GOBIERNO DE ESPAÑA
MINISTERIO DE JUSTICIA

TOXICOLOGICAL FINDINGS IN ROAD TRAFFIC FATALITIES

2022 Report

Recommended citation: *Toxicological Findings in Road Traffic Fatalities (2022).* National Institute of Toxicology and Forensic Sciences. Ministry of Justice.

National Institute of Toxicology and Forensic Sciences
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Toxicological findings in road traffic fatalities

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Madrid, 2023

Publications of the Ministry of Justice: https://www.mjusticia.gob.es/es/areas-actuacion/documentacion-publicaciones/publicaciones

General Catalogue of Official Publications: https://cpage.mpr.gob.es

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NIPO (pdf): 051-20-012-0

Published by: Ministry of Justice. General Technical Secretariat

Content

Introductory note and acknowledgements

The National Institute of Toxicology and Forensic Sciences (INTCF), the Institute of Legal Medicine and Forensic Sciences of Catalonia (IMLCFC), the Basque Institute of Legal Medicine (IVML), the Institute of Legal Medicine and Forensic Sciences of Aragon (IMLCFA), the Institute of Legal Medicine and Forensic Sciences of Murcia (IMLCFM), the Institute of Legal Medicine and Forensic Sciences of Valencia (IMLCFV), the Institute of Legal Medicine and Forensic Sciences of the Balearic Islands (IMLCFIB) and the Institute of Forensic Sciences Luis Concheiro (INCIFOR), with the collaboration of the National Road Safety Observatory (ONSV) of the General Directorate of Traffic (DGT), present the annual report on deaths that occurred in traffic accidents during 2022 and that have been investigated from a toxicological-forensic point of view in the entire national territory.

In this edition we continue with the initiative we undertook in 2020 to include in this report not only toxicological analyses carried out by the INTCF, but also those carried out by those institutes of forensic medicine and forensic sciences (IMLCF) equipped with a chemical-toxicological analysis laboratory, with the inclusion of toxicological data provided by a total of seven IMLCF. The ultimate aim is to be able to provide the most complete information possible on the toxicological analysis of road traffic fatalities.

The statistical data presented in this report (as well as the data for the years 2020 and 2021) are dynamically made available to the different administrations and citizens through https://datos.justicia.es/intcf developed by the Directorate General for Digital Transformation (DGTD) of the Ministry of Justice. Therefore, the different autonomous communities (A Cs) can easily explore the toxicological findings in road traffic fatalities within the territory of their own autonomous region.

The data presented in relation to toxicological findings comes from requests made by the various judicial bodies. The information presented in this report refers to the toxicological analyses carried out by the INTCF (reference centre for toxicology) and by the IMLCFs equipped with a chemical-toxicological analysis laboratory (IMLCFC, IVML, IMLCFA, IMLCFM, IMLCFV, IMLCFIB and INCIFOR) on *post-mortem* samples from 854 drivers and 221 pedestrians killed in road traffic accidents in 2022. Its purpose is to show the results of toxicological tests for the presence of alcohol, drugs of abuse and psychopharmaceuticals. This has made it possible to highlight the incidence of the use of each of these three groups of intoxicants, either in isolation or in combination. The study also relates these toxicological findings to several epidemiological variables, such as gender, age, type of vehicle or the day of the week on which the fatal accident occurred. These data, as well as those presented in previous reports, provide very relevant information for those working on road traffic accident prevention. Finally, a comparative study with *post-mortem* toxicological data obtained in previous years is presented in order to show the change over time of some of the parameters evaluated.

The INTCF would like to express its sincere thanks to all the INTCF and IMLCF staff of forensic doctors, medical doctors, specialist technicians and laboratory assistants who have been involved in the chemical-toxicological analyses related to these cases. In particular, we would like to highlight the coordination work carried out by the heads of the Chemistry and Drugs Services of the different INTCF offices (María Antonia Martínez González, Begoña Bravo Serrano, Teresa Soriano Ramón, Nuria Sanvicens Diez and Luis Manuel Menéndez Quintanal).

We are also grateful for the contribution of the following IMLCFs in collecting and sending *post-mortem* samples to the INTCF for analysis, without whose collaboration it would not have been possible to prepare this report:

- Institute of Legal Medicine and Forensic Sciences of Andalusia
- Institute of Legal Medicine and Forensic Sciences of Castile-León
- Institute of Legal Medicine and Forensic Sciences of Castile-La Mancha
- Institute of Legal Medicine of Galicia (IMELGA)
- Institute of Legal Medicine and Forensic Sciences of the Community of Madrid
- Institute of Legal Medicine and Forensic Sciences of the Canary Islands
- Institute of Legal Medicine and Forensic Sciences of Extremadura
- Institute of Legal Medicine and Forensic Sciences of Navarra
- Institute of Legal Medicine and Forensic Sciences of Asturias
- Institute of Legal Medicine and Forensic Sciences of Cantabria
- Institute of Legal Medicine and Forensic Sciences of La Rioja
- Institute of Legal Medicine and Forensic Sciences of Ceuta and Melilla

Our thanks also go to the ONSV for the work carried out in the detailed review of each of the cases presented in accordance with the criteria established by the DGT.

In addition, as director of the INTCF, I would like to express my special thanks to the staff of the IT section of the Madrid, Seville and Barcelona Departments for configuring and performing the statistical searches in the INTCF LIMS system, to Beatriz Ibor Alonso for her efforts in compiling the data and to David Barroso Domínguez for the final processing of all the data.

Antonio Alonso Alonso Director of the INTCF

General data
(n = 1214)

FIGURE 1: NUMBER OF FATALITIES (n = 1214) ANALYSED BY THE DIFFERENT BODIES

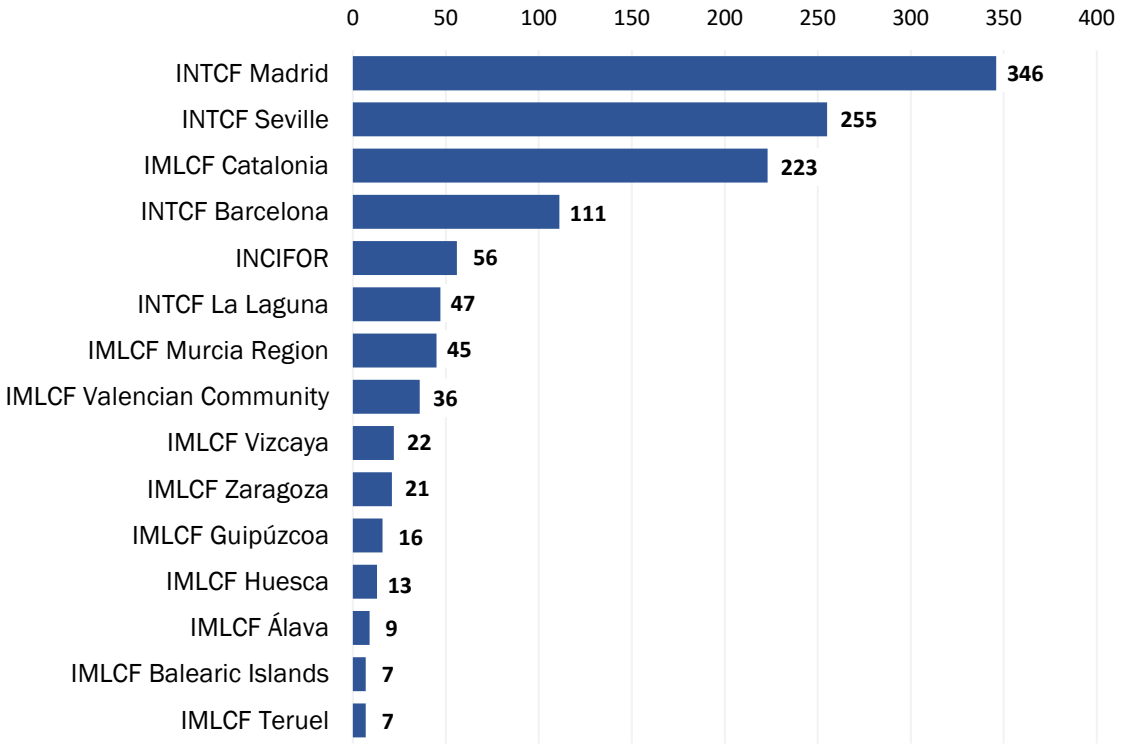


FIGURE 2: SCOPE OF ACTIVITY OF THE INTCF

FIGURE 3: DISTRIBUTION BY AUTONOMOUS COMMUNITY (fatalities per 100,000 inhabitants)

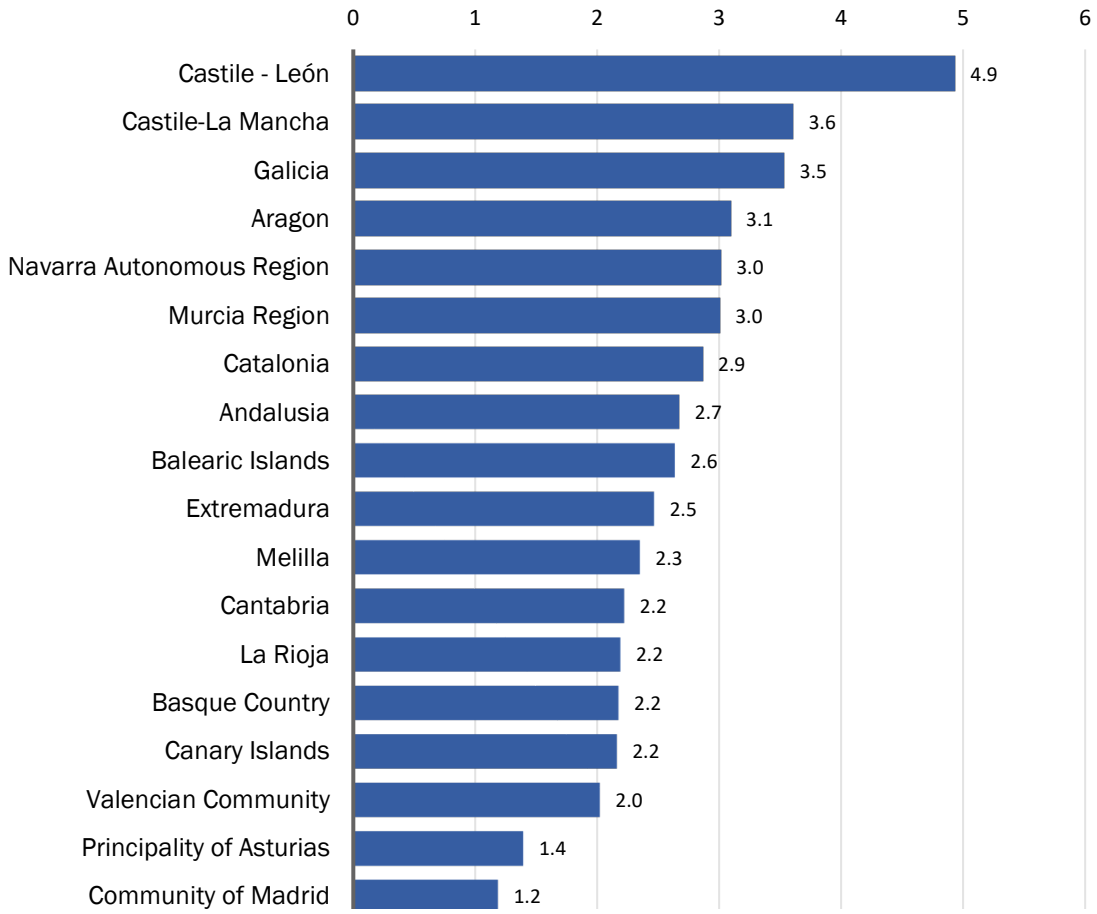
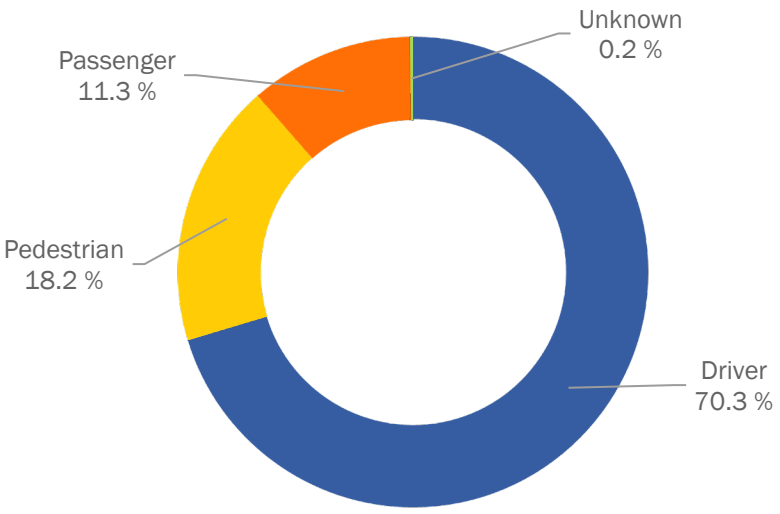


FIGURE 4: PERCENTAGE DISTRIBUTION OF THE NUMBER OF FATAL VICTIMS (n = 1214) ACCORDING TO THEIR ROLE IN THE INCIDENT



Drivers (n = 854)

