Epidemiological and prognostic factors associated with road traffic accidents occurring in the Center East of Tunisia.

Dorra Loghmari, Y. Hicheri, Sarra Soua., Rabeb Mbarek, M. Boudriga, F. Lihiou, Naoufel Chebili.

Sahloul Emergency Medical Service (SAMU03), Sahloul University Hospital.

Corresponding author: *Dorra Loghmari, email: dorraloghmari@yahoo.com*

Abstract

Introduction: Road Traffic accidents (RTAs) are a major public health concern associated with significant morbidity and mortality. The objective of this study was to describe the epidemiological aspects of RTAs and their prognostic factors in the center east of Tunisia.

Methods: This was a prospective cross sectional descriptive study conducted in the Emergency Medical Services area 03 of the center east of Tunisia for a period of 18 months from February 1 2020 to July 31 2021.

Results: Three hundred forty five patients were included. Among them 82.8% were male (Mean age: 33±17.2 years). The injured patient was the driver in 57.1% of cases. Traffic accidents involving pedestrians and motorists were the most frequent types of accident (18.8%). Traffic accidents often occurred on Monday and Saturday (18.2% and 16.8%) between 6 p.m. and midnight (36.2%). In 54.4% of cases, injured patients did not meet effective safety measures such as helmet use and seat belt. Etiological events related to the patients that lead to traffic accident were, alcoholism is 29 cases (26.1%), excessive speed in 25 cases (22.5%). Etiological events related to the road were poor road conditions in 34 cases (39.5%). Etiological climate related events were rainy weather in 33 cases (47.1%). Thirty-one victims were died in the first 24 hours (8.9%). Univariate analysis of epidemiological factors of victims of RTAs showed 4 factors significant predicting mortality included in our study: location of the traffic accident in the city of "Kairouan" (p=0.005), road related factors: low-light areas (p=0.029), weather related factors: rainy weather (p=0.003) and patient related factors: alcoholism (p=0.044).

Conclusion: Road Traffic accidents are of considerable socio-economic importance for our community. It is necessary to know how to manage a RTA's victim through the circumstances of the accident and its risk factors.

Keywords: Emergency Medical Services; Epidemiology; Traffic accidents

INTRODUCTION

Road Traffic accidents (RTAs) are a major public health problem; they are responsible for high rates of mortality and morbidity [1].

It is the leading cause of death in young people aged between 15 and 29 years. According to the July 2017 World Health Organization (WHO) Report, over 1.3 million people die, every year, from RTAs and 20-50 million people suffer from traumatic consequences [2].

Tunisia has the second-highest mortality prevalence in the Maghreb region. RTAs are the fifth leading cause of death, responsible for 3.3% of all observed deaths in Tunisia [3]. The 2016 National Road Safety Observatory announced around 1,505 deaths related to RTAs [3].

In Tunisia, there are around thirty accidents per day; these accidents are responsible for around four deaths and about forty serious and minor injuries per day. These figures are 50% higher than the European average [3].

This carnage strikes a considerable human heritage, which is thus destroyed with very heavy social and economic consequences. Indeed, for each person killed, injured, or disabled by a traffic accident, a whole group of other people including the family and the entourage of the person concerned are deeply affected [4].

However, we have noted a drop in the incidence of RTA since the SARS-CoV-2 pandemic, which could be explained by the confinement procedure imposed by several countries.

In Tunisia, the incidence of RTA has dropped reaching 23.4% during the confinement period; from March to June 2020. The epidemiological characteristics have also been modified [5].

We conducted this study to describe the epidemiology of RTAs in the east center of Tunisia and to investigate its associated and gravity factors. This study may help in better health resource allocation and policymaking.

METHODS

Type of study: A cross-sectional descriptive study was carried out by the emergency medical services of the East Center of Tunisia (EMS 03) during a period of 18 months; from February 1, 2020, to July 31, 2021.

The study population: Our study population was a non-probability sample of convenience.

We included all victims of RTAs occurring in the territory of the EMS 03 and which the regulation room played a part in the decision of transport. This territory of EMS 03 includes four governorates: Sousse, Monastir, Kairouan, and Mehdia. It represents 8.16% of the total surface of Tunisia.

Victims of RTCs off territory, victims of other types of accidents, and victims who died before the intervention of the EMS03 were not included in this study.

Collection of data: The data was collected from the regulation files and the intervention forms

filled by the mobile intensive care unit (MICU) at the scene of the accident. The data has been aggregated on a pre-established data collection" sheet for the study. The circumstances of the RTA were grouped into three categories: related to the patient, related to the state of the road, and related to the climate.

