Driving under influence: analyzing trends in Fatal Traffic Accidents linked to Alcohol, Drugs, and Psychotropic Substances in Algeria

Zakaria Khemici

***Abstract*—Algeria, like many other countries, has witnessed a significant increase in fatal traffic accidents, leading to considerable human and material losses as well as negative repercussions on national security and the economy. Among the primary causes of these tragic incidents are alcohol, drugs, and psychoactive substances, which severely impair driving ability. This paper aims to assess the extent of this phenomenon in Algeria by diagnosing fatal traffic accidents attributed to these substances, it focuses on the drivers involved in such incidents and analyzes their spatiotemporal distribution to identify prevailing trends. Additionally, the role of traffic control efforts by security services is evaluated, particularly their effectiveness in identifying instances of driving under the influence of drugs. Furthermore, the legal frameworks established by the Algerian government are compared to those of leading countries in this field, and a comprehensive and coordinated approach that integrates legislative, operational, and awareness-raising strategies to reduce the incidence of traffic accidents is suggested.**

***Keywords*— Fatal Traffic Accidents, Driving Ability, Blood Alcohol Concentration, Safe Driving, Driving Under the Influence of Drugs, Traffic Control.**

I. INTRODUCTION

Traffic issues have emerged as a significant threat to individual and societal safety due to substantial human and material losses incurred from traffic accidents. These incidents adversely impact national security and economic stability. According to statistics from the World Health Organization for 2023, over two deaths occur every minute globally, amounting to more than 3.200 deaths daily. Traffic accidents remain the leading cause of death for children and young adults aged 5 to 29 years [1]. In Algeria specifically, statistics from security services indicate a 14% annual increase in drivers involved in fatal traffic accidents from 2020 to 2024, alongside a 15% rise in fatalities.

Traffic accidents can be attributed to various factors related to human behavior, environmental conditions, and vehicle characteristics. Recent studies have shown that human factors are primarily responsible for most traffic accidents [2]. Notably, driving under the influence of alcohol, drugs, or psychotropic substances is one of the most critical direct causes linked to human error in these incidents due to its detrimental effects on driving ability.

Despite ongoing efforts to raise awareness among drivers about the serious consequences of operating vehicles under the influence of these substances, many still underestimate the irisks involved. This underscores the need for a comprehensive understanding of traffic accidents—particularly fatal ones—related to substance use. Accordingly, the following central question is posed: "*What is the trend among drivers involved in fatal traffic accidents under the influence of alcohol, drugs, or psychotropic substances in Algeria?*" To address this question, several hypotheses have been formulated:

- Hypothesis 1: There is an increasing trend in the number of drivers involved in fatal traffic accidents while under the influence of alcohol, drugs, or psychotropic substances.

- Hypothesis 2: Drivers involved in fatal traffic accidents are more likely to be under the influence of drugs and psychotropic substances than alcohol.

- Hypothesis 3: Preventive traffic control operations aimed at detecting cases of driving under the influence of alcohol, drugs, and psychotropic substances contribute significantly to reducing traffic accidents associated with these substances.

In this paper, concepts outlined by Algerian legislation in Law N°. 01-14 of August 19, 2001, are utilized regarding road traffic organization and safety. Key definitions include:

- *Driving under the influence of Alcohol:* The Algerian legislature defines this using Blood Alcohol Concentration (BAC), prohibiting driving with a BAC equal to or exceeding 0,2 g/l.

- *Driving under the influence of drugs:* This refers to operating a vehicle while impaired by any narcotic substances or plants.

- *Saliva Drug Testing Device*: A device used for detecting drugs or hallucinogens through saliva analysis.

- *Fast Alcohol Detection Device:* A device that provides instant and accurate measurements of alcohol concentration by analyzing exhaled air.

Similarly, other concepts are used, which can be defined as follows:

- *Traffic Control:* This refers to the responsibilities undertaken by security personnel to ensure the safety of the road network and traffic flow. The primary aim is to reduce the incidence of traffic accidents caused by hazardous behaviors, excessive speed, the consumption of alcohol, narcotics, and psychotropic substances [3].

- *Positive Primary Control*: This situation occurs when initial testing for alcohol, drugs, or psychotropic substances in drivers on the road is conducted using a primary detection device, yielding a positive result.

