

EVALUATION OF ROAD SAFETY INTERVENTIONS AND SOCIAL MARKETING STRATEGIES IN PROVINCIAL AREAS. CASE STUDY: ISLAND OF CHIOS, GREECE

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ABSTRACT

This paper presents a series of actions, surveys and campaigns that take place in an insular area. Based on collecting data, related to indicators of attitudes and perceptions, socio-economic characteristics, driving reactions, past experiences, it is made an effort to analyze road user's behavior in provincial areas and especially in islands and at evaluating road safety interventions and social marketing techniques pre and post. A case study is developed for the island of Chios (Greece). Since 2008 a series of actions began with vision Chios to become the first Greek county with high road safety awareness and zero deaths. The traffic accidents were recorded in statistical databases and analyzed. Meanwhile, questionnaire surveys were taken place in order to explore the factors that affect not only adults' driving and transport behavior but teenagers' as well. Then a series of campaigns about drinking and driving, speed management, eco-driving and social marketing strategies for promoting bicycle use have taken place, aiming at changing driving behaviour and promoting alternative transport modes and especially active transport. The preliminary results of the third part of the survey show that the numbers of traffic accidents have been reduced, citizens are more aware on road safety issues and that the number of cyclists has been increased significantly.

1. INTRODUCTION

Road traffic accidents are one of the leading causes of death and permanent disability worldwide. More than 3000 people die on the world's roads every day and tens of millions of people are injured or disabled every year [1].

Worldwide, an estimated 1.2 million people are killed in road crashes each year and as many as 50 million are injured. Projections indicate that these figures will increase by about 65% over the next 20 years unless there is new commitment to prevention [2].

Billions of dollars are invested every year in order to build and repair road net-works [3]. In spite of safer vehicles and roadways, driving behavior remains frustratingly far from the ideal as people today are driving in a more complex traffic environment than ever before [4].

This research, based on collecting data, related to indicators of attitudes and perceptions, socio-economic characteristics, driving reactions, past experiences, attempts to analyze road user's behavior in provincial areas and especially in islands and at evaluating road safety interventions and social marketing techniques pre and post.

A case study is developed for the island of Chios. Its population is approximately 50.000 inhabitants, a figure which doubles during summer period. Due to the limited

transport options, the inhabitants constantly use their cars or their motorcycles, thus creating congestion. This in combination with the poor infrastructure leads to traffic accidents [5].

Since 2008 a series of actions began with vision Chios to become the first Greek county with high road safety awareness and zero deaths [6]. First of all, the traffic accidents were recorded in statistical databases and analyzed by cause, age, location etc. Meanwhile, questionnaire surveys were taken place in order to explore the factors that affect not only adults' driving and transport behavior but teenagers' as well. The use of reliable data to identify problems and target resources more effectively is a key element of the Safe System approach to road safety. Then a series of campaigns about drinking and driving, speed management, eco-driving and social marketing strategies for promoting bicycle use have taken place, aiming at changing driving behavior and promoting alternative transport modes, such as bicycles. The third part of the research, that is ongoing, includes data collection in order to compare the driving and transport behavior pre and post the campaigns and evaluate them.

The preliminary results of the third part of the survey show that the number of traffic accidents has reduced, citizens are more aware on road safety issues and that the number of cyclists has increased significantly. The models that are developed in order to evaluate the effects of the road safety campaigns can improve our understanding of the characteristics associated with different patterns of driving behavior and will support the development of methods and tools to modify driving and transport behavior and potentially contribute to road safety.

2. LITERATURE REVIEW

Considerable attention in developed countries is being directed at implementing countermeasures to reduce the high rate of crash and especially the involvement of young drivers.

