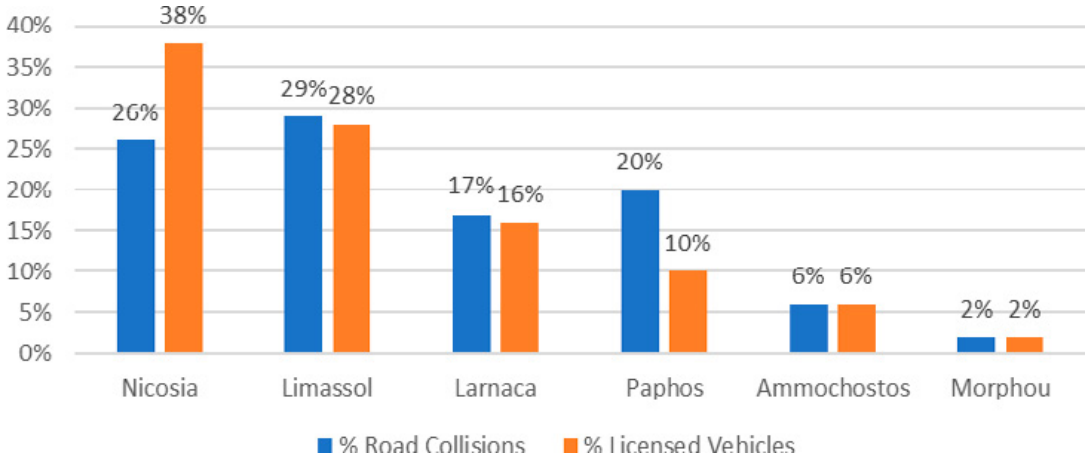
Overall, a significant decrease in all types of road collisions is identified (fatal collisions, serious and slight injuries and damage only). Of great importance is the reduction observed in the latter category of road collisions recorded by the police for the same period. This is attributed to the greater involvement of insurance companies in these cases.

The current analysis concludes that the number of both fatalities and injuries due to road collisions per 100,000 inhabitants decreased from 686 in 1994 to 118 in 2015, with a steady downward tendency in road collisions detected in all districts. These figures are discussed in further detail below.

Area

As shown in Figure 2, most of the collisions were recorded in Limassol and Nicosia, the largest districts in Cyprus, with 29% and 26% respectively. Interestingly, the rate of collisions in Nicosia (29%) was much lower than the percentage of licensed vehicles (38%). The opposite is noticed in Paphos where the percentage of collisions (20%) outweighs the percentage of licensed vehicles (10%). It is also worth noticing that the main categories of vehicles involved in the road collisions under investigation were cars (84%), motorcycles (12%), trucks (3%) and buses (1%).

Figure 2. Percentage of Road Collisions and Licensed Vehicles per District (1994-2016).