- *Positive Control:* This term describes a scenario where preliminary test results are confirmed through laboratory analysis of biological samples, identifying the presence of drugs or psychotropic substances in the blood or determining blood ethanol content (≥0,2 g/l).

- *Fatal Traffic Accident*: Defined as a collision involving at least one vehicle on a public road that results in the death of at least one individual.

In this article, a situational approach to crime prevention is adopted as a theoretical framework. This approach encompasses a range of non-punitive measures aimed at preventing criminal acts by altering specific circumstances under which similar

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Z. Khemici is with National Institute of Criminalistics and Criminology, Algiers /Algeria. (email: zkhemici@gmail.com).

offenses may occur [4]. Rather than seeking to explain crime or identify its causes and characteristics, this framework focuses on understanding crime as an act that arises from particular situations. It emphasizes implementing necessary measures to prevent the recurrence of such acts under similar conditions through five strategies: increasing effort, increasing risks, reducing rewards, reducing incentives, and removing excuses [5]. The effectiveness of situational prevention lies in creating tailored preventive measures that specifically target types of crime committed under certain conditions [6].

Based on this framework, this paper aims to elevate the perceived risks associated with driving under the influence of alcohol and drugs. By enhancing the likelihood of detection through traffic control operations, potential offenders may hesitate to engage in such behaviors due to the increased risk of arrest [7].

II. RESULTS FROM THE LITERATURE

Research related to fatal traffic accidents involving alcohol, drugs, and psychotropic substances varies widely. Some studies endeavors, such as the study by Vanita Parekh [8], center on the concept of safe driving by elucidating its principles and prerequisites. Other studies delve into the detrimental effects of alcohol, drugs, and psychoactive substances on driving performance and the heightened risk of involvement in fatal traffic accidents under the influence of these substances. Notable examples include the works of ABBEY, H., & TALLEC, A. [9], as well as Compton, Richard P., and Berning, Amy [10], other studies have compared the effects of alcohol and drugs on driving and fatal accidents, such as the study by Beasley, Erin and others, at Canadian Centre on Substance use and addiction, 2011 [11].

Additionally, the European Road Safety Thematic Report by Charles Goldenbeld [12] underscores the compounded risks associated with the concurrent use of multiple drugs or the combination of alcohol and drugs. Furthermore, some researchers, such as Laurent Carnis, Etienne Blais [13], and Etienne Blais, Maurice Cusson [14], have explored the implementation of field measures aimed at curbing impaired driving. These studies also identify the critical conditions necessary to enhance the efficacy of such interventions in reducing traffic accidents, with a particular emphasis on their broader preventative and enforcement dimensions.

In the same context, a number of studies and reports were reviewed in order to identify the legislation of some of the by prominent countries such as Belgium, France, Spain, and Canada and the strategies applied to reduce traffic accidents under the influence of alcohol, drugs and psychotropic substances [15] [16] [17].

A. Prerequisites for Safe Driving

Driving is a complex activity that encompasses various behaviors required to operate a vehicle safely while adhering to traffic laws. Preventive driving entails compliance with traffic regulations and encompasses key characteristics such as:

- Adherence to traffic rules.
- Careful attention while driving.
- Regular monitoring of vehicle condition.
- Awareness of environmental factors affecting driving [18].

Safe driving is essential for traffic safety and demands concentration, coordination, decision-making skills, and quick reflexes [8]—all of which can be impaired by alcohol, drugs, and psychotropic substances.

B. The Effect of Alcohol on Driving Ability

Numerous studies have demonstrated that alcohol consumption significantly diminishes drivers' functional abilities [19]. The extent of impairment cotablerrelates directly with blood alcohol concentration (BAC), as detailed in Table I. It is important to note that individual factors such as weight, body fat percentage, and metabolism influence the amount of alcohol required to reach specific BAC levels.

Table I

The effect of alcohol on driving ability according to its blood concentration [20].