A growing body of research has examined the characteristics of crashes and the factors contributing to higher propensity for crash involvement. Some identified factors affecting driving behavior and transport behavior are: a) gender [8], [9], b) attitudes towards risk (Karlsson et al., 1997); c) lack of driving experience [10], [11], [2], d) lifestyle [12] and alcohol use [13], [14], e) parental restriction for youth drivers [15], [16], [17], f) social interactions and peers [1], g) other personality characteristics such as hyperactivity disorder [18], e) residence area - rural residence and infrastructure [15], [19], [20], [21]. These factors increase the likelihood of road traffic injuries occurring, not only among adults, but also in teenagers.

Especially teenagers are a special group, because they do not understand or react to complex traffic situations in the same way as adults. Their developmental immaturity means that in the traffic environment youths and teenagers lack certain abilities that adults possess and this increases their risk to road traffic crashes [2]. Gender differences play an important role in driving practices and transport behavior. Eustace and Wei [22] using FARS data for the three-year period (2001-2003) found that male teenage drivers, especially those between 16-18, were more likely to be responsible for deaths of people other than themselves. A study by Williams and Shabanova [23] using the FARS 1996-2000 databases found that young male drivers, aged 16-22 years old, had the highest rate of fatal crash involvement and the highest rate of death for which they were considered

being at-fault per licensed drivers. They also found that young males were more likely to be responsible in fatal crashes than young females. Young males are more likely to overestimate their driving ability [24], and this overconfidence has been shown to be correlated with increased risk-taking behavior involvement in accidents and violations [25], [26], [27].

Adolescent drivers tend to engage in numerous risky behaviors including speeding which has been found to significantly correlate with a greater risk for accidents [25]. They are more likely to exhibit and report greater risk-taking such as following too closely, unsafe accelerations, and rapid lane changes [9], [16]. Simons-Morton et al. [16] by recording the speed and headway of passing traffic using video and LIDAR technology, at 10 high schools nearby places, found that teenage drivers drove faster than the general traffic and allowed shorter headways, particularly in the presence of a male teenage passenger. Also, young drivers and passengers put themselves at greater risk of injury in crashes (Dellinger et al. 2004) by wearing their safety belts less often than more mature drivers and passengers [26].

Lifestyle issues can be involved as well. Karlsson and Romelsjo [29] found that early social and behavioral factors, including alcohol and other substance use, predicted men's subsequent drunk driving offenses. Begg et al. [30] used injury crashes, non-injury crashes, and all crashes as separate outcome variables, to study explanatory measures collected from 15- and 18-yearold youth. There were several significant measures predicting involvement in at least one type of crash: alcohol use, substance dependence, depression, having a motorcycle license, and low levels of family involvement.

Other individuals who can influence persons' driving style are their peers. Gregersen and Bjurulf [24] developed a model in which other factors were shown to influence driver behavior, such as attitudes of others. Teenagers who socialize with others who display risky behaviors are more likely to engage in that type of behavior [34]. Shope et al. [12] analyzed statewide driving data for 4813 subjects. They concluded that those who are susceptible to peer pressure have more offenses and crashes. The driving behavior of peers sets a norm that is an understandable influence on drivers. Peer passengers can also influence drivers' behavior, as seen in the negative influence of a male passenger on male drivers, and the moderating effect of a female passenger on drivers of both genders [16].

Situational factors, such as rural residence, geographical location, family living structure, are reported to affect driving and riding [31], [32], but little is known about how environmental variables (e.g. living arrangement, residence, infrastructure) affect sensation seeking and driving behavior [33]. Abdel-Aty et al. [19] by analyzing the 1994 and 1995 Florida accident databases found that residence plays an important role in driving behavior. By classifying residency as in-state (local and in-state drivers) and out-of state (out-of-state and foreign) concluded that out-of-state drivers experience higher percentages of alcohol/drug-related accidents for the younger age groups. In another survey, Abdel Aty et al. [20] using traffic and roadway data from Roadway Characteristics Inventory (RCI) database for State Road 50 and negative binomial modeling technique found that heavy traffic volume, narrow lane width, larger number of lanes, urban roadway sections, narrow shoulder width and reduced median width increase the likelihood for accident involvement. Clearly, more research is needed to define the interrelationship between type of residence and transport and driving behavior.