We did a 24-hour follow-up of victims who were transported to the emergency departments or the intensive care unit (ICU).

RESULTS

We included 345 RTA victims, 82.8% of them were male with a sex ratio M/F of 4.84.

The mean age of the victims was 33 +- 17.2 years with extremes ranging from 2 to 81 years. Victims were mainly young subjects aged between 15 and 29 years with a prevalence of 36.2%.

The majority of victims had no medical history (72.1%). Diabetes represented the most common comorbidity among victims with past medical history (35.4%). Most of the identified victims were drivers (57.1%) followed by pedestrians (24.6%) then vehicle passengers (18.3%). (Table 1)

The city of Sousse had the highest prevalence of RTA with a rate of 57.1%. In the governorate of Sousse, the "Sahloul" region had the highest prevalence of RTAs (16.7%).

In our study, we noted that the prevalence of RTAs was higher on Monday (18.2%) and Saturday (16.8%), however, it was the lowest on Wednesday (12.4%).

Table 1: Socio-demographic characteristics of the study population.

	Injured n (%)	Deceased n (%)	P
Age			
< 15 years	70 (20.2)	3 (9.6)	0.656
15 – 29 years	125 (36.2)	10 (32.2)	0.723
30 – 59 years	115 (33.5)	12 (38.7)	0.919
>60 years	35 (10.1)	6 (19.3)	0.917
Gender			
Male	286 (82.8)	28 (90.3)	0.116
Female	59 (17.2)	3 (9.7)	0.102
Comorbidities			
No	249 (72.1)	22 (70.9)	0.841
Yes	96 (27.9)	9 (29.1)	0.286
Diabetes	34 (35.4)	2 (22.2)	0.845
	23 (23.9)	1 (11.1)	0.586
Cardiovascular			
hypertension	9 (9.3)	0	-
Neurological	9 (9.3)	1 (11.1)	0.586
Psychiatric	7 (7.2)	0	
Others	5 (5.6)	4 (44.4)	0.336
Unknown	9 (9.3)	1 (11.1)	0.586
Type of road user			
Pedestrians			
Drivers	85 (24.6)	6 (19.3)	0.714
Passengers	197 (57.1)	22 (70.9)	0.569
	63 (18.3)	4 (12.9)	0.189

According to the hours of occurrence of RTA, we found that the highest rate of RTAs was during the time interval between 6 p.m. and midnight (36.2%).

Regarding the flow of accident victims, we found that the peak of accidents was in the month of February 2020 with a percentage of 27%

while the lowest accident rate was in the month of April 2020 with a percentage of 9.2 %.

Table 2: Epidemiological characteristics of RTA

	Injured n (%)	Deceased n (%)	p
Hour			
06h-12h	71 (20.5)	7 (22.5)	0.832
12h-18h	114 (33)	8 (25.3)	0.823
18h-00h	125 (36.2)	13 (41.9)	0.489
00h-06h	35 (10.3)	3 (9.6)	0.479
Day			
Monday	63 (18.2)	4 (12.9)	0.616
Tuesday	44 (12.7)	3 (9.6)	0.624
Wednesday	43 (12.4)	6 (19.3)	0.324
Thursday	44 (12.7)	4 (12.9)	0.227
Friday	48 (13.9)	4 (12.9)	0.227
Saturday	58 (16.8)	7 (22.8)	0.345
Sunday	45 (13.3)	3 (9.6)	0.624
Place			
Governorate			
Sousse	197 (57.1)	10 (32.2)	0.071
Monastir	41 (11.8)	5 (16.1)	0.116
Mahdia	49 (14.2)	4 (12.9)	0.189
Kairouan	58 (16.9)	12 (38.4)	**0.005**
Urban	238 (68.9)	15 (48.3)	0.187
Rural	107 (31.3)	16 (51.7)	0.194
Type of RTA			
Pedestrian *light vehicle*	65 (18.8)	4 (12.9)	0.196
Two wheels *light vehicle*	62 (17.9)	7 (22.5)	0.140
Two wheels	56 (16.2)	1 (3.22)	0.199
Light vehicle	47 (13.6)	6 (19.3)	0.148
Light vehicle *light vehicle*	49 (14.2)	5 (16.1)	0.096
Pedestrian *two wheels*	16 (4.6)	0	0.646
Two wheels *two wheels*	14 (4)	2 (6.4)	0.646
Light vehicle *heavy vehicle*	15 (4.3)	2 (6.4)	0.646
Light vehicle *van*	6 (1.7)	2 (6.4)	0.199
Two wheels *van*	4 (1.1)	0	0.199
Two wheels *heavy vehicle*	5 (1.4)	1 (3.22)	
Heavy vehicle	2 (0.5)	0	
Pedestrian *heavy vehicle*	2 (0.5)	1 (3.22)	
Pedestrian-bus	1 (0.2)	0	
Bus	1 (0.2)	0	