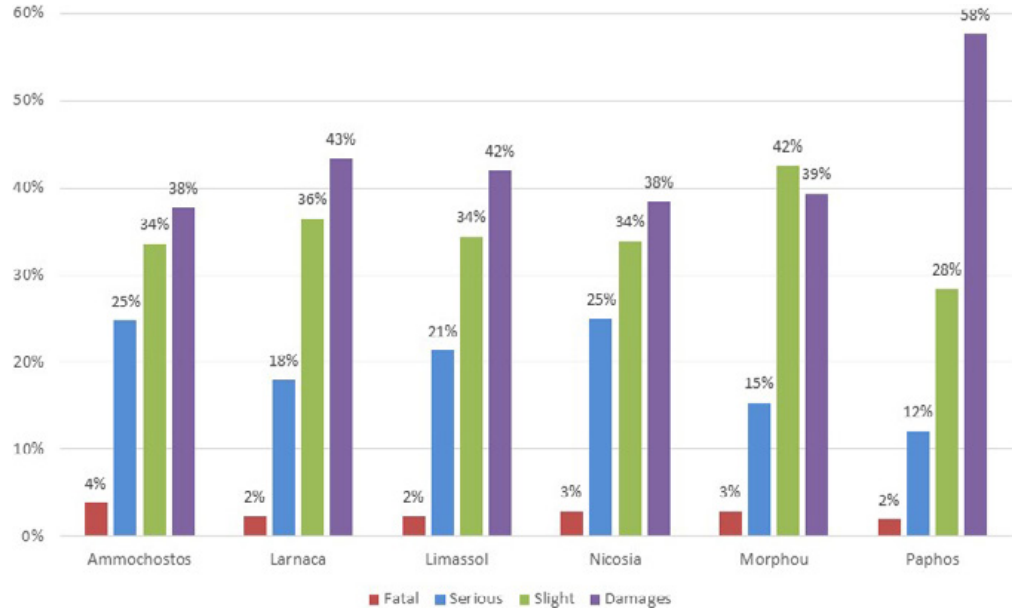


Moreover, after the relevant statistical test chi-square ($\chi 2$) was carried out, a significant association (p-value≤0.05) was found to exist between the severity of road collisions and the district where they occurred. Specifically, the percentages for the categories of fatal and serious road collisions in Ammochostos and Nicosia were higher in relation to those for other districts. As shown in Figure 3, the percentages for these two categories in Ammochostos amount to 4% and 25% respectively, while for Nicosia they were 3% and 25% respectively. The percentages of 3% for the fatal road collisions for the Morphou region and 42% for slight road collisions were also high. In contrast, in Paphos, the rates of fatal and serious road collisions were limited to 2% and 12% respectively, while a large proportion (58%) was recorded for road collisions with damage.

A further factor examined was the number of road collisions in relation to the time they occurred, that is, the day and the hour. Most road collisions occurred on Fridays and Saturdays (15% respectively), while the days with the lowest percentages were Wednesdays and Tuesdays. Unlike other road collisions, fatal road collisions present an increasing trend throughout the week to reach a peak on Sundays, with a percentage of 19%. With regards to the hours that the road collisions occurred, the analysis showed that most of them (7%) took place between the hours 17:00-17:59, while an important percentage was recorded in the afternoon, between 16:00-16:59 and 18:00-18:59 (6% and 7% respectively).

The majority of road collisions (63%) occurred during the daytime. A large number of collisions (27%) occurred at nighttime on roads with road lighting, while the percentage for accidents occurring at night on roads without road lighting was 6%. In the case of fatal road collisions, the rate recorded at night on roads without road lighting was 17%. In terms of the place that road collisions occurred during the period under study, the majority (83%) occurred in a residential area and 17% in a non-residential area.

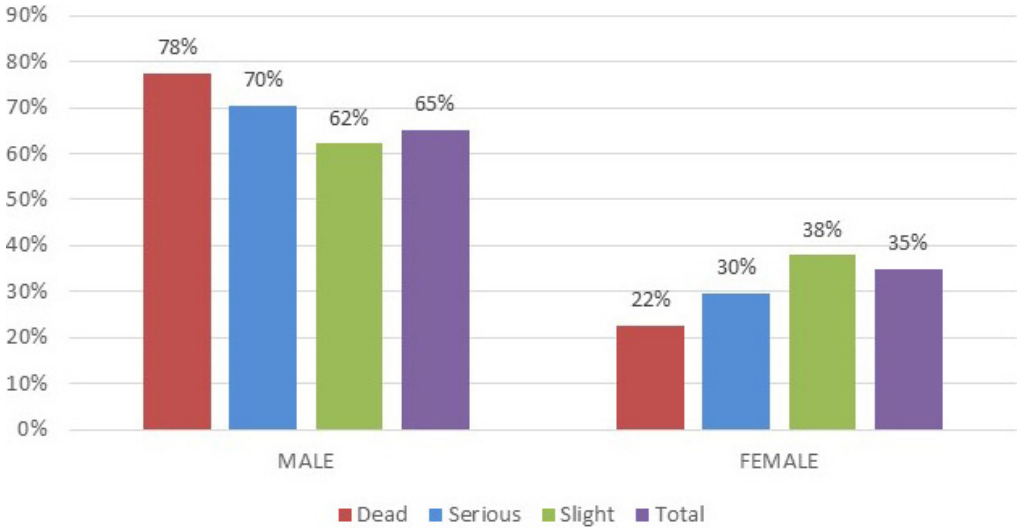
Figure 3. Severity of Road Collisions per District (1994-2016).