Blood Alcohol Concentration (g/L)	Predictable Effects on Driving
0,2	Decline in visual functions (rapid tracking of a moving target), decline in ability to perform two tasks at the same time (divided attention).
0,5	Reduced coordination, reduced ability to track moving objects, difficulty steering, reduced response to emergency driving situations.
0,8	Concentration, short-term memory loos, speed control, reduced information processing capability (e.g., signal detection, visual search), impaired perception.
1,0	Reduced ability to maintain lane position and brake appropriately.
1,5	Substantial impairment in vehicle control, attention to driving risk, and in necessary visual and auditory information processing.

The relationship between BAC and the likelihood of being involved in a traffic accident which remains even with a low concentration [10] is shown in Fig. 1, and statistical data from both the United States and Great Britain [21] indicate that the risk doubles at a BAC of 0.3 g/l, increases fivefold at 0.5 g/l, and escalates tenfold at 0.8 g/l. Higher BAC levels not only increase the probability of involvement in accidents but also heighten their severity [9].

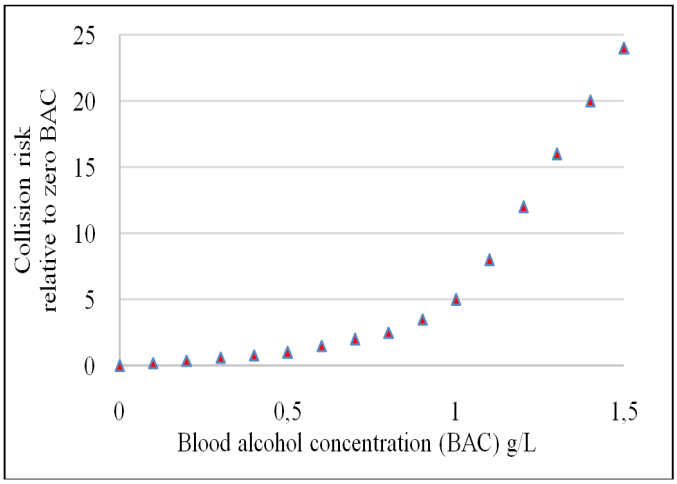


Fig. 1.The Risk of Involvement in a Traffic Accident with Blood Alcohol Concentration Level (as estimated in a repeat of the Grand Rapids study by Compton et al.1964).

C. The Impact of Drugs and Psychoactive Substances on Driving Ability

Table II

The impact of various drugs and psychoactive substances on driving ability [14].

Impacts on simulated driving		
Cannabis/ synthetic cannabis	**Methamphetamine**	**Ecstasy**
- Increased reckless driving - Slower driving, larger headways - More signaling errors - Impaired control of speed, headway and lateral position - Decreased car control as task demand increases - Decreased performance on road tracking tasks - Decreased psychomotor skills, reaction time, visual functions, attention and encoding	- Release the brakes inappropriately when stopping - Drive too fast for the traffic conditions - Travel slower on the freeway in an emergency - Impaired control of lateral position - Execute right turn against movements with a smaller gap - More aggressive driving	- Higher urban speed - Acceptance of smaller gaps - More simulated crashes - More signaling errors - More skidding - More inappropriate braking, - Less safe following distances - More aggressive driving

In addition to alcohol's detrimental effects on driving ability, drugs and psychotropic substances can impair both mental and physiological functions [22]. The impact varies according to the specific drug used; Table II summarizes these effects on driving capabilities. The data clearly indicate that narcotics and psychotropic substances significantly compromise essential physiological functions required for safe driving. The risk associated with driving under the influence of drugs varies by substance type; Table III illustrates that amphetamines pose a particularly high risk. Alarmingly, combining multiple drugs can increase this risk from fivefold up to thirtyfold; similarly, combining alcohol with drugs can amplify the risk from twentyfold up to two hundredfold compared to average drivers [12].

Table III

The Increased Risk of Traffic Accidents According to Selected Groups of Drugs and Psychoactive Substances [12].