FIGURES 5 and 6: DISTRIBUTION BY GENDER AND AGE RANGE (854 DRIVERS)

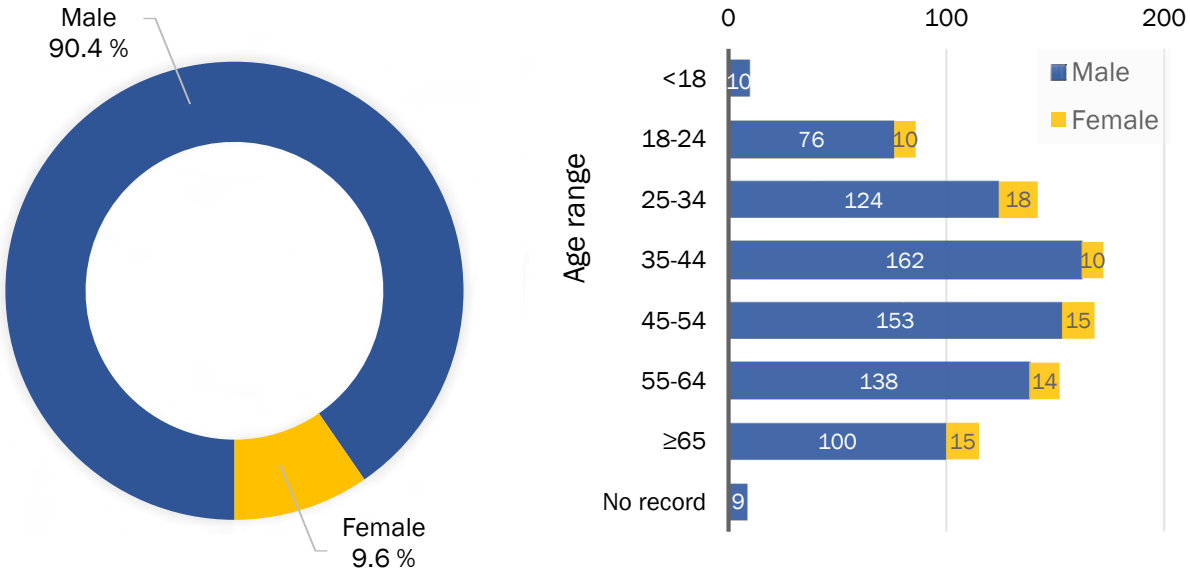
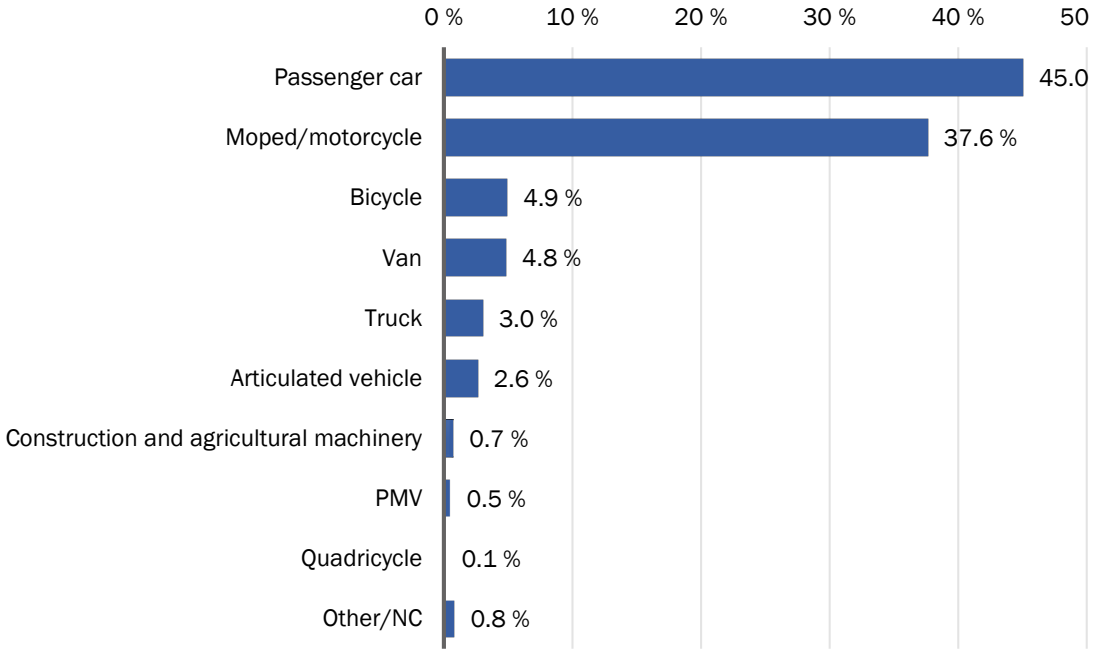


FIGURE 7: PERCENTAGE DISTRIBUTION BY TYPE OF VEHICLE (854 DRIVERS)



PMV: personal mobility vehicle.

FIGURE 8 A: PERCENTAGE DISTRIBUTION ACCORDING TO TOXICOLOGICAL RESULTS (854 DRIVERS) (blood alcohol threshold: 0.3 g/l)

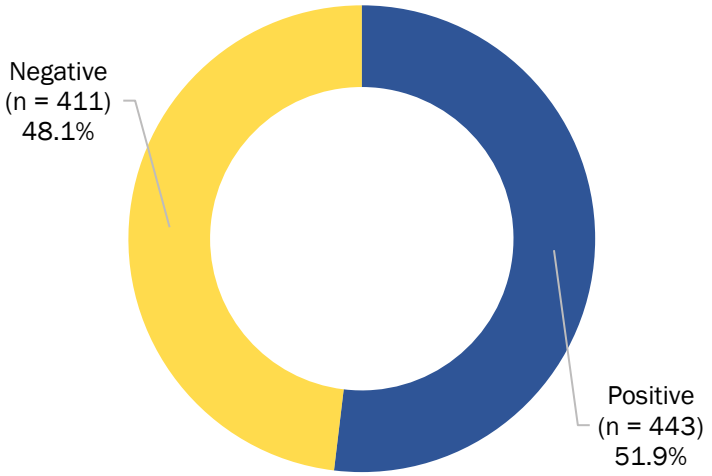
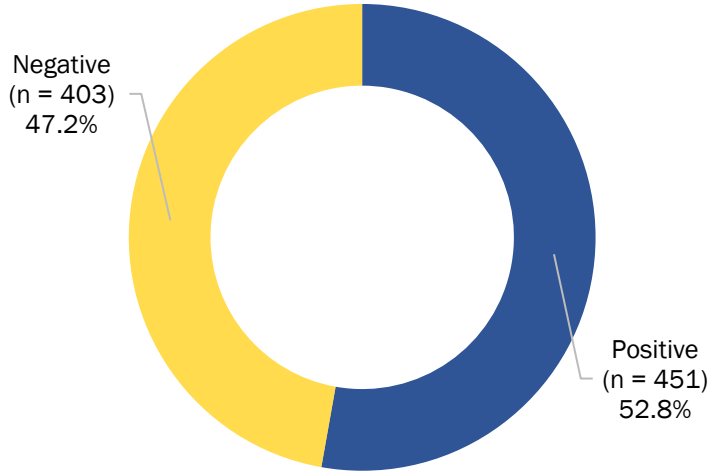


FIGURE 8 B: PERCENTAGE DISTRIBUTION ACCORDING TO TOXICOLOGICAL RESULTS (854 DRIVERS) (blood alcohol threshold: 0.1 g/l)



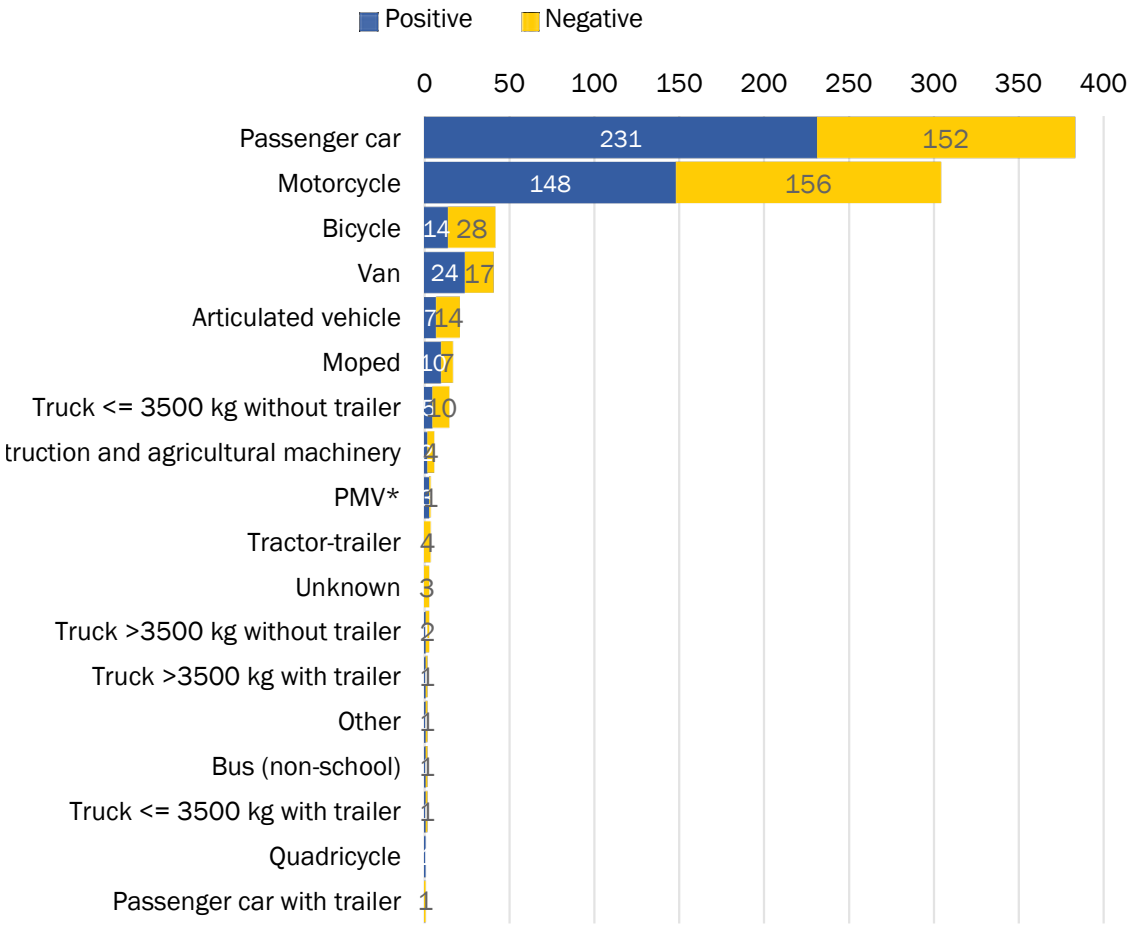
In previous editions of this report, a positive result has been considered whenever the presence of any abused drug or psychopharmaceuticals, regardless of the quantity, or a blood alcohol concentration equal to or higher than 0.3 g/l in the blood (blood alcohol limit for novice and professional drivers) [1], as shown in figure 8A.

In this edition of the report, as well as on the justice data web-based portal, we also wanted to show the total data of "positives" according to strictly toxicological criteria and thresholds with respect to alcohol, i.e. including those cases in which the presence of any drugs of abuse or psychopharmaceuticals is found, regardless of the quantity, or a blood

alcohol concentration above 0.1 g/l (as a detection threshold according to international criteria) [2]), as shown in figure 8 B.

This is intended to provide scientific data that is more objective and, at the same time, consistent with the idea that "the only alcohol level that is truly safe is 0.0 g/l", a criterion applied in Law 18/2021, of 20 December, which amends the combined text of the Traffic, Circulation of Motor Vehicles and Road Safety Act, approved by Royal Legislative Decree 6/2015, of 30 October, on the subject of points-based driving licences [3] for under-age drivers.

FIGURE 9: DISTRIBUTION ACCORDING TO TOXICOLOGICAL RESULT AND TYPE OF VEHICLE (854 DRIVERS)



*PMV: personal mobility vehicle.