Victim demographics

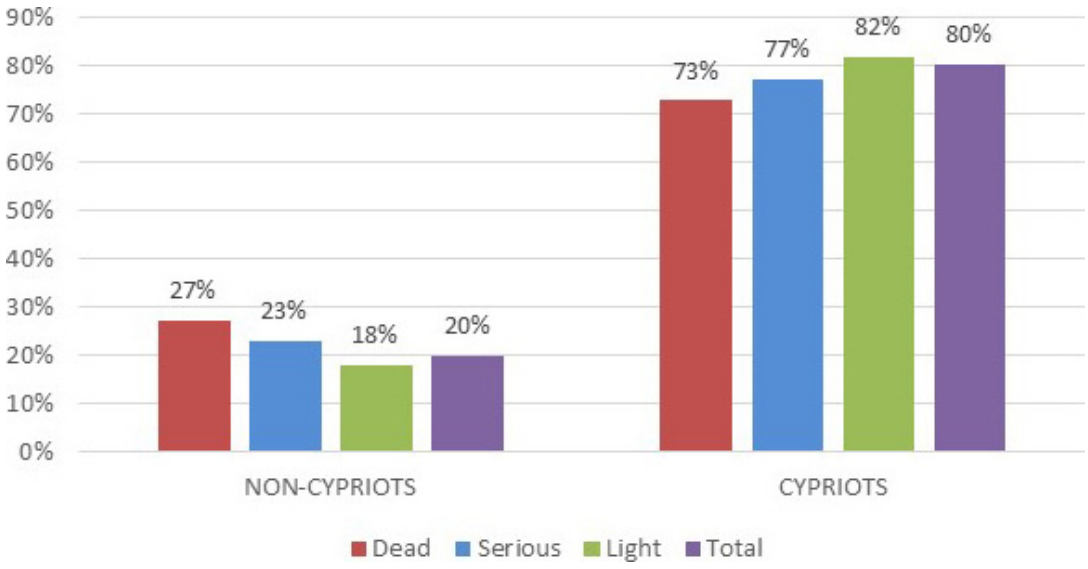
As far as the demographics of the road users are concerned, various points were observed. With regard to gender, the majority of the persons involved in road collisions were men (65%), while the rest (35%) were women. The relevant statistical test chi-square ($\chi 2$) revealed a significant association between the severity of road collisions and gender (p-value ≤ 0.05). As shown in Figure 4, more men were involved in fatal and severe road collisions, while the percentage of women involved was higher for non-serious collisions.

Figure 4. Victims by Injury Severity and Gender (1994-2016).



In terms of the nationality of the victims, as shown in Figure 5, 80% were Cypriots while 20% were nationals of other countries. The relevant statistical test chi-square ($\chi 2$) has shown a significant association (p-value≤0.05) between the seriousness of the road collision and nationality, with nationals of other countries more likely to be involved in fatal and serious road collisions than Cypriot nationals.

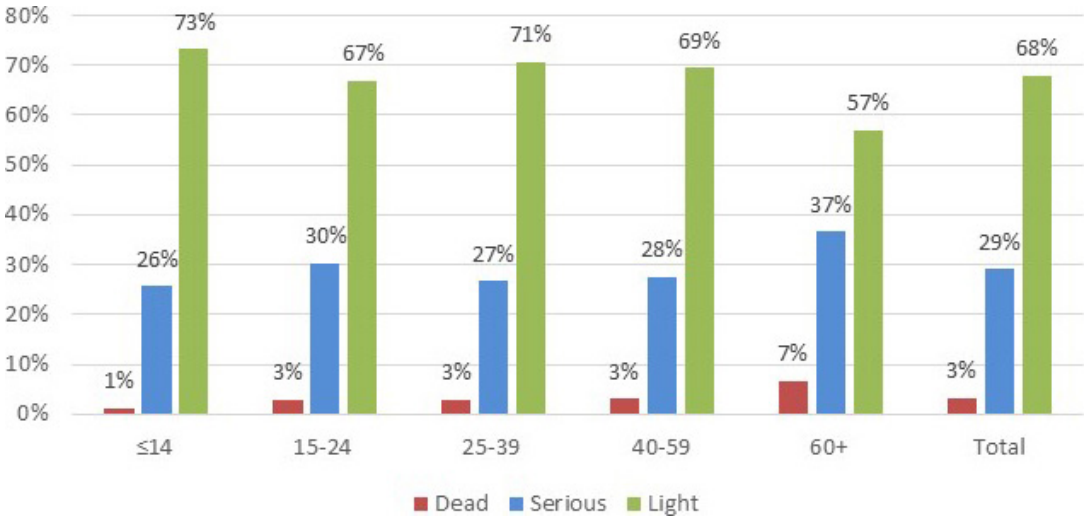
Figure 5. Victims by Injury Severity and Nationality (1994-2016).