Drug	Crash severity	Risk increase
Amphetamines	Fatal (Elvik, 2013)	5,2
	Injuries (Elvik, 2013)	6,2
Cannabis	Fatal (Elvik, 2013)	1,3
	Injuries (Elvik, 2013)	1,1
	Fatal and injuries (Rogeberg&Elvik, 2016)	1,4
	Fatal and injuries (Els et al., 2019)	2,5
	Fatal and injuries (Rogeberg, 2019)	1,3
	Crashes (China-Meyyappan et al., 2023)	1,15
Cocaine	Fatal (Elvik, 2013)	3,0
	Injuries (Elvik, 2013)	1,7
Opiates	Fatal (Elvik, 2013)	1,7
	Injuries (Elvik, 2013)	1,9
Multiple drugs	Crashes (Hels et al., 2011)	5 – 30
Combination alcohol & drugs	Crashes (Hels et al., 2011)	20 – 200

Notably, a notable lack of research specifically analyzing fatal traffic accidents involving alcohol, drugs, and psychotropic substances in Algeria has been identified. This gap prompted the investigation of this phenomenon through an analysis of fatal traffic accidents involving drivers under the influence. Additionally, this article examines preventive traffic control activities designed to reduce instances of driving under the influence and subsequently lower traffic accident rates.

III. ANALYSIS OF BIOLOGICAL SAMPLE RESULTS FOR DRIVERS INVOLVED IN FATAL TRAFFIC ACCIDENTS

To ascertain how many drivers involved in fatal accidents were under the influence of alcohol or drugs—and to identify trends over time— Biological test results from drivers involved in fatal traffic accidents between 2021 and 2024 were examined, with an estimated 6.613 drivers undergoing testing during this period.

A. The Evolution of Drivers Involved in Fatal Accidents Under the Influence

As illustrated in Fig. 2, there has been a consistent upward trend in the number of drivers engaged in fatal accidents while under the influence of alcohol, narcotics, or psychotropic substances over recent years, with an average annual increase rate of 21,5%.

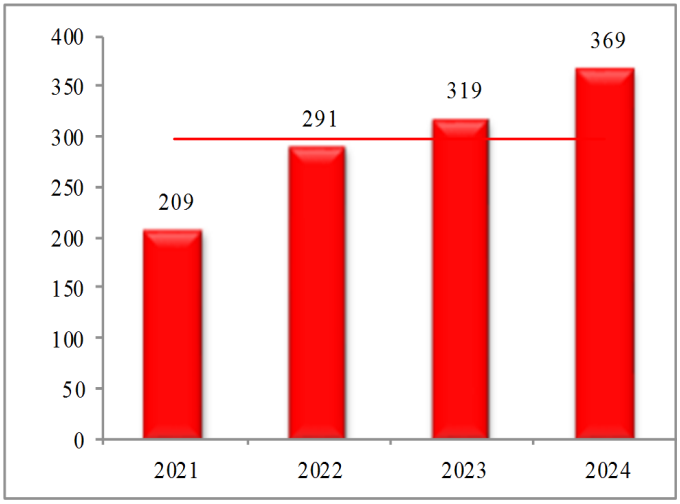


Fig. 2. Annual development of the number of drivers involved in fatal traffic accidents under the influence of alcohol, drugs, and psychoactive substances.

B. Trends of Drivers Involved in Fatal Accidents Under the Influence of Alcohol, Drugs, and Psychoactive Substances

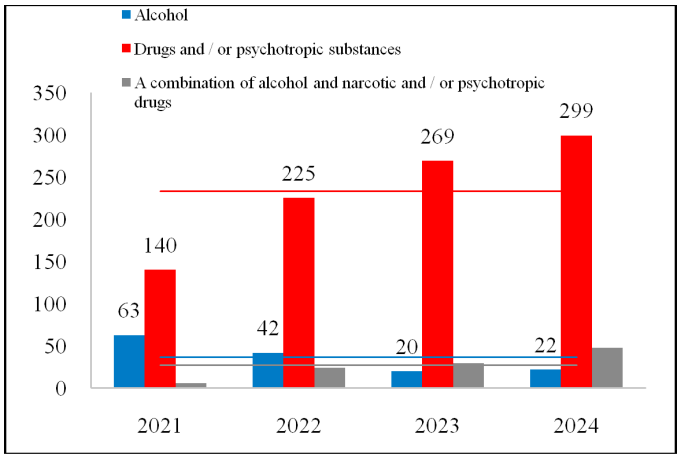


Fig. 3. Trend in the Number of Drivers Involved in Fatal Traffic Accidents Based on the Substance Detected in the Driver's Blood.