FIGURE 10: DRIVERS (n = 854) PERCENTAGE DISTRIBUTION ACCORDING TO TYPE OF SUBSTANCE DETECTED
(alcohol detection threshold of 0.1 g/l)

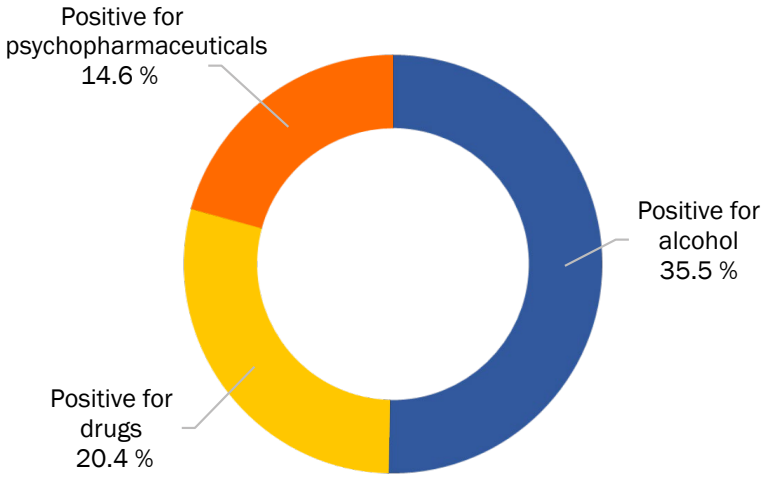
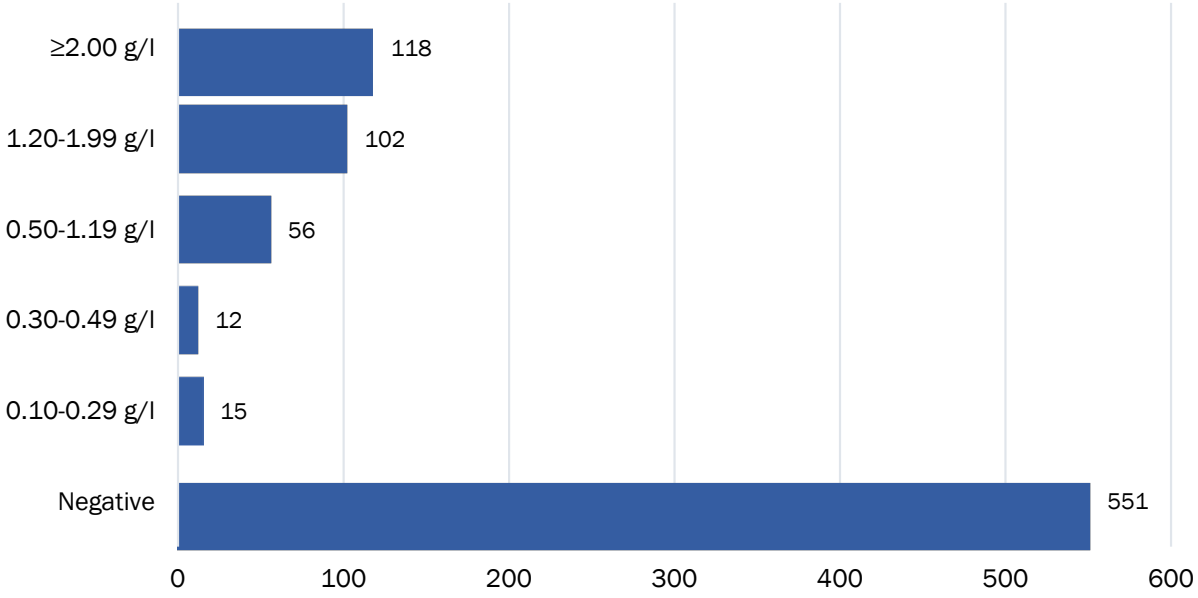
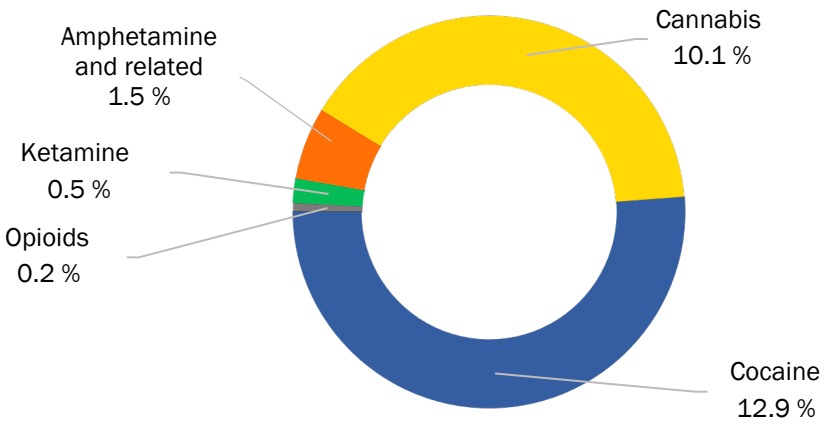


FIGURE 11: DRIVERS (n = 854) DISTRIBUTION ACCORDING TO BLOOD ALCOHOL LEVEL



25.7% of drivers had a blood alcohol level of 1.20 g/l or more.

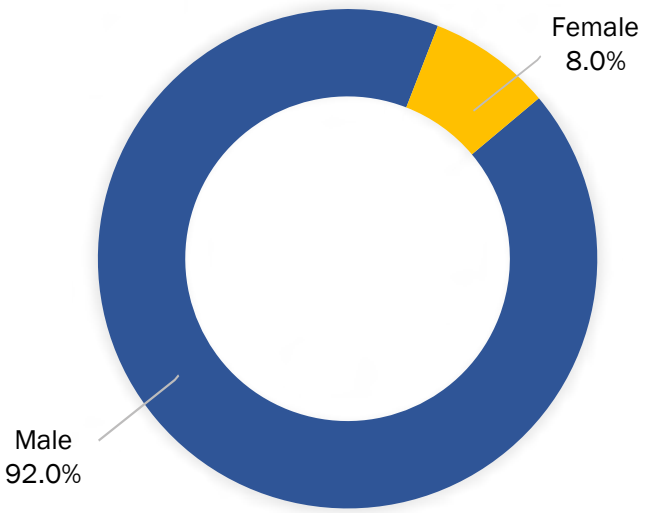
FIGURE 12: DRIVERS (n = 854) PERCENTAGE DISTRIBUTION OF DRUGS DETECTED



Regardless of whether there was combined use of drugs of abuse, alcohol and/or psychotropic drugs, cocaine used alone was the most commonly used drug(**12.9%**), followed by cannabis(**10.1%**).

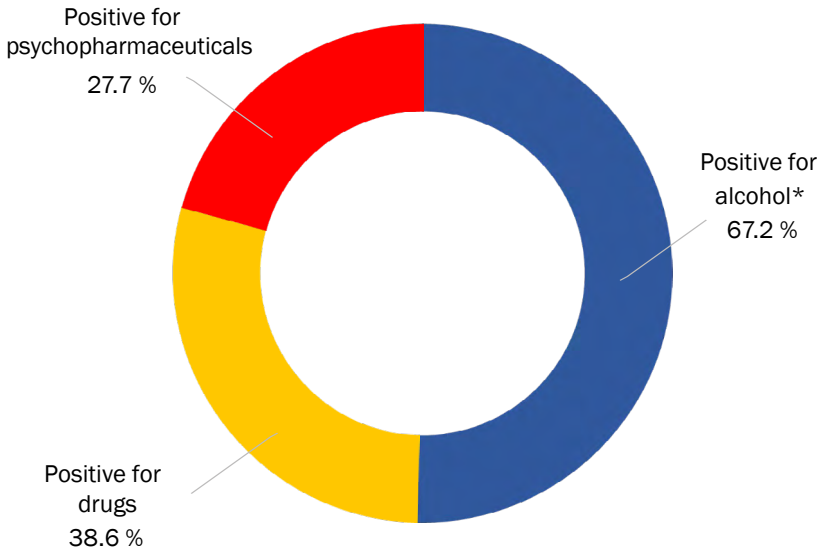
DRIVERS: CASES WITH POSITIVE TOXICOLOGICAL RESULTS (n = 451)

FIGURE 13: DRIVERS TESTING POSITIVE (n = 451). PERCENTAGE DISTRIBUTION BY GENDER



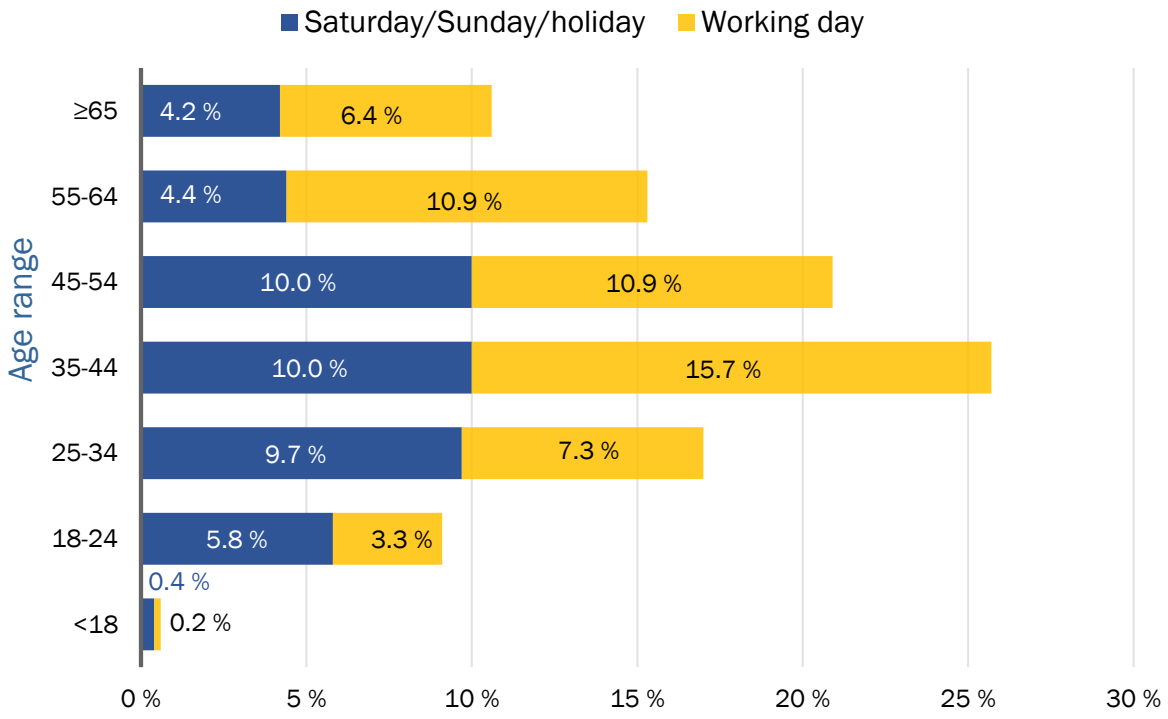
Males accounted for **92.0%** of the drivers with positive toxicological results.

FIGURE 14: DRIVERS TESTING POSITIVE (n = 451). PERCENTAGE DISTRIBUTION ACCORDING TO THE TYPE OF SUBSTANCE DETECTED



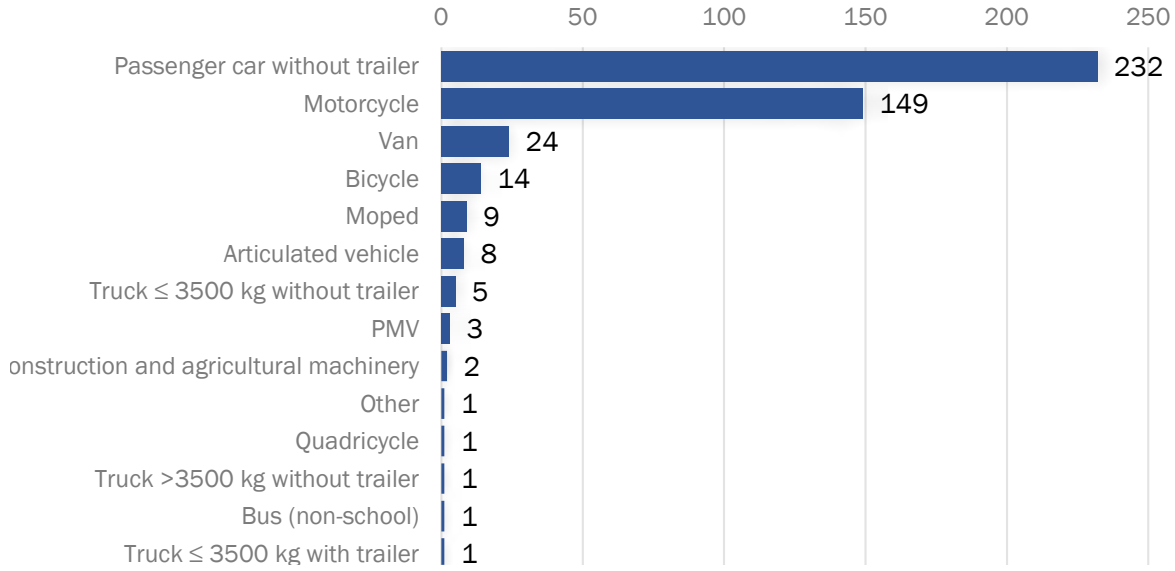
* Positive for alcohol: blood alcohol level of 0.10 g/l or more.

FIGURE 15: DRIVERS TESTING POSITIVE (n = 451). PERCENTAGE DISTRIBUTION BY AGE RANGE AND DAY OF THE WEEK



63.6% of drivers with positive toxicological results were in the 25-54 age group. **54.7%** of the fatalities with positive toxicological results nationwide occurred on working days, regardless of age group. In the **<18-34 years** age group, the majority of deceased drivers with positive toxicological results occurred on Saturdays, Sundays and public holidays(**15.9%** compared to **10.8 %** on weekdays). However, in the **35->65 years** age group, fatal accidents occurred mostly on working days(**43.9%** compared to **28.6%** on Saturdays, Sundays and public holidays).

FIGURE 16: DRIVERS TESTING POSITIVE (n = 451). DISTRIBUTION BY TYPE OF VEHICLE



PMV: personal mobility vehicle.