With regard to the age of the victims of road collisions, most of them belong to the age group of 15-24 years of age (32%). The aetiology behind the collisions in which people between the ages 15-24 were involved includes distracted driving, speeding and the violation of traffic signs (13%, 12% and 11%, respectively). A significant relation (p-value≤0.05) was observed as well, after using test chi-square ($\chi 2$), between the severity of the road collision with the age group. According to Figure 6, a higher percentage of older people (60+ years) were involved in fatal and severe road collisions, with 7% and 37% respectively. The involvement of people between the ages 15 – 24 in serious collisions (30%) is high too.

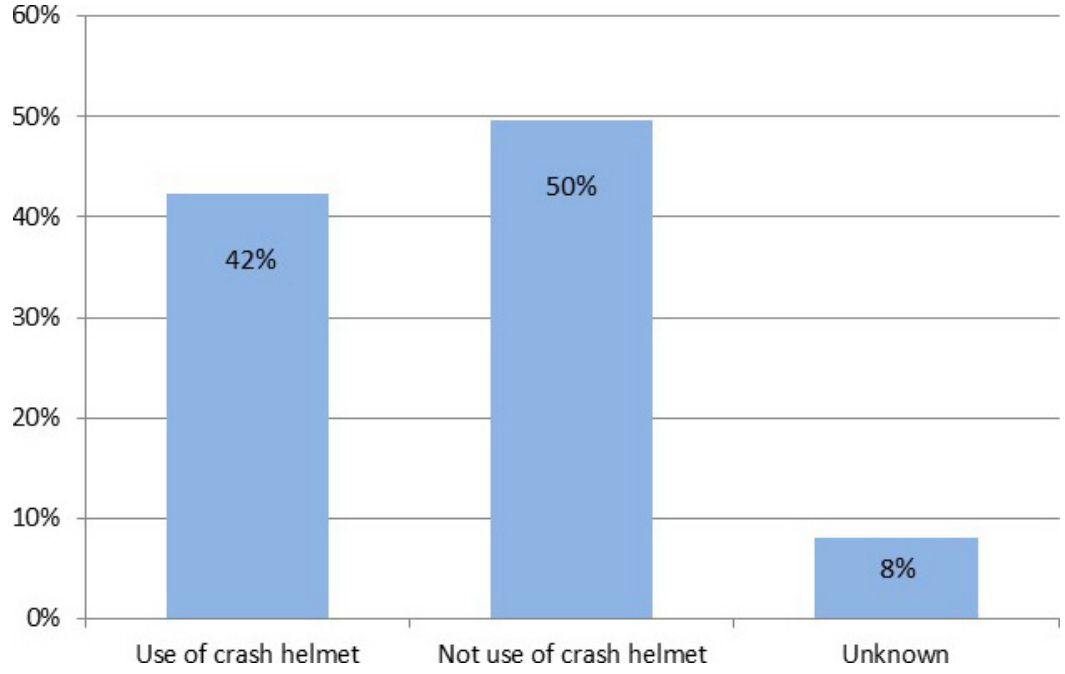
In line with the aforementioned, the main causes of road collisions identified for the period of 1994-2016, were negligent and reckless driving, not keeping a safe distance between vehicles, and traffic signal violations (12%, 11% and 11%, respectively). Likewise, for fatal road collisions, the main causes recorded during the above-mentioned period were speed, negligent and reckless driving, and driving under the influence of alcohol (20%, 16% and 15%, respectively).

Figure 6. Victims by Injury Severity and Age (1994-2016).



With regard to road users' behaviour, as shown in Figure 7, 50% of motorcyclists, who were involved in road collisions, did not use a protective helmet, with those who suffered a fatal road collision accounting for a percentage of 71%. Also, it is worth noticing that 71% of the drivers and passengers in vehicles involved in road collisions were wearing a safety belt, while in the case of the fatal road collisions, the respective percentage was only 29%.

Figure 7. Fatalities in relation to the use of Crash Helmet (1994-2016).



Finally, car drivers, passengers and motorcycle drivers (40%, 24% and 21%, respectively), were identified as the high-risk groups in terms of the status of the victims. The recorded proportion of pedestrian victims of 9% is also important and should be taken into consideration as vulnerable road users.

Discussion of Results

In the existing literature and statistical reports of the World Health Organization (WHO, 2018) and the European Transport Safety Council (ETSC, 2018), road collisions are identified as a major global public health issue.