Fig.3 illustrates a notable increase in the number of drivers involved in fatal accidents under the influence of drugs and psychotropic substances over the years. This trend is accompanied by a decrease in the number of drivers involved in fatal accidents due to alcohol, while there is a rise in incidents involving a combination of alcohol and various drugs. These findings suggest a general shift among drivers toward using drugs and psychotropic substances instead of alcohol, reflecting the growing prevalence of these substances across different segments of society. Additionally, an analysis of biological samples from drivers engaged in fatal traffic accidents revealed that cannabis derivatives constituted the largest proportion of detected substances, accounting for 58%. Interestingly, 26.6% of these drivers exhibited signs of using a combination of various substances, highlighting the significant risks posed by this group. The likelihood of being involved in fatal traffic accidents for drivers using multiple substances is estimated to be 5 to 30 times higher compared to typical drivers.

C.Temporal Distribution of Fatal Traffic Accidents Under the Influence of Alcohol, Drugs, and Psychoactive Substances

To analyze the temporal distribution of fatal traffic accidents involving these substances, incidents were examined based on the days of the week and hours of the day. Fig. 4 reveals that the average of fatal traffic accidents caused by alcohol is 21 cases per weekday, with extreme values on Thursday (the day before the weekend) and Friday (the first day of the weekend), while fatal accidents under the influence of drugs and psychotropic substances occur almost equally every day of the week, with an average of around 133 cases per weekday. Fig. 5 shows that fatal accidents related to alcohol are significantly more frequent between 7 pm and midnight, accounting for 65% of these incidents. Unlike fatal accidents under the influence of drugs and psychotropic substances which are distributed throughout the day. The analysis demonstrates a clear association between alcohol-related fatal accidents and time variables; these incidents tend to cluster on weekends and during nighttime hours. Conversely, no significant temporal patterns were observed for accidents involving drugs and psychotropic substances. This discrepancy may be attributed to differing consumption patterns: alcohol consumption typically peaks during nighttime hours and weekends, while drug use appears more irregular and driven by individual circumstances rather than specific times.

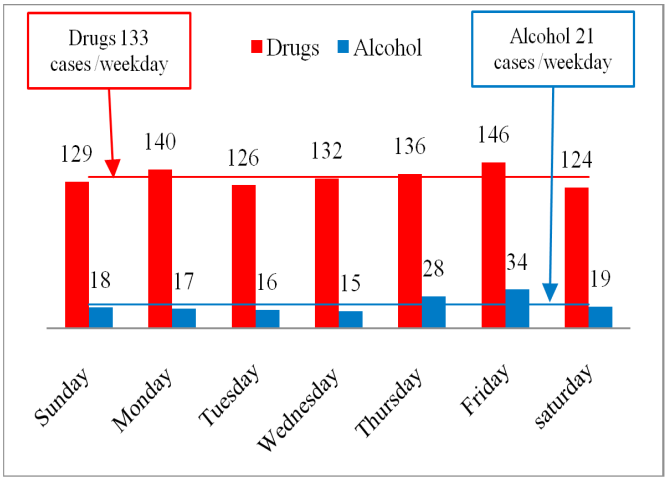


Fig. 4.Temporal Distribution of Fatal Traffic Accidents Under the Influence of Alcohol, Drugs, and Psychoactive Substances by Day of the Week..

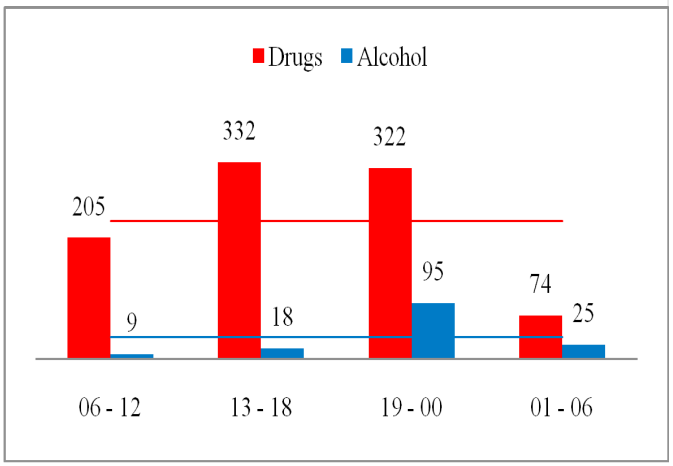


Fig. 5.Temporal Distribution of Fatal Traffic Accidents Under the Influence of Alcohol, Drugs, and Psychoactive by Hours of the Day.