In the past, active transportation to school offered an important source of daily physical activity for youth. More recently, however, factors related to distance, safety, or physical or social environments may have contributed to the proportion of children who travel to school by motorized vehicle [35]. Fulton et al. [35] using a sample of boys and girls aged 8 to 18 years found that overall, 14% of children and adolescents reported Active Transportation to School (ATS). ATS was more frequent among boys (16.6%) than girls (11.1%), and among children in lower than upper grades.

The above mentioned factors are used to develop an extended framework of adults' and high school students' driving behavior. Exploring factors such as attitudes and perceptions, activities, trips, transport mode, licensure, past experiences, parental behavior, social networking and demographics, provides a better understanding of accident causes and allows for the development and implementation of specific preventive road safety measures.

3. CASE STUDY: GREEK INSULAR AREAS, THE ISLAND OF CHIOS

Road traffic accidents in Greece result in about 1700 deaths, 2000 heavy injuries and 17000 injuries per year [36]. Young drivers aged between 16 to 28 years old, are involved in the majority of these accidents. Also, teenagers are involved in a significant proportion in traffic accidents. 10% of dead, 25% of heavy injured and 8% of injured are between 12 to 18 years old.

Teenagers in Greece are allowed to obtain a driving license for a 50cc motorcycle at the age of 16 years old. However, driving schools do not undertake to teach persons for this license category, as the Greek law imposes that driving schools are responsible only for educating drivers above 18 years old for over 125cc motorcycles, cars and vans. Therefore, teenagers tend to learn to drive a motorcycle by their friends, family or by themselves.

In order to better understand the factors affecting teenagers' transport and driving behavior and the factors affecting it, a case study is developed for the island of Chios in Greece. It is worth noting that Chios' population is approximately 50,000 inhabitants, a figure which doubles during summer period, as Chios is a tourist destination. Chios has about 2,800 students in high schools aged from 12 to 18 years old. It is the 3rd city in Greece with the highest car per capita ownership (429 cars per 1000 inhabitants) and the 1st with the highest motorcycle per capital ownership (265 motorcycles per 1000 inhabitants) (Koutoura, 2009). Chios has a significant number of traffic accidents, especially during summer, Christmas and Eastern periods [36].

Due to the limited public transport availability, citizens mainly use their motorcycles and cars. Especially teenagers, and moreover these from rural areas, tend to utilize their motorcycles for their trips to school or their leisure activities with the consent of their parents.

Many accidents occur in which teenagers are involved. Teenagers are a special age group that has not developed / shaped their driving behavior yet. By investigating the factors affecting their driving style and transport mode choice training methods can be proposed that can improve not only their driving behavior but road safety as a whole. Moreover, the proposed methodology can be applied and in other cities facing the same safety issues and concerns.

Since 2008 a series of actions began with a vision of Chios becoming the first Greek county with high road safety awareness and zero deaths [5], [6]. Initially, traffic accidents were recorded in statistical databases and analyzed by cause, age, location, etc. In parallel, two questionnaire surveys took place in order to explore the factors that affect adults' and teenagers' driving and transport behavior. The use of reliable data to identify problems and target resources more effectively is a key element of the Safe System approach to road safety. Latent variable models capturing adults' risky and aggressive driving behavior and teenagers propensity for illegal driving were estimated [7].

4. METHODOLOGICAL FRAMEWORK – WORK PACKAGES

These series of surveys, actions and campaigns began in October 2008. The need of actions in order to improve road safety was imperative, as in one month (May 2008) 8 teenagers, aged between 14-17years old, were killed on road accidents. The local community asked from University of the Aegean to contribute in order to find ways to face the problem.