51.4% of the drivers with positive toxicological results were driving a passenger car and **33% were** riding a motorcycle or moped.

FIGURE 17: DRIVERS TESTING POSITIVE (n = 451). CLASSIFICATION OF RESULTS ACCORDING TO THE TYPE AND/OR COMBINATION OF SUBSTANCES DETECTED

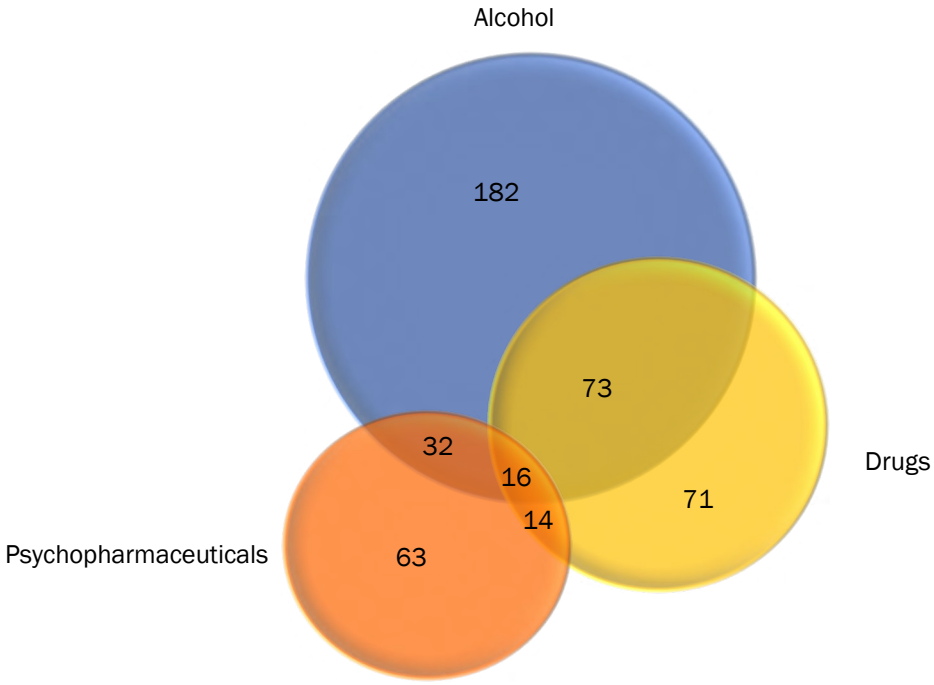
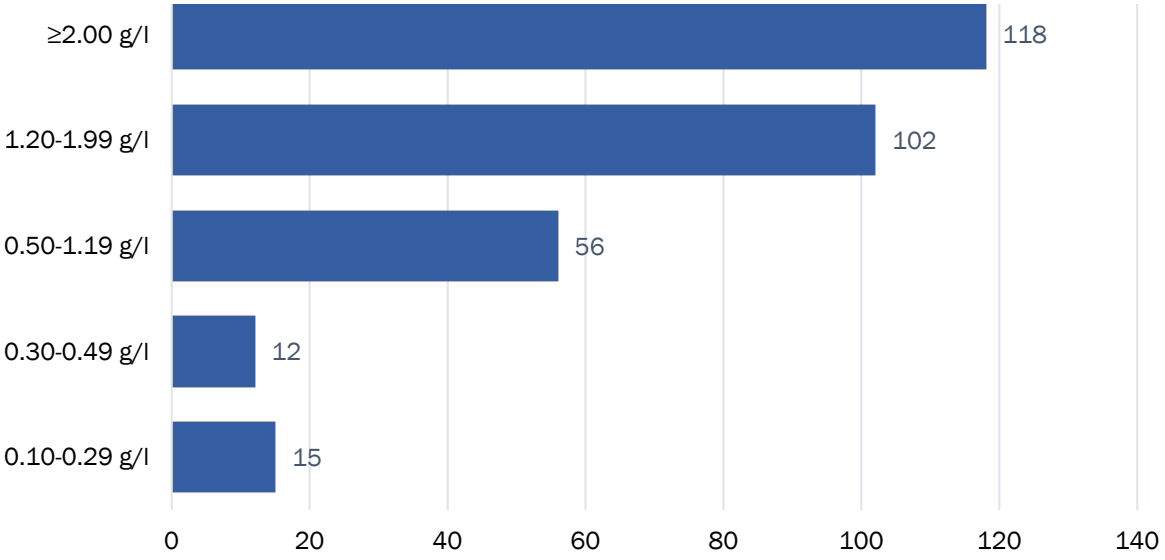
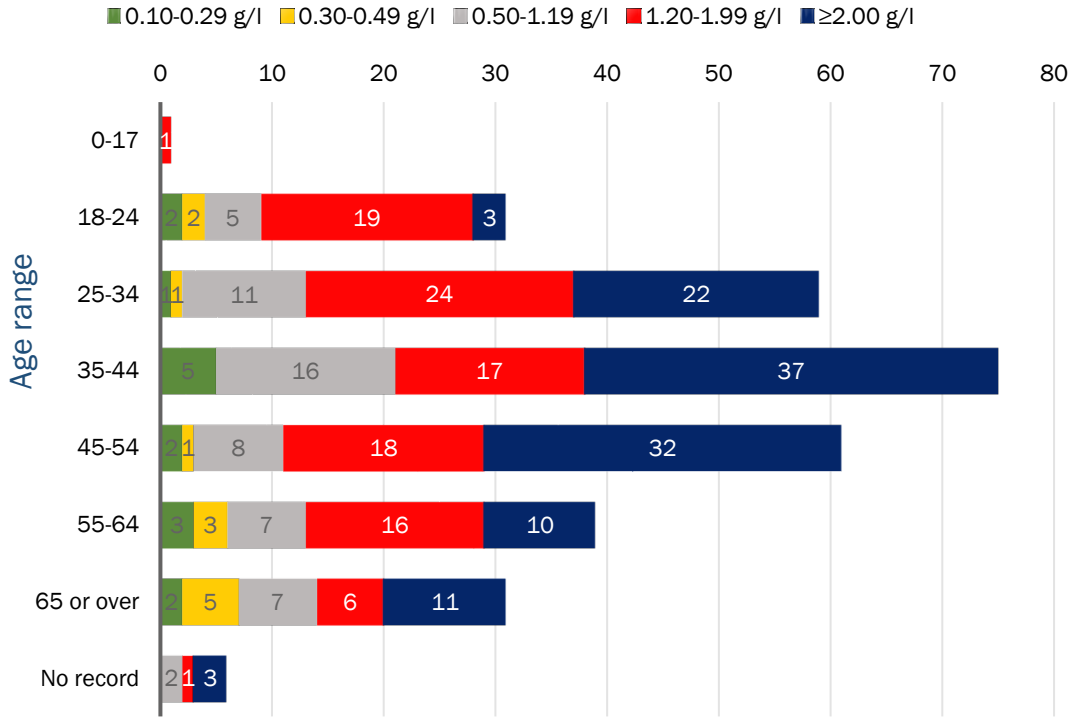


FIGURE 18: DRIVERS TESTING POSITIVE FOR ALCOHOL (n = 303). DISTRIBUTION ACCORDING TO BLOOD ALCOHOL LEVEL



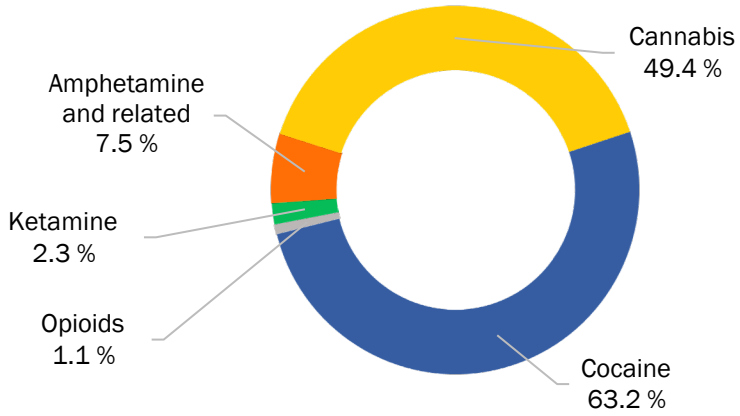
72.6% of the drivers who tested positive for alcohol had a blood alcohol level of 1.20 g/l or more.

FIGURE 19: DRIVERS TESTING POSITIVE FOR ALCOHOL (n = 303). DISTRIBUTION ACCORDING TO BLOOD ALCOHOL LEVEL AND AGE RANGE



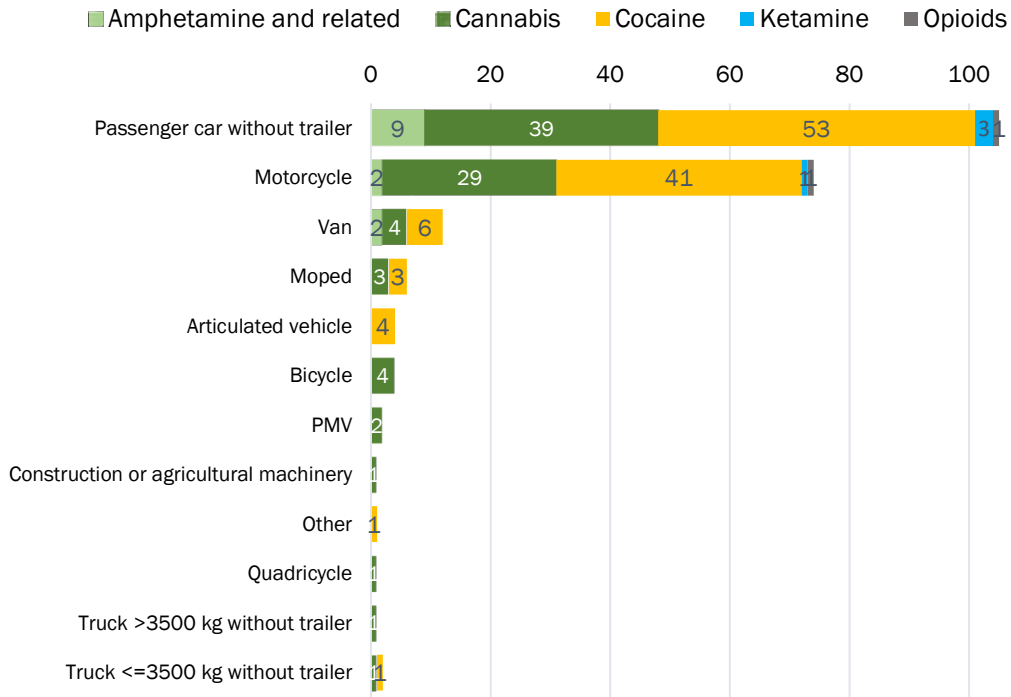
49.5% of the drivers who tested positive for alcohol with a blood alcohol level of 1.20 g/l or more were in the 25-54 age group.

FIGURE 20: DRIVERS TESTING POSITIVE FOR DRUGS (n = 174). PERCENTAGE DISTRIBUTION OF DRUGS DETECTED



Regardless of whether there was associated use of abused drugs, alcohol and/or psychopharmaceuticals, cocaine used alone (**63.2 %**) was the most commonly used drug, followed by cannabis(**49.4%**).

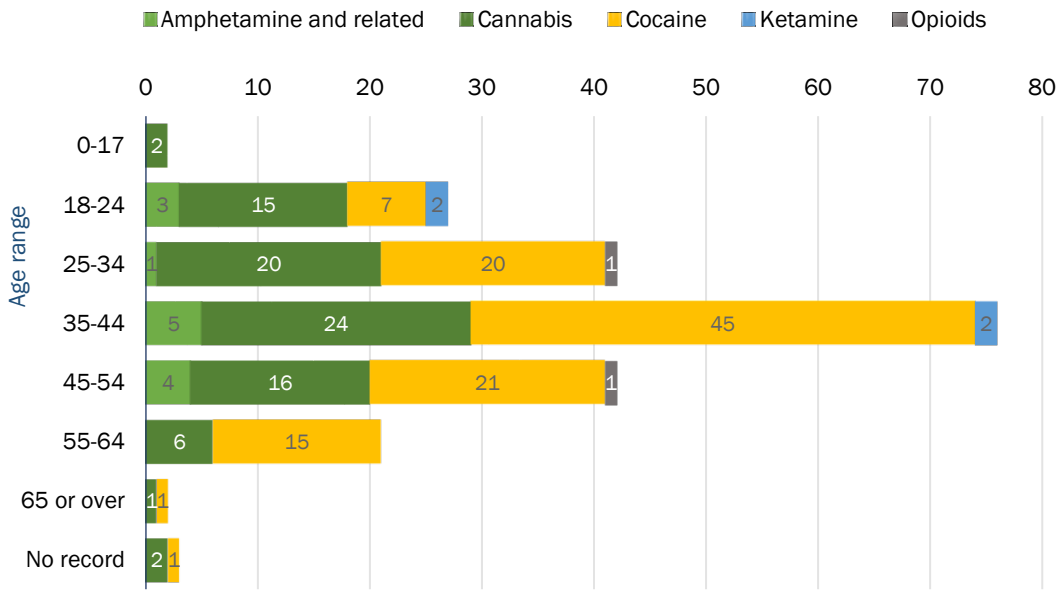
FIGURE 21: DRIVERS TESTING POSITIVE FOR DRUGS (n = 174). DISTRIBUTION ACCORDING TO DRUG DETECTED AND TYPE OF VEHICLE



PMV: personal mobility vehicle.