IV. PREVENTIVE TRAFFIC CONTROL TO DETECT DRIVING UNDER THE INFLUENCE OF ALCOHOL, DRUGS, AND PSYCHOACTIVE SUBSTANCES

To combat traffic accidents—particularly those involving substance use—Article 19 of Law N°. 01-14 (August 19, 2001), concerning road traffic organization and safety, mandates traffic surveillance aimed at detecting cases of driving under the influence. It stipulates that "judicial police officers may subject any driver suspected of intoxication to operations outlined in Article 19 during road surveillance." Officers can conduct preliminary alcohol tests using an ethyl meter and assess narcotic drug use through saliva testing kits. If preliminary tests yield positive results or if a driver refuses testing, biological samples must be collected for further analysis at a scientific police laboratory. Table IV compares the number of positive initial traffic control cases sent to the National Institute of Criminalistics and Criminology with the number of drivers involved in fatal accidents due to alcohol, drugs, or psychoactive substances across various provinces. The data indicates that A, B, C and D, lead in traffic control operations aimed at identifying impaired driving but rank lower in terms of fatal traffic accidents caused by these substances. Moreover, several studies [14] have demonstrated that traffic surveillance operations targeting alcohol and drug use can reduce such incidents by at least 17%, accounting for 10 % to 15% of total traffic accidents. Periodic reports [13] indicate that road checkpoints effectively prevent impaired driving-related accidents. Additionally, random traffic surveillance has proven effective in enhancing preventive measures.

Table IV

Comparison of positive traffic monitoring operations with the number of drivers involved in fatal accidents under the influence of alcohol, drugs, and psychoactive substances in selected Algerian provinces.

Province	Number of Positive Initial Monitoring Cases	Ranking by Monitoring Operations	Number of Drivers Involved in Fatal Accidents Under Influence	Ranking by Number of Drivers
A	1706	**1**	9	17
B	897	**2**	7	28
C	555	**3**	8	25
D	417	**4**	2	27

V. ALGERIAN LAW AND LEGISLATION IN LEADING COUNTRIES AGAINST DRIVING UNDER THE INFLUENCE

After analyzing drivers involved in fatal accidents related to alcohol, drugs, and psychoactive substances—and noting the increasing trend toward drug use over alcohol—it is essential to examine policies enacted by prominent countries such as Belgium, France, Spain, and Canada. This analysis focuses on initial detection mechanisms for impaired driving and penalties outlined in their legislation to combat such behaviors. The goal is to identify effective best practices that can be adopted to improve responses and reduce traffic accident rates. Key findings from this legislative comparison include [15] [16] [17]:

- In France, Spain, and Belgium, breathalyzer results serve as evidence for driving under the influence; blood samples are only taken in exceptional circumstances or if contested by the driver. Conversely, Algerian law relies solely on blood alcohol concentration as evidence, necessitating transportation to medical facilities for sampling—this can lead to diminished BAC due to metabolic elimination before testing.
- Penalties for driving under the influence increase with higher BAC levels in France, Spain, and Belgium; however, Algerian law imposes fixed penalties regardless of BAC concentration despite studies indicating that accident severity correlates directly with BAC levels.
- Canadian and French legislation differentiates penalties for driving under the influence of alcohol versus drugs or combinations thereof; Algerian law applies uniform penalties across both offenses.
- In France and Belgium, drivers must complete mandatory training focused on traffic safety awareness and psychological examination before regaining their driving privileges after an offense.

VI. DISCUSSION

A. Presentation of Results:

The study yielded several key findings:

- A steady increase in drivers involved in fatal accidents under the influence of alcohol or drugs is observed annually at an estimated rate of 21,5%.

- There is a consistent rise in the number of drivers involved in fatal accidents linked to drugs and psychotropic substances while incidents involving alcohol have decreased.

- Fatal accidents committed under the influence of narcotic drugs and Psychotropic Substances, not tied to a specific time period or timing, unlike fatal traffic accidents under the influence of alcohol, which are usually previewed on weekends and in night periods.