First of all, University of the Aegean come in contact with all local agencies, the Traffic Department of Police and Marine Police, the Hospital, the Secondary Education, local Associations and NGO's, Media, Press and all road safety stakeholders.

The first step was to record the road traffic accidents (from 2005-2010) in electronic data bases in order to analyse them by cause, by day, by time of day, by gender and age of the involved persons, by type of vehicle involvement etc. The analysis of the data shows where exactly the problem is. Also, it was recorder the tickets that police gave in 2009 and 2010.

The second step of the proposed methodology contains the literature review of road accidents, driving and transport behaviour and then the design of the methodology that was imposed in the survey in order to model the factors that affect driving behaviour and lead to road accidents. Based on the methodology it was designed two pilot questionnaires, one for adult population and one for high schools' students. The pilot survey began on November 2008 and continued until March 2009. The fifth action of the second work package referred to analysis of pilot survey results and to preliminary model estimation.

In the meanwhile, when the pilot survey was completed, began a series of campaigns that referred to speed management, alcohol and driving, courtesy on road, eco-driving, cycle to work, active transportation to school and road safety lessons at secondary education.

The third work package consists of the questionnaire refinement and full data collection that is on-going. Action 3 referred to descriptive data analysis and model estimation.

Based on the findings of third work package, it will be proposed the appropriate public policies, the design of road safety lessons at schools and the appropriate campaigns in order to improve road safety. Figure 1 shows the work packages of the Road Safety actions, surveys and campaigns that have taken place in Chios since 2008.