The highest percentages relate to cocaine use (**55.7%**) and/or cannabis use (**41.4%**), among car and moped/motorcycle drivers.

FIGURE 22: DRIVERS TESTING POSITIVE FOR DRUGS (n = 174). DISTRIBUTION ACCORDING TO DRUG DETECTED AND AGE RANGES



The highest percentages are for cocaine use (**49.4%**) and/or cannabis use(**34.5%**), in drivers in the 25-54 age group. Cannabis was the most commonly used drug in the **<18-34** age group, while cocaine was the most commonly used drug in the **35-64 age** group.

FIGURE 23: DRIVERS TESTING POSITIVE FOR ALCOHOL AND DRUGS (n = 89). DISTRIBUTION OF CASES ACCORDING TO THE DRUG DETECTED. MOST FREQUENT COMBINATIONS

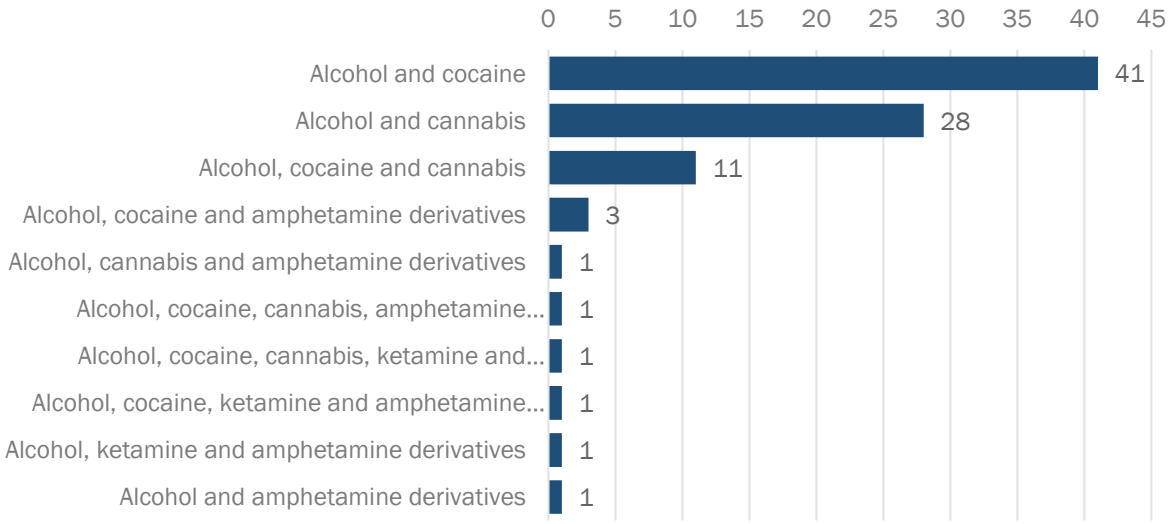
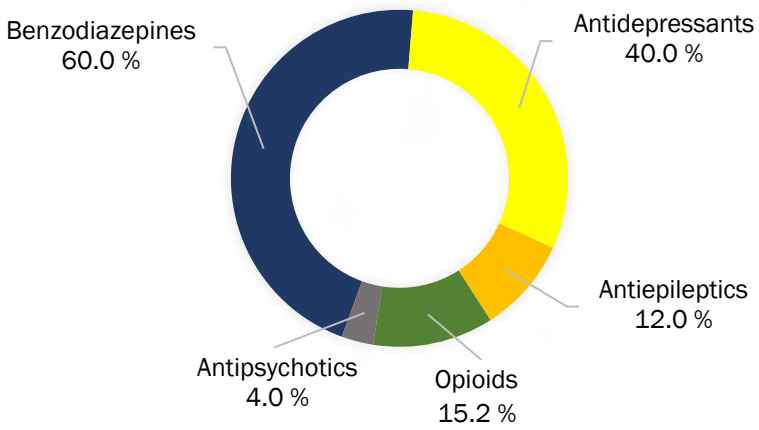


FIGURE 24: DRIVERS TESTING POSITIVE FOR PSYCHOPHARMACEUTICALS (n = 125). PERCENTAGE DISTRIBUTION OF PSYCHOPHARMACEUTICALS DETECTED



The term “opioids” refers to drugs (tramadol, oxycodone, methadone, etc) that bind to opioid receptors in the central nervous system, excluding heroin.

Pedestrians (n = 221)

FIGURE 25: PEDESTRIANS (n = 221) PERCENTAGE DISTRIBUTION BY GENDER

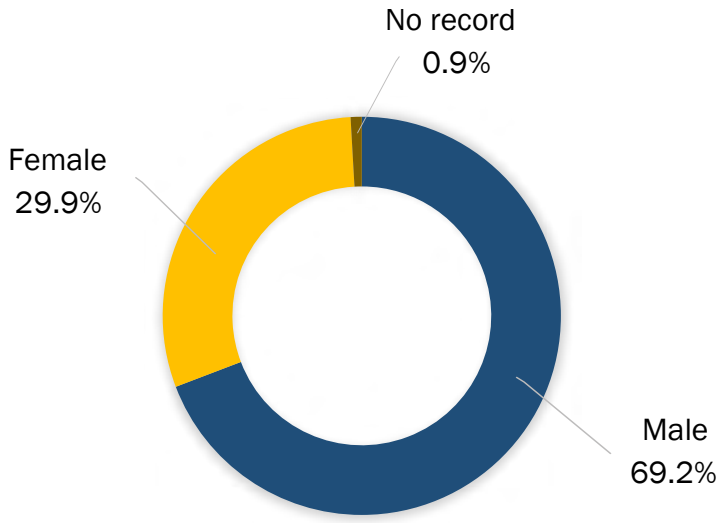


FIGURE 26: PEDESTRIANS (n = 221) AGE RANGE DISTRIBUTION

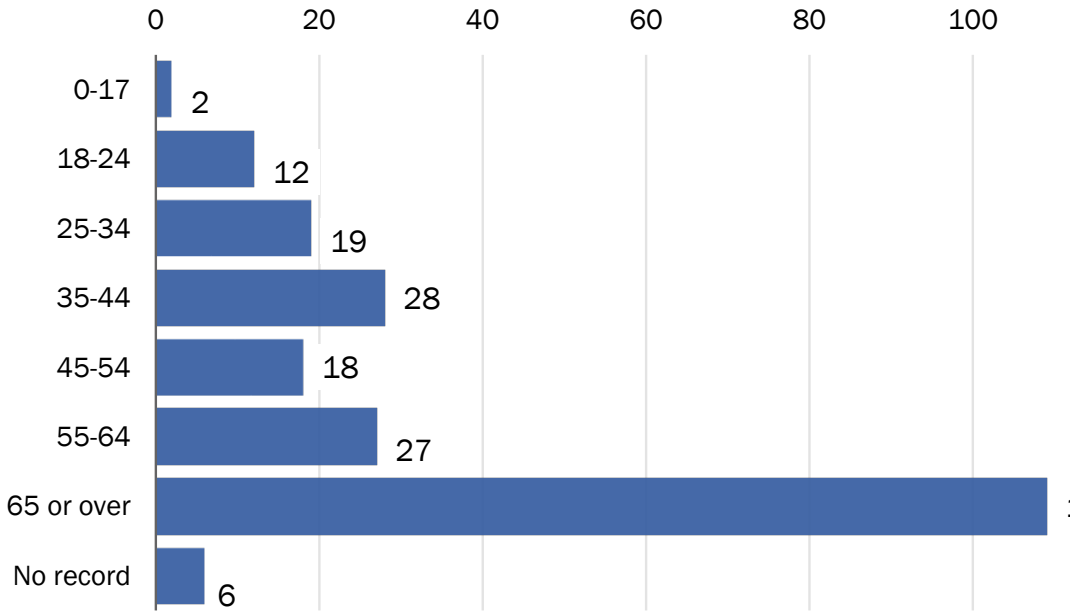
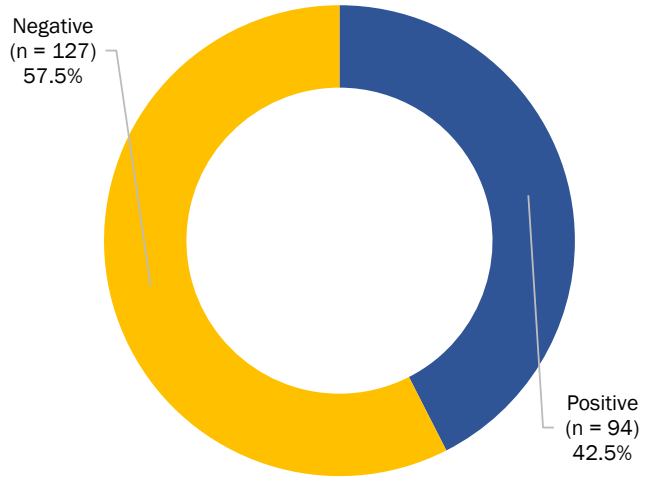
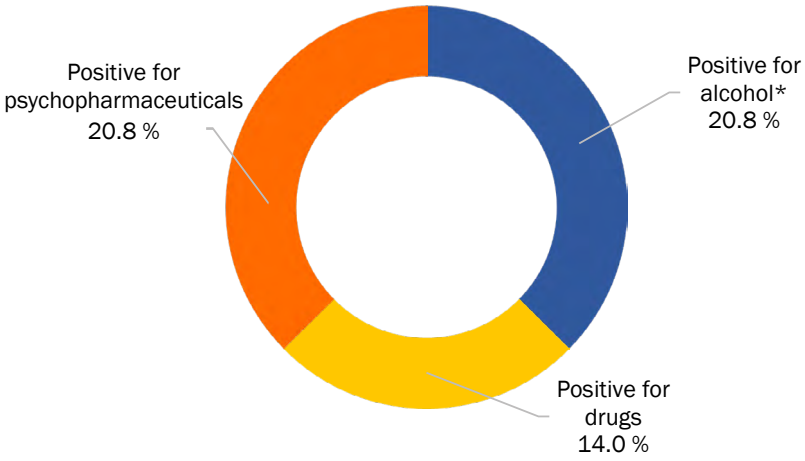


FIGURE 27: PEDESTRIANS (n = 221) PERCENTAGE DISTRIBUTION BY TOXICOLOGICAL RESULT



Of 221 pedestrians deceased in road traffic accidents and were subjected to an autopsy, 94 (**42.5%**) showed positive toxicological results for alcohol, abused drugs and psychopharmaceuticals, alone or in combination.

FIGURE 28: PEDESTRIANS (n = 221) PERCENTAGE DISTRIBUTION ACCORDING TO THE TYPE OF SUBSTANCE DETECTED



* Positive for alcohol: blood alcohol level of 0.10 g/l or more.