The most prevalent type of accident was a crash between light vehicles (VL) against pedestrians with a prevalence of 18.8%, followed by two wheels -VL (17.9%) (Table 2).

actors related to victims were found in 32.2% of cases. The factor with the highest prevalence of RTA injuries was alcohol consumption (26.1%) followed by speeding (22.5%), drug intake (neuroleptics, opiates: codeine, anxiolytics) (15.3%), fatigue (12.6%), and mental state (8.1%).

Regarding weather-related factors, rainy weather had the highest prevalence of RTAs (47.1%), followed by foggy weather (27.1%) than other weather conditions such as the presence of clouds or storms (25.8%). Weather-related factors were found in 20.3% of cases.

As for factors related the road conditions which were present in 25% of cases, RTAs were more likely to happen when driving on a road with basic conditions (39.5%). Poor lighting was involved in 34.8% of cases and 18.6% of cases, the road surface was slippery. Other road conditions were present in 7.1% such as traffic and roadwork.

Concerning safety measures among the drivers, only 45.4% of them wore helmets or seat belts.

According to "Vittel" criteria, regarding RTAs' kinetic elements; 54.6% of victims did not respect safety measures (no helmet or seat belt), 22.5% of RTAs were associated with high speed, 11.8% of victims were ejected, 7.6% of RTAs

were deadly for another passenger in the same accident and in 4.4% of RTAs, the car was significantly deformed.

According to the victim's type of transport, 58.5% of victims were transported by the mobile care unit team, 31.1% of them were transported by civil protection, and 10.4% by a type B ambulance or by simple means.

In our study, we had 31 (8.9%) victims died in the first 24 hours after the accident.

Most of them are young (38.7% aged between 30-59 years); male (90.3%); drivers (70.9%) and most of the drivers deceased (16 victims) did not respect safety measures (72.7%).

We conducted an analytical study focused on mortality risk factors based on the statistical significance of Pearson's chi-squared test.

The univariate analysis of the epidemiological factors of road accident victims showed only 4 statistically significant predictors of death in our population: Place of occurrence of the accident according to the governorate: Kairouan; Road related factor: Poor lighting; Weather condition: Rainy; Circumstances related to the victim: Alcohol consumption. Table 3 details these results.

DISCUSSION

In our study, we found that men are 4 times more exposed to the risk of RTAs than women are. Such a predominance has been reported in several studies: according to road safety in France in the report on accident rates of the year

2018, death on the road occurred three times more in men (2,492) than in women (756). This ratio was found in other occidental countries [6].

Table 3: Special circumstances related to RTAs

Factors	Injured n (%)	Deceased n (%)	
Related to the victim			
No particular factor	234 (67.8)	18 (58)	0.274
With particular factor	111 (32.2)	13 (42)	0.454
Alcohol consumption	29 (26.1)	2 (15.3)	0.044
Speeding	25 (22.5)	1 (7.6)	0.668
Medication	17 (15.3)	3 (23)	0.945
Mental state	14 (8.1)	1 (7.6)	0.668
Fatigue	9 (12.6)	3 (23)	0.945
Others	17 (15.3)	3 (23)	0.945
Related to weather			
No particular factor	275 (79.7)	24 (77.4)	0.012
With particular factor	70 (20.3)	7 (22.6)	0.018
Rainy	33 (47.1)	7 (100)	0.003
Foggy	19 (27.1)	0	
Others (clouds, storms)	18 (25.8)	0	
Related to the road condition			
No particular factor	259 (75)	19	0.004
With particular factor	86 (25)	(61.2)	0.013
Poor lighting	30 (34.8)	12 (38.8)	0.029
Bad road state	34 (39.5)	2 (16.6)	0.278
Slippery surface	16 (18.6)	9 (75)	0.378
Others (Traffic, roadworks)	6 (7.1)	1 (8.3) 0	

Similarly, in most countries in the world, we found that the young population was the one to pay the heaviest price in terms of traffic accidents. In our series of studies, the average age was 33 years and the most affected age group was between 15 and 29 years. In the "road safety in France "report on accident rates for the year 2018, in terms of the number of deaths and injuries, people aged between 20-24 years were the most affected by road accidents; followed by the ones aged between 15-19 year and between 25-29 years [6].