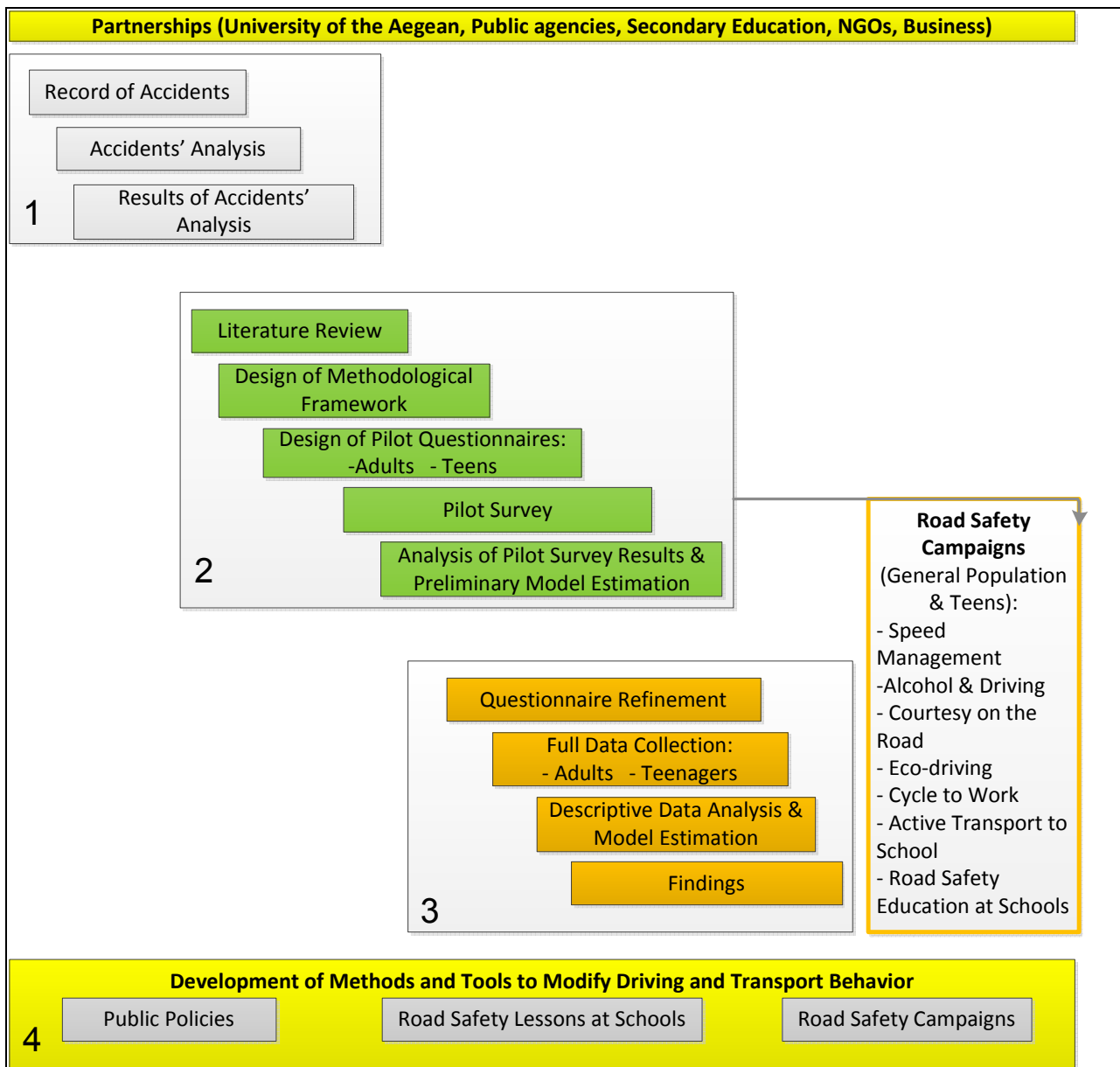
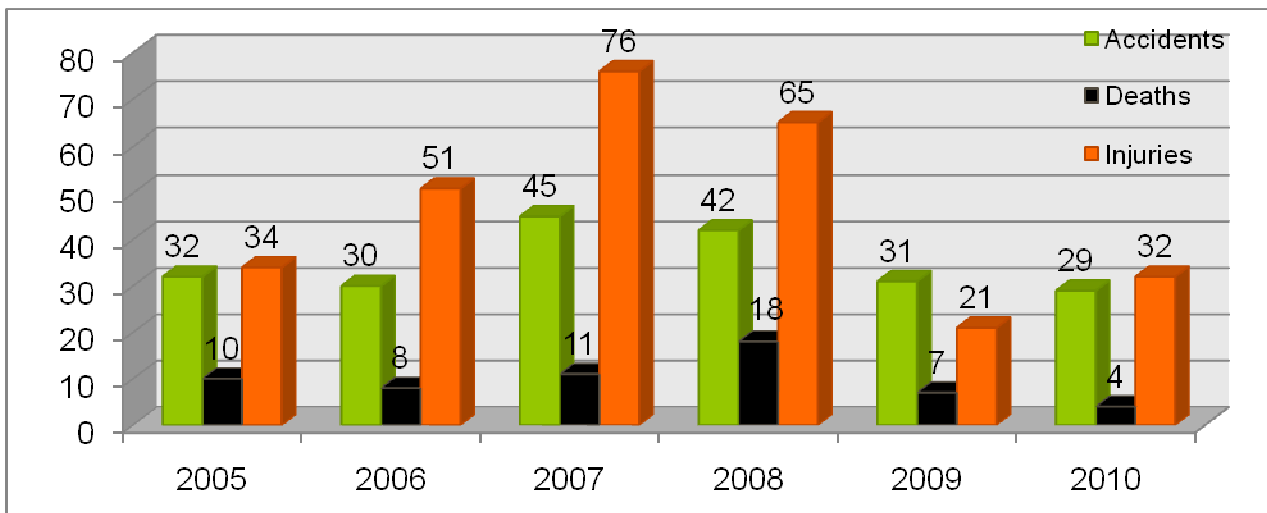


Figure 1: Work Packages of Road Safety Actions in Chios Island

5. ACCIDENTS' ANALYSIS

Generally, the total number of accidents is not extremely high (Graph 1), but the 58% of deaths are referred to youths (18-28 years old). Although it is known that there are teenagers' deaths in road traffic accidents, during the record of the accidents there were no teenagers' death recorded in the accidents' reports.