FIGURE 29: PEDESTRIANS (n = 221) DISTRIBUTION ACCORDING TO BLOOD ALCOHOL LEVEL

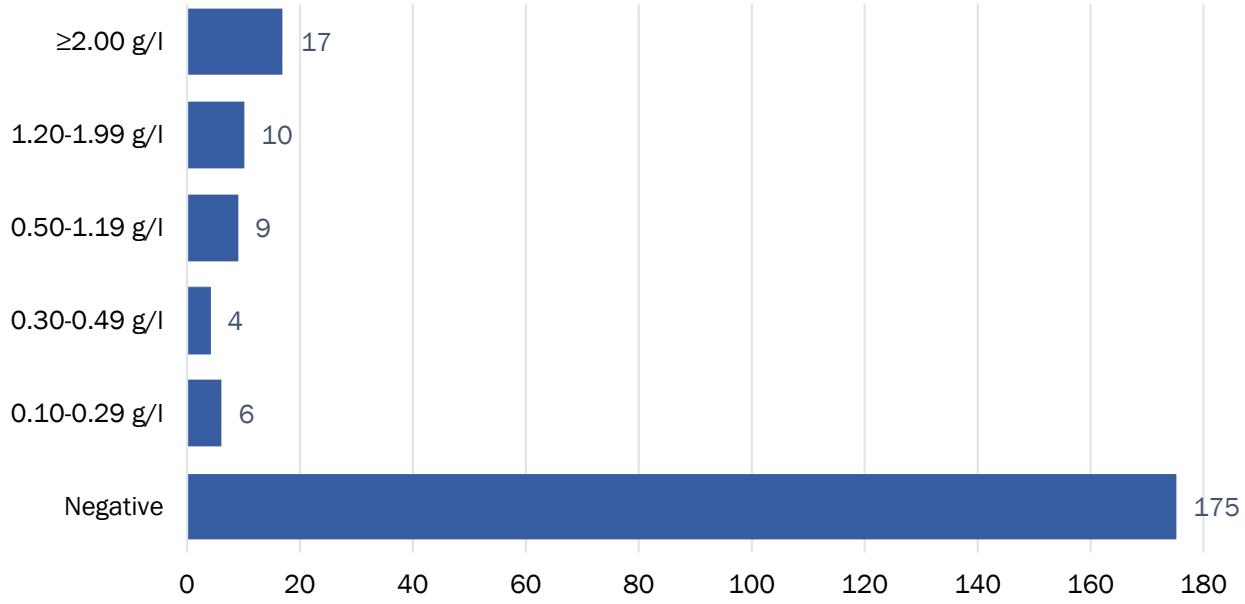
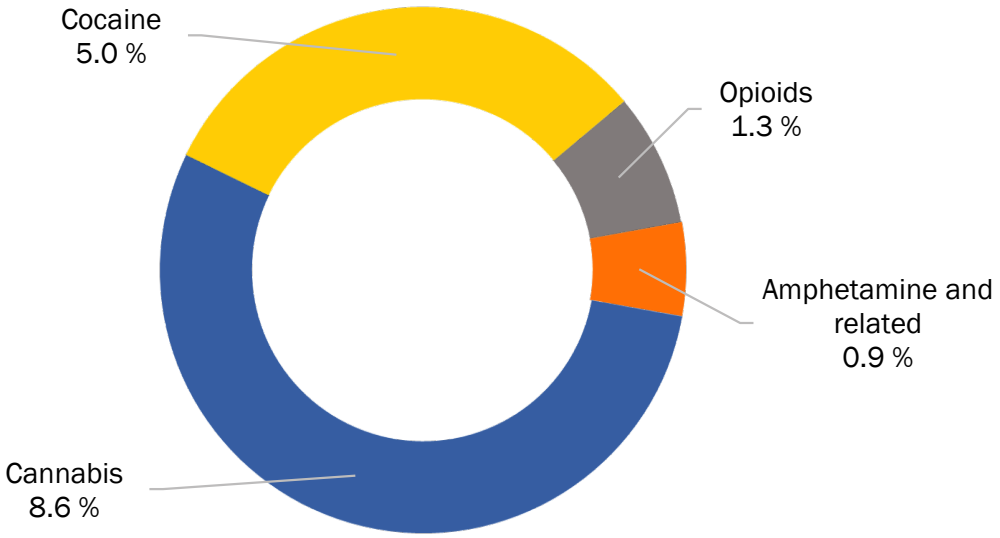
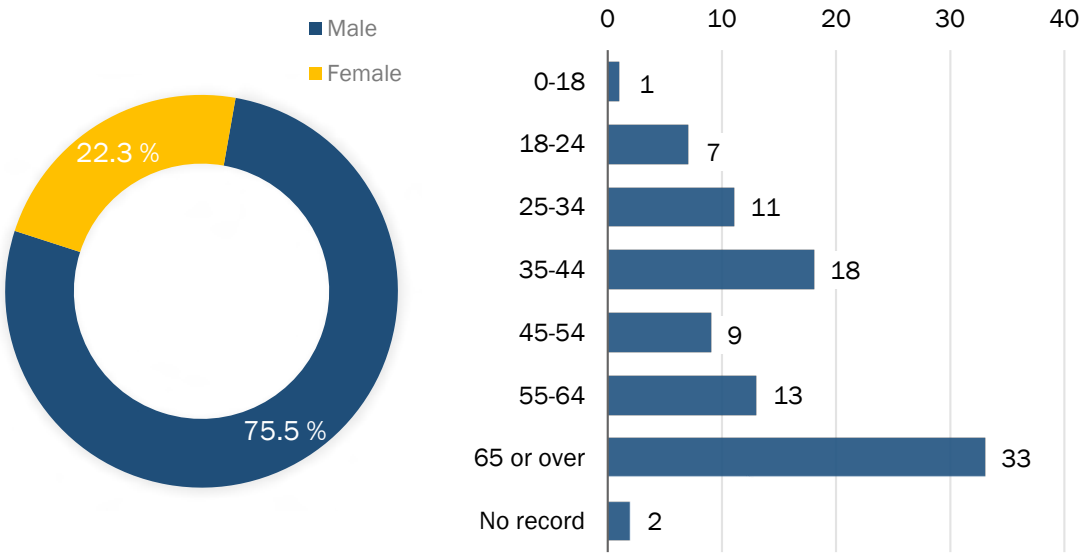


FIGURE 30: PEDESTRIANS (n = 221) PERCENTAGE DISTRIBUTION OF DRUGS DETECTED



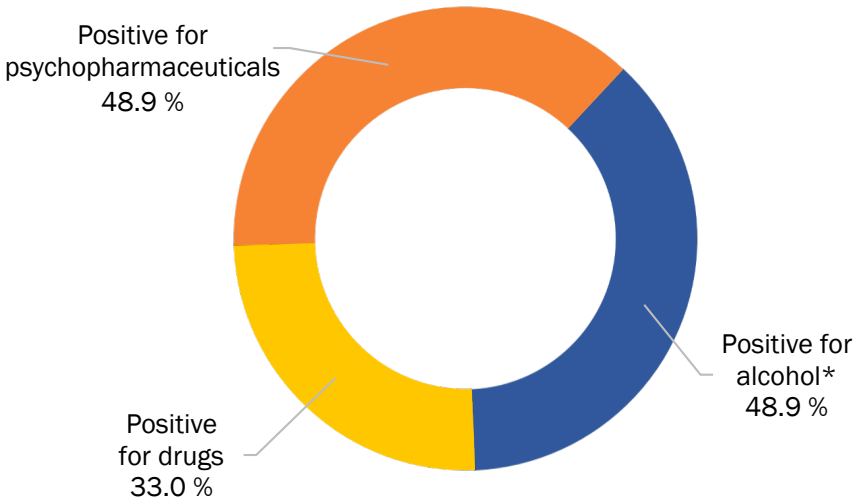
PEDESTRIANS. CASES WITH POSITIVE TOXICOLOGICAL RESULTS (n = 94)

FIGURES 31 and 32: PEDESTRIANS TESTING POSITIVE (n = 94). DISTRIBUTION BY GENDER AND AGE RANGES



Males accounted for **75.5%** of the pedestrian road traffic fatalities with positive toxicological results.

FIGURE 33: PEDESTRIANS TESTING POSITIVE (n = 94). PERCENTAGE DISTRIBUTION BYTYPE OF SUBSTANCE DETECTED (without taking into account possible associations)



* Positive for alcohol: blood alcohol level of 0.10 g/l or more.

FIGURE 34: PEDESTRIANS TESTING POSITIVE (n = 94). CLASSIFICATION OF RESULTS ACCORDING TO THE TYPE AND/OR COMBINATION OF SUBSTANCES DETECTED

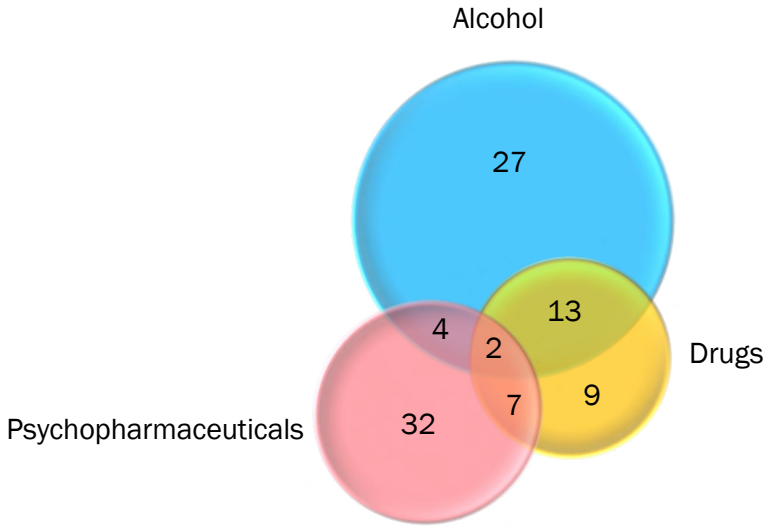
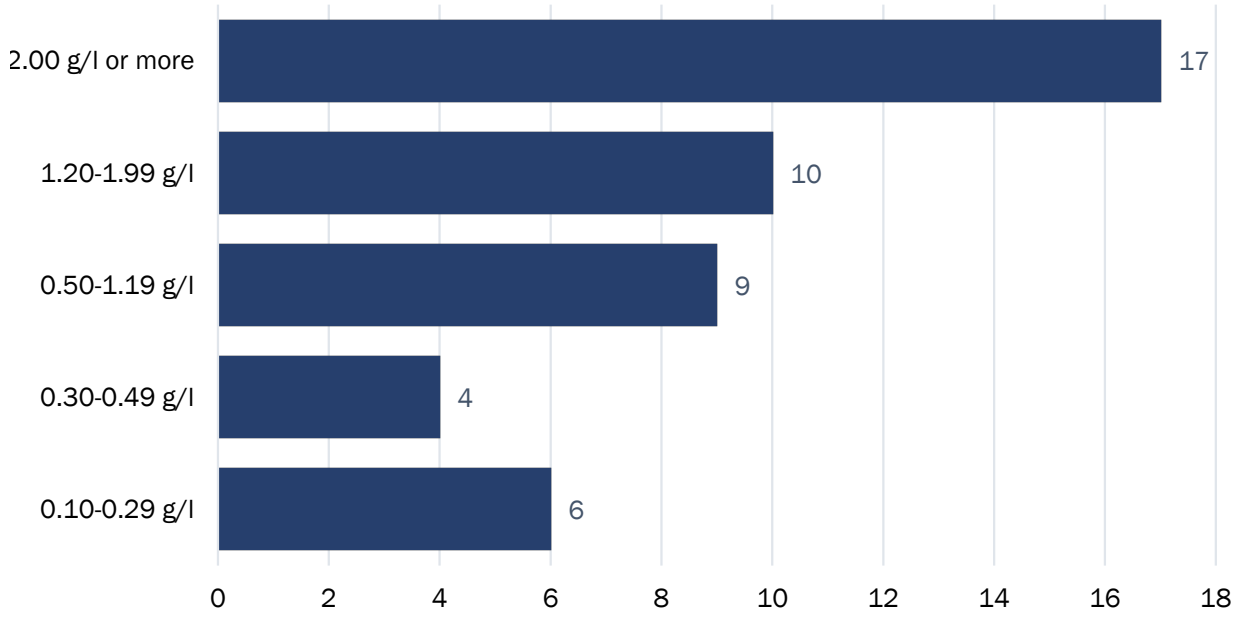


FIGURE 35: PEDESTRIANS TESTING POSITIVE FOR ALCOHOL (n = 46). DISTRIBUTION ACCORDING TO BLOOD ALCOHOL LEVEL



58.7% of the pedestrian fatalities tested positive for alcohol had a blood alcohol level of 1.20 g/l or more.

FIGURE 36: PEDESTRIANS TESTING POSITIVE FOR ALCOHOL (n = 46). DISTRIBUTION ACCORDING TO BLOOD ALCOHOL LEVEL AND AGE

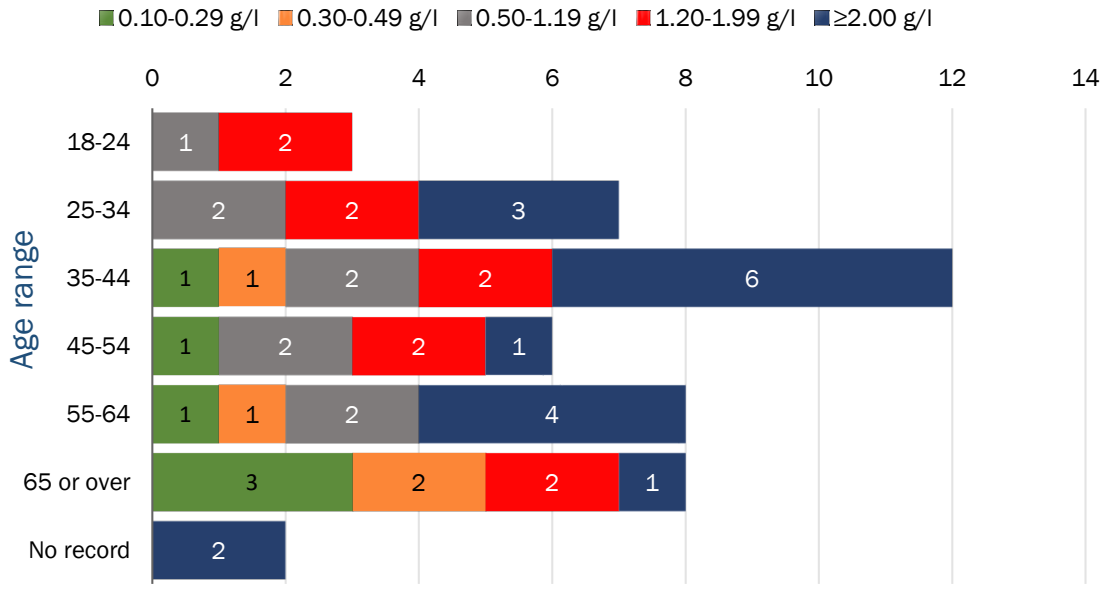
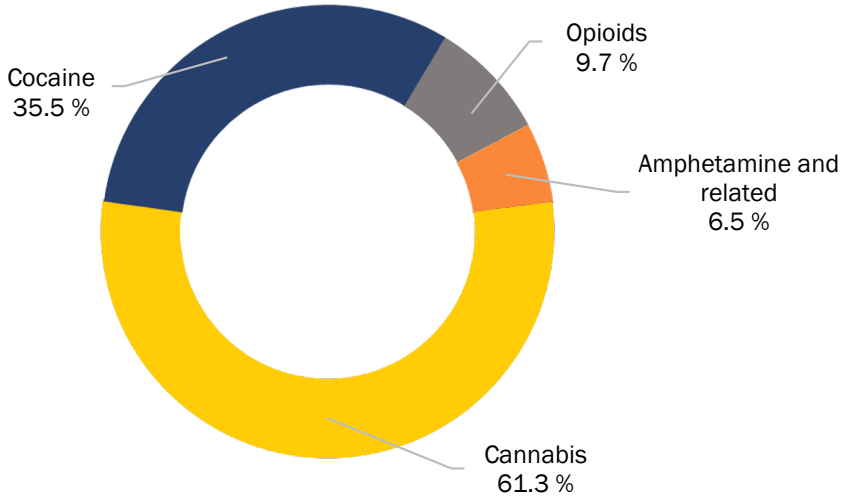


FIGURE 37: PEDESTRIANS TESTING POSITIVE FOR DRUGS (n = 31). PERCENTAGE DISTRIBUTION OF DRUGS DETECTED



Regardless of whether there was associated use of abused drugs, alcohol and/or psychopharmaceuticals, cannabis (**61.3%**) was the most commonly used drug on its own.