A number of significant conclusions regarding road collisions have emerged from the findings of this study and the analysis of the Cyprus Police raw data covering the years 1994 to 2016. A declining trend was identified, both in road collisions and in the number of victims involved. However, despite the reduction observed, the problem remains serious. It is one of the main socio-economic issues of highest priority, both for society itself and Cyprus Police, as many human lives are still lost every year due to road collisions (drivers, passengers, cyclists, motorcyclists or pedestrians).

Further noteworthy factors regarding the high number of fatal road collisions, within the period under study, are the period of time (most were recorded in July) and the area they occurred (the majority were recorded in residential areas), as well as the demographics of the victims.

As most of the victims are men, belonging to the age group 15-24 years, Cyprus Police has developed road awareness programmes for this specific target group as well as even for the younger ages. Equally, another age group with high percentages for being involved in fatal and serious road collisions is the 60 years and older. The use of a relevant statistical test indicated a significant relationship between the severity of road collisions and the age group. Specifically, it became clear that the percentage of dead and seriously injured drivers in the 60 years and older age group is much higher than for the other age groups. Initiatives for this age group, such as closer monitoring or extended programmes directed at a wider audience should be considered.

Many of the causes leading to road collisions need to be further explored and the interventions applied should address them more directly. In an effort to record black spots on the road network, the Cyprus Police also uses the GIS system. This, however, does not fully represent the extent of road collisions in Cyprus, since minor road collisions are not usually recorded by the Police, but only by insurance companies. It is thus imperative to refer to the absence of a single database on road collisions (Insurance Companies, Contingency Chambers) and the need to create one. This would assist in maintaining a comprehensive record of the actual number of road collisions and the factors affecting

the overall problem in Cyprus. Equally, the existence of an integrated system for recording data on road collisions can make a significant contribution to the planning of actions, in terms of the prevention and the reduction of harm (before, during and after the collision).

Therefore, as the results of this study indicate and as documented by the findings of earlier international scientific research, the role of policing in the management of road collisions at a national level and the implementation of coordinated and multiple policing approaches are absolutely essential. Through strict traffic enforcement, policing can be a deterrent. This does not only translate into severer penalties, but also shifting policing methods towards specific directions using to-the-point strategies. Literature advocates also the implementation of systematic and organized policing for the enforcement of the Traffic Code (Agapakis & Migiakis, 2003).

Similarly, the police need to engage in wider programmes in society, such as providing incentives to citizens who respect the Traffic Code and specialized training and advice to road users, while the media must strongly support police measures and actions by publicising them. Generally, the police should make use of all the means at its disposal to promote its policing programmes, in its effort to reduce road traffic offences and the extent of road collisions and their consequences.

In line with the above and based on current literature, there is a need for further scientific study of the nature of traffic violations and, consequently, of road collisions at national level. It is also imperative to investigate the factors that lead to offensive driving behaviour and the risks taken by traffic offenders as well as by all road network users in general. The analysis of the economic, social and personal cost of the consequences of road collisions within the general population of Cyprus is also absolutely imperative.

Gaps have also been identified in relation to the modeling and evaluation of the impact (positive or negative) of the practices that have been applied in the field of road safety during the period under study but also of others that have followed. Unfortunately, this did not allow the assessment of any cost or result-benefit of the practices already implemented in the field of preventing road collisions.

Conclusion

The causes of road collisions in Cyprus are clustered primarily into three categories: human error, road environment, and the type of the vehicle itself. Most collisions, however, are attributed to human error, especially the road user's perception of danger and risky behaviour. These findings resulting from the analysis of the Cyprus Police data on the aetiology of road collisions correspond to those presented in international literature. The

causes identified include speeding, driving under the influence of alcohol, failure to wear a safety belt and protective helmets, violation of red traffic lights, as well as other Traffic Code rules. Generally, road safety issues involve people between the ages of 15 – 24, as well as people over 60 years old, while men seem to have a higher proportion of involvement in fatalities than women. Conversely, women are more often involved in non-serious collisions occurring mainly in urban areas than men. Moreover, the need for further research in the field of road safety at national level and the implementation of systematic proactive measures in terms of education, communication, and policing is obviously essential.

Additionally, further cooperation among stakeholders and more campaigns for increasing awareness should be considered. Lastly, the implementation of these suggested measures should be carried out on the basis of specific strategies, which should be supervised and evaluated in order to redefine actions. The role of policing in the management of road collisions is of great importance for society and should be considered as an issue of great priority.

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