Graph 1: Road Traffic Accidents in Chios, 2005-2010

In addition, the analysis of the accidents shows that 42% of them happen in Friday night and the early morning hours of Sunday. In 68% of the accidents are involved motorcycles. The main cause of accidents, as referred in reports, is drivers' destruction and then high speed. It is widely known that the cause of a lot of accidents is alcohol consumption, but the analysis showed that only 8% of them caused by drinking and driving. Maybe this happen because the social networks are closely and police officers cover drunk drivers, in order to them be protected by the insurance of their vehicles and not to pay huge amounts to the victims.

Also the data analysis in 2008 showed that 58% of the accidents took place in the coastal road of Vrontados, where drivers can run at high speed. After Aegean University's intervention in 2009, it was constructed a barrier in the middle of the road (Picture 1) and car accidents at this point have been reduced by 95%.



Picture 1: Barrier in the Coastal Road of Vrontados

Furthermore, 33.1% of 2009's traffic tickets was for non-helmet use and 11.6% for non-seat belt use, but there was no tickets for unlicensed driving, although the majority of the teens drives unlicensed, as it is concluded from the data analysis from the survey at high schools (Polydoropoulou and Kamargianni, 2010).

6. ROAD SAFETY CAMPAIGNS

After the First work package and pilot survey began in Chios a series of road safety campaigns. For the implementation of these campaigns, it is of high significance the participation of volunteers. Students at the Department of Shipping, Trade and Transport of the University of the Aegean and members of the Chios' Sectoral Committee of Mental Health have consisted a team which in cooperation with other local and national road safety stakeholders organizes road safety campaigns. The goal is to organize at least one campaign per month for adults and three campaigns at each high school per year. Below are presented the road safety campaigns that take place in Chios.

6.1 Campaigns at High Schools

As referred above, teenagers are a special age group that hasn't developed their driving style yet. The priority of these actions is to inform and educate high schools' students about road safety. Members of the research team participated in road safety schools, in order to get the appropriate knowledge for organising road safety campaigns at schools.

Since March 2009 have participated in the campaign 22 high schools and have been educated on road safety issues more than 1600 students. Teenagers were informed about the harmful effects of road accidents, about speed management, drinking and driving, active transportation to school and they participated in road safety workshops. The photos below are from campaigns at high schools.



Picture 2: Road Safety Campaigns at Chios' High Schools

In the meanwhile, a questionnaire survey takes place in order to explore the factors that affect teenagers driving and transport behavior. In the questionnaire survey have participated until now 1150 students, aged from 12 to 18 years old. The questionnaire survey took place in high schools before the road safety lesson began. The researchers assure the students that their answers are confidential and help them to fill in the questionnaire.

The descriptive statistics of the teens' sample are presented in Table 1.