FIGURE 38: PEDESTRIANS TESTING POSITIVE FOR DRUGS (n = 31). DISTRIBUTION ACCORDING TO DRUG DETECTED AND AGE RANGES

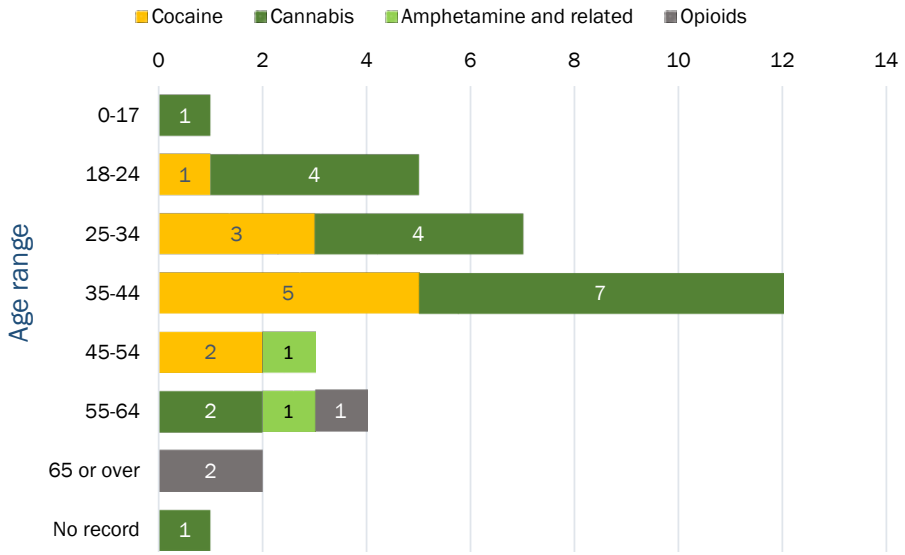
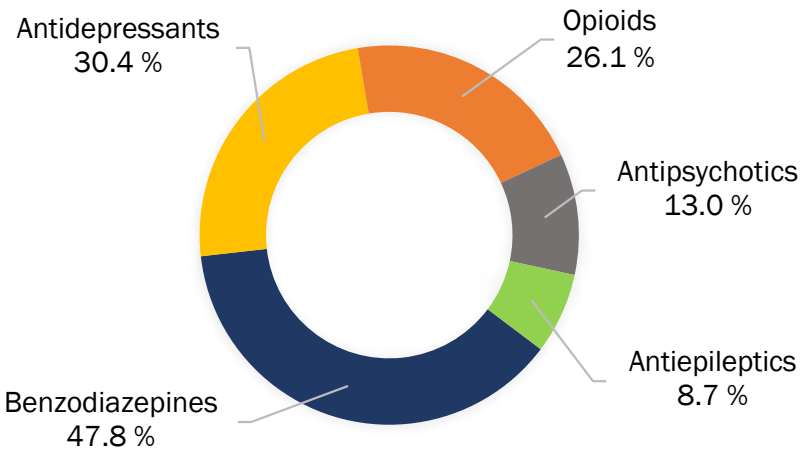


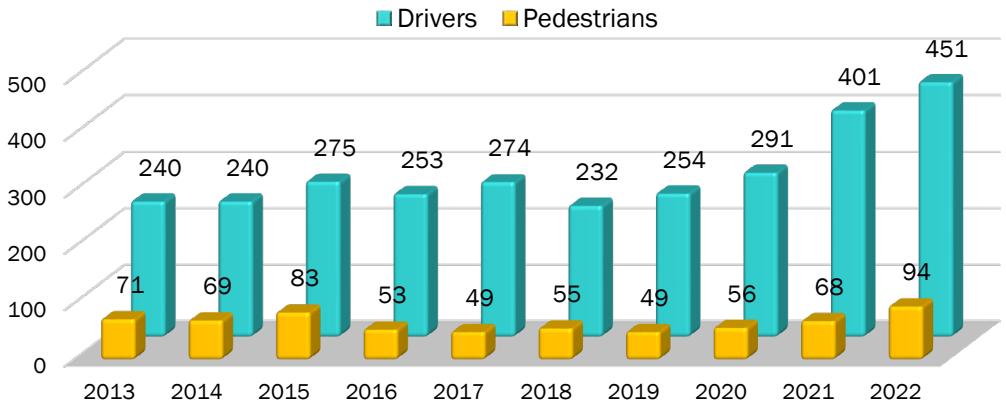
FIGURE 39: PEDESTRIANS TESTING POSITIVE FOR PSYCHOPHARMACEUTICALS (n = 46). PERCENTAGE DISTRIBUTION OF PSYCHOPHARMACEUTICALS DETECTED



The term “opioids” refers to drugs (tramadol, oxycodone, methadone, etc) that bind to opioid receptors in the central nervous system, excluding heroin.

Comparative study in relation to previous years

FIGURE 40: CHANGE OVER TIME IN THE NUMBER OF FATALITIES ANALYSED



This graph, which presents absolute data, shows a very considerable increase in the number of drivers killed since 2022 compared to previous years. This is not due to an increase in road accidents, but to an increase in the number of total victims analysed from a toxicological point of view, as the data for the years 2021 and 2022 includes not only the victims analysed by the INTCF, but also those analysed by seven IMLCFs.

FIGURE 41: EVOLUTION OVER TIME OF THE PERCENTAGE OF DRIVERS BY TOXICOLOGICAL RESULT

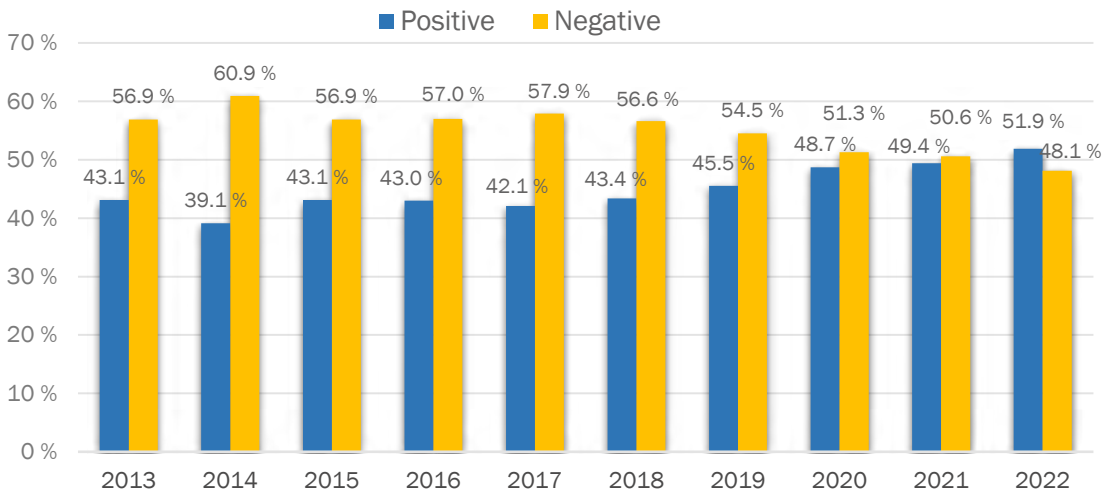


FIGURE 42: EVOLUTION OVER TIME OF THE PERCENTAGE OF PEDESTRIANS BY TOXICOLOGICAL RESULT

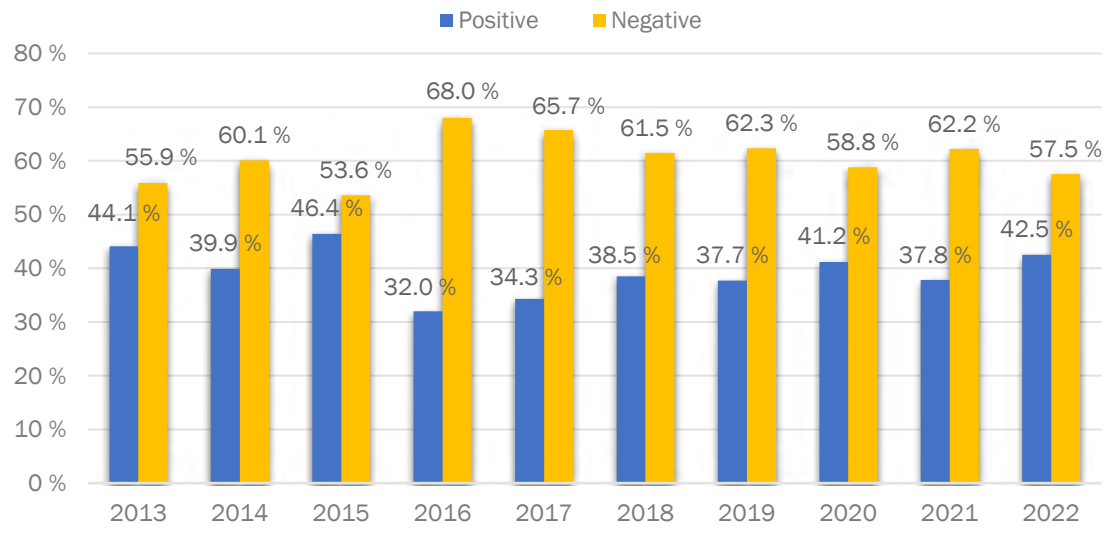
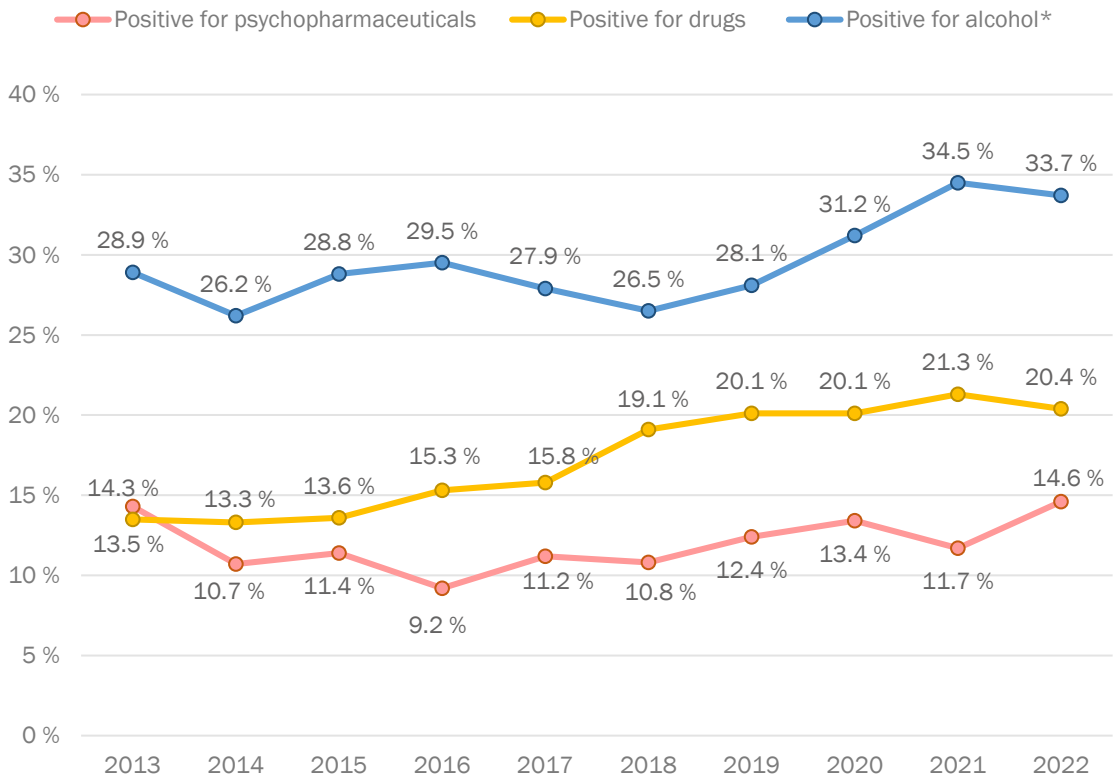


FIGURE 43: EVOLUTION OVER TIME OF THE PERCENTAGE OF DRIVERS TESTING POSITIVE BY TOXICOLOGICAL RESULT



* Positive for alcohol: blood alcohol level of 0.30 g/l or more.