- Preventive traffic control operations conducted by security agencies have proven effective in reducing fatalities related to alcohol, drugs and Psychotropic Substances use.

- The criminal policy adopted by the Algerian legislator in the fight against traffic accidents under the influence of alcohol, drugs and Psychotropic Substances is based mainly on the emphasis on the two crimes of driving under the influence of these substances, compared to the legislation of some countries, in particular, the adoption by the Algerian legislator of the permissible blood alcohol concentration by driving, which is less than 0,2 g/l, with the adoption of a zero-tolerance policy for drugs and Psychotropic Substances.

- Despite varying severity levels associated with different substances or combinations thereof, Algerian law imposes identical penalties regardless

B. Hypothesis Discussion

The findings of this study provide robust evidence to support the research hypotheses, drawing from statistical analysis and observable trends.

First, Hypothesis 1 is confirmed, as the analysis indicates a consistent annual increase in driver involvement in fatal traffic incidents where biological tests detected the presence of alcohol or drugs. Between 2021 and 2024, the projected annual rise in such incidents was approximately 21.5%, underscoring a growing trend in alcohol- and drug-related traffic collisions. These results highlight the urgent need for stronger preventive measures and public awareness campaigns to address this escalating issue.

Hypothesis 2 is also supported by the data, which reveal a significant disparity between the proportions of drivers involved in fatal accidents under the influence of drugs compared to alcohol. Specifically, 14% of drivers tested positive for drugs, while only 2% tested positive for alcohol. This disparity underscores the critical importance of prioritizing drug detection and prevention efforts within traffic safety initiatives.

Similarly, Hypothesis 3 is validated by evidence demonstrating the effectiveness of preventive traffic surveillance activities conducted by the National Gendarmerie. These efforts have played a significant role in reducing mortality rates associated with the consumption of alcohol, drugs, and psychotropic substances. This finding emphasizes the value of proactive enforcement measures in improving road safety and reducing preventable fatalities.

VII. STUDY OUTCOMES

The study resulted in several recommendations aimed at addressing traffic accidents involving alcohol, drugs, and psychoactive substances:

A. Legislative Recommendations

- Amend Article 74 of Law N°. 01-14 (August 19, 2001) concerning road traffic safety by differentiating penalties for driving under the influence based on whether it involves alcohol alone or both drugs and alcohol.

- Drivers found under the influence should undergo complementary measures such as attending Traffic Safety Awareness Courses at their own expense along with mandatory medical evaluations before regaining driving privileges.

- For first-time offenders caught under the influence who are identified as substance-dependent through expert assessment should receive detoxification treatment as part of rehabilitation efforts.

B. Detection of Driving Under the Influence

- Focus preventive traffic control operations on detecting impaired driving due to narcotics given recent trends.

C. Media Sector Recommendations

- Ensure comprehensive media coverage supporting security authorities' efforts against impaired driving while conducting awareness campaigns through various platforms about the dangers associated with driving under the influence.

VIII. CONCLUSION

This study highlights a significant rise in the number of drivers involved in traffic accidents in Algeria due to the influence of alcohol, drugs, and psychotropic substances in recent years. By analyzing biological test results and examining trends over the

past decade, the study reveals a concerning increase in drug use among drivers involved in fatal accidents, now surpassing alcohol as the primary contributing factor. Additionally, the research emphasizes the pivotal role of preventive traffic monitoring operations, specifically those targeting drivers under the influence of alcohol, drugs, and psychotropic substances, in reducing substance-related traffic accidents.

The findings underscore the urgent need for a comprehensive, multi-faceted approach to address this issue effectively. This approach should integrate stringent legislative measures, robust enforcement strategies, and widespread public awareness campaigns. Efforts must focus on adapting prevention and control mechanisms to align with emerging trends, thereby minimizing accidents caused by impaired driving and enhancing overall road safety. Future research should aim to deepen the understanding of this phenomenon, ensure continuous monitoring of trends, and evaluate the effectiveness of implemented measures to achieve sustainable improvements in traffic safety. Such initiatives are essential to mitigate the growing threat posed by impaired driving and to safeguard public health and safety on Algerian roads.

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