Regarding the flow of accident victims, we found that the peak of accidents was in the month of February 2020 with a percentage of 27% while the lowest accident rate was in the month of April 2020 with a percentage of 9.2 %.

These results were not found in the literature; In fact, the traffic accident rate is classically higher during summer. A study carried out in France in 2001 found that the winter months (January to March) were at a low level of accidents followed by a rise in the spring that culminates during the summer with a gradual descent during the fall [7].

The differences between our results and those found in the literature can be explained by the lockdown implemented in April 2020 for the fight against the COVID-19 pandemic; therefore, the month of February 2020 represents the most accident-prone month in our study.

The days of the week with the highest numbers of traffic accidents were Monday and Saturday.

The most accident-prone time interval during the day was from 6 p.m. to midnight, while the time interval with the lowest number of accidents was from 6 a.m. to 12 p.m.

Similar results have been found in other studies: in fact, a study carried out in France by Gayrard A et al; showed that the days at the start of the week had a lower average number of deceased accident victims at 17 deaths per day. Weekends had an average of 27 deaths per day [7]. The 2018 study by Bernagaud AS et al; showed that

there was an increase of 18% in the number of accidents during the morning rush hour (7 a.m. to 9 a.m.) and 52 % during the evening rush hour (5 p.m. to 7 p.m.) [6].

In our study, the third of the RTAs had special circumstances: the most important one was alcohol consumption in 26.1% of cases, and excessive speed in 22.5% of cases, several other studies have found similar results [8-9-10].

The subject of the contributing factors to RTAs is both complicated and recurrent in the field of road safety [11]. In fact, in the search for the causal factors of RTAs, there are several factors related to both the driver and the environment. The contribution of human factors in traffic accidents is far from being easy to isolate in accidental mechanisms. In fact, among the main human factors contributing to road accidents, we typically find speeding and alcohol consumption. Each of these variables has been the subject of abundant literature, which has largely proven their harmful effect on driving activity.

In our sample, it was found that 24% of RTAs occurred under poor weather conditions and 29.5% of RTAs were influenced by road-related factors. Among the road deaths in our study, 36.8% were associated with particular weather conditions, and 21% were associated with road-related conditions.

Several other studies showed the impact of these conditions on the incidence and severity of road accidents; A Finnish study published in 2018

assessed the relative accident risk of different road and weather conditions. The study analyzed traffic accidents on 43 major Finnish roads between the years 2014-2016 [12]. To simplify the analysis, the potentially dangerous conditions were combined into five categories: slippery road, very slippery road, poor visibility, icy rain, and slush. All road weather conditions had an increased relative crash risk of more than 50%

In our study, 54.6% of victims did not respect safety measures (no helmet or seat belt). Among the deceased victims, most of them (16 victims) did not take road safety measures, in particular wearing a helmet or a seat belt.

Similar results have been found in the literature: It was the case of the accident rate report for 2018 in France, which insisted on the importance of wearing seat belts as well as helmets. In the period 2013-2017 [6], 1,779 people who died in road accidents were not wearing their seatbelts.

LIMITATIONS

Our study was conducted during the COVID-19 lockdown, for that reason; the size of our sample was small. This may influence research findings by making p-values stray from significance affecting the ability to study associations. It is more difficult to distinguish between a real effect and a random variation.

Despite these limitations, this study offers a picture of the epidemiology of RTA and its associated factors in Tunisia, which may aid in identifying factors suitable for the development of preventive programs and the allocation of resources by Tunisian health authorities.

CONCLUSION

Our study focused on a series of 345 victims of RTAs in the territory of EMS 03 in the Center East of Tunisia. We described the epidemiological and prognostic characteristics of the RTAs. The results showed the circumstances and etiological factors of RTAs as well as the epidemiological and clinical profiles most frequently found.

The majority of victims were males (82.8%), and young with an age between 15 and 29 years (36.2%). In 18.8 % of cases, the victim was a pedestrian hit by VL, and in 17.9% of cases; the victim was a driver of a two-wheeled vehicle hit by a light vehicle. Safety measures were taken only in 45.4 % of drivers victims.

Weather-related factors were found in 20.3% of cases. Road-related factors were found in 25% of cases.

Accidents took place most frequently in Sousse (57.1%), on Monday and Saturday (18.1 and 16.8%) of cases. The injured person was taken to the emergency department by the mobile care unit team in almost half of the cases.

Through this study, we were able to identify the severity and the mortality predictive factors. Thus, all measures that can preserve life must be implemented, such as adapting the traffic environment to users and educating and training

drivers and pedestrians to change their behavior in the desired direction.

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