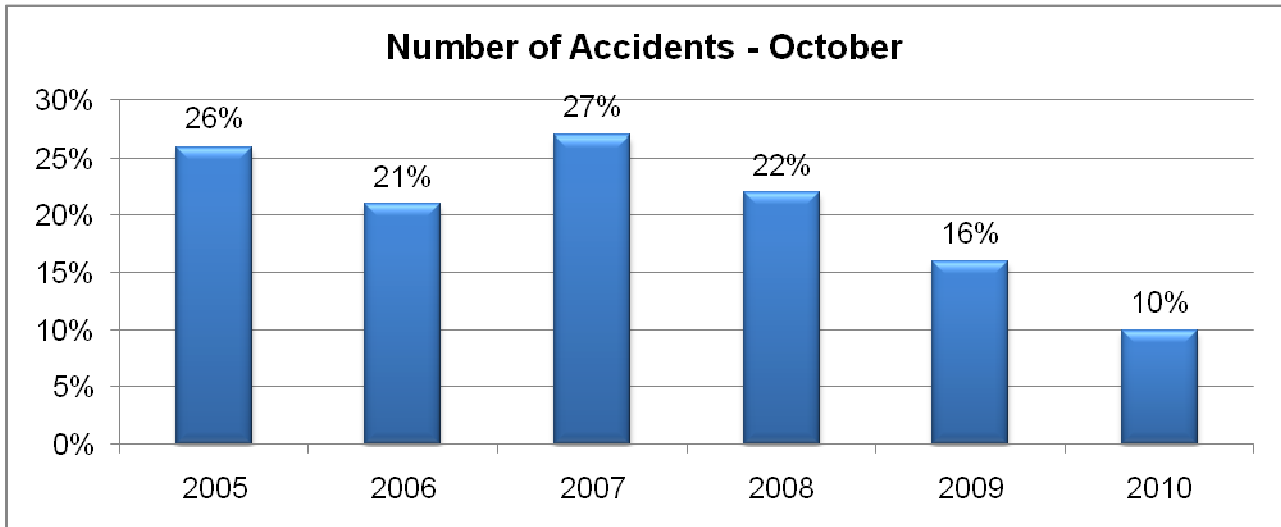
Table 1: Descriptive statistics of High School Questionnaire Survey

| | Non-Drivers N=607obs | Drivers | |
|--|-------------------------|--------------------------|----------------------------|
| | | Legal Drivers*(N=119obs) | Illegal Drivers*(N=424obs) |
| SEX | | | |
| Boys | 36% | 70% | 55% |
| Girls | 64% | 30% | 45% |
| AGE | | | |
| 12-13 | 16% | 0% | 5% |
| 14-15 | 56% | 0% | 44% |
| 16-17 | 21% | 80% | 45% |
| 18 | 7% | 20% | 6% |
| HIGH SCHOOL | | | |
| General | 95% | 85% | 85% |
| Technical | 5% | 15% | 15% |
| SCHOOL AREA | | | |
| Urban | 43% | 30% | 35% |
| Sub-urban | 57% | 70% | 65% |
| GRADES | | | |
| 9-11 | 0% | 0% | 3% |
| 11-14 | 3% | 15% | 17% |
| 14-16 | 12% | 25% | 34% |
| 16-18 | 27% | 45% | 28% |
| 18-20 | 58% | 15% | 18% |
| POCKET MONEY | | | |
| Low (€2-4) | 45% | 35% | 26% |
| Medium (€4-6) | 27% | 25% | 30% |
| High (more than €6) | 38% | 40% | 54% |
| FATHER'S OCCUPATION | | | |
| Farmer | 4% | 5% | 6% |
| Seafarer | 16% | 15% | 13% |
| Businessman | 27% | 25% | 35% |
| Employer in Public Services | 40% | 50% | 33% |
| Employer in Private Services | 13% | 5% | 14% |
| MOTHER'S OCCUPATION | | | |
| Housewife | 48% | 40% | 66% |
| Unemployed | 4% | 5% | 1% |
| Businesswoman | 8% | 20% | 8% |
| Employer in Public Services | 10% | 10% | 11% |
| Employer in Private services | 30% | 25% | 14% |
| SMOKE | | | |
| No | 92% | 50% | 65% |
| YES | 8% | 50% | 35% |
| VEHICLE TYPE (that they drive) | | | |
| Motorcycle <50cc | - | 100% | 64% |
| Motorcycle >50cc | - | 0% | 63% |
| Car | - | 0% | 18% |
| AGE FIRST TIME DROVE MOTORCYCLE | | | |
| 7-9 | - | 10% | 10% |
| 10-12 | - | 10% | 12% |
| 13-15 | - | 70% | 60% |
| 16 | - | 10% | 18% |
| AGE QUANDO BOUGHT MOTORCYCLE | | | |
| 7-9 | - | 0% | 5% |
| 10-12 | - | 0% | 13% |
| 13-15 | - | 50% | 63% |
| 16-17 | - | 50% | 19% |
| Legal Drivers = Drivers that are licensed for the vehicle type that they drive | | | |
| Illegal Drivers = Drivers that they don't have license for the vehicle type that they drive | | | |

6.2 European Night without Accidents

Since 2009, every Second Saturday of October, in cooperation with Road Safety Institute “Panos Mylonas”, University of the Aegean organizes the “Night without accidents”. The event takes place in the night clubs and bars of Chios. Volunteers inform the residents of the clubs about drinking and driving and invite them for a friendly alcohol test. Since the campaign began the accident numbers that took place in the October have been reduced by 29% (Figure 2). Picture 3 shows moments from “Night without accidents” in Chios.

Table 2: Number of Accidents that take place in Chios During October



Picture 3: Night without accidents, 2009-2010

During the campaign the research team collects data about the attitudes and perceptions towards drinking and driving and police enforcement.

6.3 Road Safety Week - Courtesy on Road

Since 2009, every third week of March, in cooperation with Hellenic Institute of Transport Engineers, Road Safety Institute “Panos Mylonas” and Chios’ Secondary Education, it is organized the Road Safety week – Courtesy on road. In this campaign except from Aegean University’s volunteers participate students from high schools as well. Volunteers pick out leaflets and inform the drivers about courtesy. On Sunday of this week, it is organized a bicycle tour entitled “Respect to Cyclists”. Photo 4 shows the poster of the Campaign of Chios and moments of the bike tour.



Picture 4: Poster of Road Safety Week – Courtesy on Road



Picture 5: Moments of Road Safety Week – Courtesy on Road, “Respect to Cyclists”

6.4 Tour de Chios

Every second Sunday per month, University of the Aegean in cooperation with the “Bacycles” Association organizes bike tours around the city of Chios. This action began on March 2009 and the number of the participants gets grower and grower.

Generally, Chios is an island with warm climate and lot of sun. The weather and the short distances affect the use of bicycle. After the implementation of this campaign the use of bicycle has been grown significantly, especially in young ageing groups.



Picture 6: Posters from Campaign “Tour de Chios”

CONCLUSIONS

Understanding transport and driving behavior is important in order to plan the appropriate programs, campaigns, measures and public policies to reduce road traffic deaths and injuries. Even if the road networks get better and cars safer, driving and transport behavior play the most important role in improvement of road safety.

This paper presents innovative multidisciplinary series of surveys and actions that take place in the island of Chios. Road safety is a multidimensional issue that must be approached from various sides.

The preliminary results of these actions show that:

- Since the campaigns began (2009-2010) the number of road traffic accidents has been reduced.
- Since the campaign began, the number of deaths from accidents has been reduced
- Road safety awareness of high school students has been grown
- Bicycle use has been grown
- Accidents due to alcohol consumption during October has been reduced

Also, the analysis of the road accidents' data from police's reports shows that:

- The accidents reports lack of information
- The police enforcement is not tough, as 78% of high school students drive unlicensed and during 2009 there was any ticket for unlicensed driving.

The findings of the researches demonstrate that there is a need to increase not only high school students' safety awareness but their parents and general population as well.

It is also apparent that police enforcement should be increased. Police controls should be intended and be stricter in order to district unlicensed/ illegal drivers and road traffic accidents. Also, the accidents reports don't provide the appropriate information about the accidents. Accident reports should be completed more carefully.

Public policies should revise the law accordingly, in order 16-18 years old drivers can be educated by driving schools.

Further actions and campaigns include special advertising campaigns aiming at promoting Active Transportation to School and in doing so at reduce of motor vehicles use. Moreover, it will be organized campaigns for parents' road safety education.

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