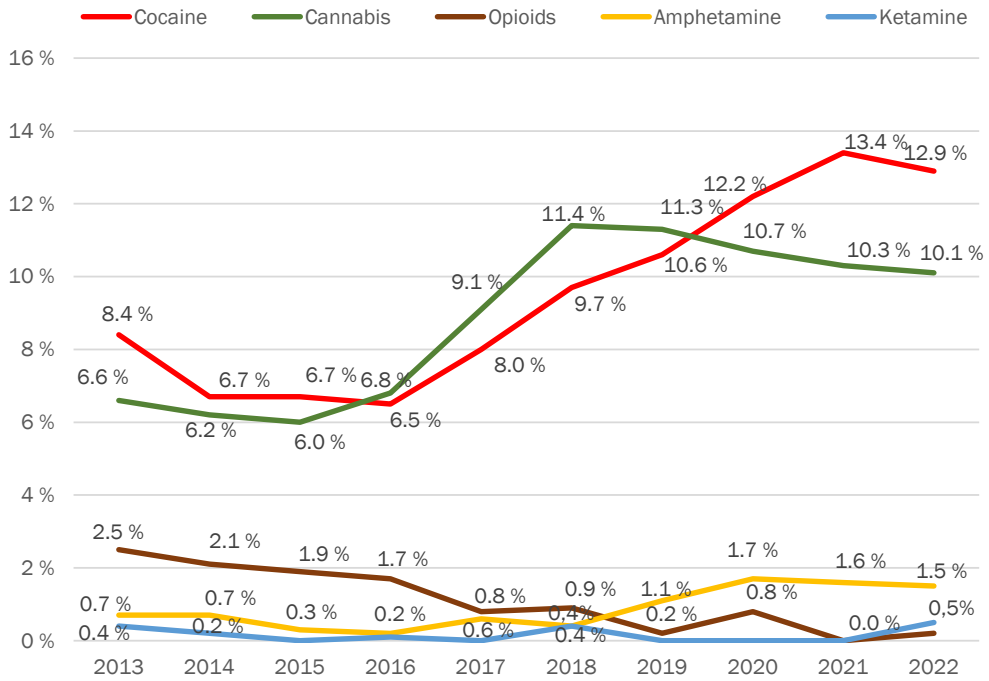
The comparative study of the last ten years of the number of drivers with positive toxicological results shows an increase of **8.8%** in 2022 compared to 2013.

With regard to alcohol consumption, a slight decrease of **0.8%** in drivers killed in road traffic accidents is observed in 2022 compared to 2021.

With regard to drug use, an upward trend is observed, with an increase of **6.9%** compared to in 2013 and a slight decrease(**0.9%**) compared to 2021.

Finally, for psychopharmaceuticals there is an increase(**2.9%**) compared to 2021.

FIGURE 44: EVOLUTION OVER TIME OF THE PERCENTAGE OF DRIVERS TESTING POSITIVE BY TYPE OF DRUG



Since 2016, there has been a marked upward trend(**6.4%**) in cocaine use among drivers who died in road traffic accidents. In the case of cannabis, use increased by **4.6%** between 2016 and 2018, with a slight downward trend of **1.3%**from 2018 to 2022.

Final considerations

SUMMARY OF FINAL CONSIDERATIONS WITH SIGNIFICANT MEDICAL-LEGAL AND SOCIAL IMPACT

From the data obtained and presented in the report, we can draw the following conclusions of major impact, not only in the medical-legal sphere, but also because of their important implications in terms of road safety.

DRIVERS

A slight decrease in the detection of alcohol and drugs of abuse and an increase in psychopharmaceuticals is detected among drivers who died in road accidents in 2022 compared to 2021.

Out of **854** drivers who died in road accidents and underwent an autopsy and toxicological analysis, **443** drivers, i.e. **51.9%** (figure 8A) showed positive toxicological results for alcohol (blood alcohol threshold 0.3 g/l), drugs of abuse and/or psychopharmaceuticals, either alone or in combination.

The increase compared to 2021 is due to a **2.9%** increase in the detection of psychopharmaceuticals among drivers in 2022 compared to 2021.

If we compare this figure with that of the prevalence of alcohol and drug use in the general population of drivers who underwent a drug test (**12%** according to DGT data in 2018 [4], or around **7%** in European drivers [5]), we realise the high impact of alcohol and drug use on traffic accident fatalities, as the prevalence of the presence of drugs in the group of deceased drivers increases by more than **39%** compared to the percentage of the general population of drivers found to be drug-impaired.

Alcohol continues to be the substance most frequently detected in deceased drivers, followed by cocaine and cannabis and, in third place, psychopharmaceuticals.

The overall data regarding the percentage distribution by type of substance detected in the total number of deceased drivers was as follows: **35.5%** positive for alcohol (blood alcohol detection threshold 0.10 g/l), **20.4%** positive for drugs and **14.6%** positive for psychopharmaceuticals (figure 10).

Deceased drivers with positive toxicological results were predominantly male.

A vast majority of the cases(**92.0%**) with positive toxicological results were male drivers, and only **8.0 %** were female drivers (figure 13), which is obviously an epidemiological finding of great significance in developing road traffic accident prevention campaigns.

Most of the drivers with positive toxicological results were driving a car, motorcycle or moped.

Most of the drivers with positive toxicological results(**84.4%**) were driving a car (**51.4%**) or a motorcycle or moped(**33.0%**) (figure 16).

The age range of the majority of drivers with positive toxicological results was 25 to 54 years old.

63.6% of drivers with positive toxicological results were in the 25-54 age group (figure 15).

In the <18-34 age group, fatal accidents involving drivers with positive toxicological results occurred mostly on Saturdays, Sundays and public holidays, while in the 35-65 age group, fatal accidents occurred mostly on working days.

54.1% of fatal accidents involving drivers with positive toxicological results nationwide occurred on weekdays, while the remaining **45.9%** occurred on Saturdays, Sundays and public holidays, regardless of age (figure 15). In the **<18-34 years** age group, the majority of driver fatalities with positive toxicological results occurred on Saturdays, Sundays and public holidays(**15.9%**, compared to **10.8%** on weekdays). However, in the **35-65** age group, fatal accidents occurred mostly on working days(**43.9%** compared to **28.6%** on Saturdays, Sundays and public holidays).

Alcohol continues to be the most commonly detected substance in the group of deceased drivers with positive toxicological results. The majority of the deceased drivers who tested positive for alcohol had a very high blood alcohol level of 1.2 g/l or more, which correlates with very severe intoxication.

The percentage distribution within the group of deceased drivers with positive toxicological results (n = 451), according to the type of substance detected, was as follows: **67.2%** were positive for alcohol, **38.6%** for drugs and **27.7%** for psychopharmaceuticals (figure 14).

It is important to highlight that **72.6%** of deceased drivers with positive results for alcohol had a very high blood alcohol level, which was equal to or higher than 1.2 g/l, which correlates with very severe intoxication levels (figure 18).

Overall data for the national territory indicates that the most commonly detected drug of abuse among deceased drivers was cocaine, followed by cannabis. Cannabis, however, was the most detected drug in the <18-34 age group, while cocaine was the most detected drug in the 35-64 age group.

Regarding cases positive for drugs of abuse (n = 174), and regardless of whether there was combined use of drugs of abuse, alcohol and/or psychopharmaceuticals, the single most detected drug nationwide was cocaine(**63.2%**), followed by cannabis(**49.4%**) (figure 21).

Cannabis was the most commonly detected drug in the <18-34 age group, while cocaine was the most commonly detected drug in the 35-64 age group (figure 22).

The overall data indicates that the most commonly detected psychopharmaceuticals in deceased drivers were benzodiazepines, followed by antidepressants, anti-epileptics and opioids.

The percentage distribution within the group of deceased drivers with positive results for psychopharmaceuticals (n = 95), by type of substance detected, was as follows: **60.0%** were positive for benzodiazepines, **40.0%** were positive for antidepressants, **15.2%** for opioids and **12.0%** for anti-epileptic drugs (figure 24).

The most prevalent combined alcohol and drugs of abuse detections were, in the first place, the simultaneous presence of alcohol and cocaine, followed by the simultaneous presence of alcohol and cannabis, and alcohol, cocaine and cannabis.

The most prevalent simultaneous alcohol and drugs of abuse detections were, in the first place, the simultaneous presence of alcohol and cocaine(**46.1%**), followed by the simultaneous presence of alcohol and cannabis(**31.5%**), and alcohol, cocaine and cannabis(**12.3%**) (figure 23).

The comparative study of the last ten years of the number of drivers with positive toxicological results shows an increase of 8.8% in 2022 compared to 2013.

The comparative study of the last ten years of the number of drivers with positive toxicological results shows an increase in 2022 of **8.8%** compared to 2013 (figure 41).

Regarding alcohol consumption, a slight decrease of **0.8%** is observed in 2022 compared to 2021.

With regard to drug use, an upward trend is observed, with an increase of **6.9%** compared to 2013 and a slight decrease(**0.9%**) compared to 2021.

Finally, with regard to psychopharmaceuticals, there is an increase(**2.9%**) compared to 2021 (figure 43).

Since 2016, there has been a marked upward trend(**6.4%**) in cocaine use among drivers who died in road traffic accidents. In the case of cannabis, use increased by **4.6%** between 2016 and 2018, with a slight downward trend of **1.3%** from 2018 to 2022 (figure 44).

PEDESTRIANS

In 2022, there was a 4.7% increase in the proportion of pedestrians road traffic fatalities with positive toxicological results for alcohol, drugs of abuse and/or psychopharmaceuticals, alone or in combination, compared to 2021.

Of 221 pedestrians killed in road traffic accidents and autopsied, **42.5%** tested positive for alcohol, drugs of abuse and psychopharmaceuticals, either alone or in combination (figure 27).

The gender distribution of deceased pedestrians with positive toxicological results is different from the distribution of deceased drivers, with **75.5%** of deceased pedestrian with positive toxicological results being male and **22.3%** being female (figure 31).

The age range distribution revealed a higher prevalence in pedestrians aged 65 years and older.

The age range distribution revealed a higher prevalence in pedestrians aged 65 years and older (**35.1%**) (figure 32).

Alcohol and psychopharmaceuticals continue to be the substances most commonly detected in pedestrian fatalities in road traffic accidents, followed by drugs of abuse.

The highest prevalence of pedestrians testing positive was for alcohol(**48.9%**) and psychopharmaceuticals (**48.9%**), followed by drugs of abuse (**33.0%**) (figure 33).

Most of the deceased pedestrians who tested positive for alcohol had a very high blood alcohol level of 1.2 g/l or higher, which correlates with very severe intoxication.

It is noteworthy that **58.7%** of the deceased pedestrians with positive results for alcohol had a blood alcohol level of 1.20 g/l or higher (figure 35).

The overall data indicates that the most commonly detected psychopharmaceuticals in deceased pedestrians were benzodiazepines, followed by antidepressants, opioids and anti-epileptics.

The percentage distribution within the group of deceased pedestrians testing positive for psychopharmaceuticals (n = 46), according to the type of substance detected, was as follows: **47.8%** were positive for benzodiazepines, **30.4%** were positive for antidepressants, **26.1%** were positive for opioids, and **8.7%** were positive for anti-epileptic drugs (figure 39).

Methodology

1. NATIONAL INSTITUTE OF TOXICOLOGY AND FORENSIC SCIENCES

1.1. Analytical techniques used and participation in intercomparison exercises.

Analytical techniques used

- Enzyme immunoassay.
- Headspace gas chromatography with flame ionisation detector (HS-GC-FID).
- High performance liquid chromatography with diode-array detector (HPLC-DAD).
- Gas chromatography coupled with mass spectrometry (GC-MS).
- Gas chromatography coupled with tandem mass spectrometry (GC-MSMS).
- Ultra performance liquid chromatography paired with tandem mass spectrometry (UPLC-MSMS).
- Liquid chromatography coupled with high resolution mass spectrometry (LC-HRMS).

All reported drug and psychopharmaceuticals drug outcomes [6] have been confirmed by analytical techniques based on mass spectrometry [7-16].

All analytical results have been obtained within the quality system implemented at the INTCF in accordance with standard **ISO 17025**, with the INTCF, in particular, accredited by the **National Accreditation Entity** (**ENAC**) for the quantitative determination of ethyl alcohol in biological fluids, among other analyses. [17].

The following is a description of the national and international intercomparison exercises in which the Chemistry and Drugs services of the different departments of the INTCF participate annually and whose results are essential to externally evaluate the competence of our laboratories in this type of drug of abuse testing.

TABLE 1: PARTICIPATION IN INTERCOMPARISON EXERCISES OF THE CHEMISTRY AND DRUGS SERVICES OF THE DIFFERENT INTCF DEPARTMENTS

	Barcelona	Madrid	Seville	La Laguna
Programme: Blood Alcohol Intercomparison Exercise **Organiser:** INTCF Seville **Frequency:** every four months **Parameters/samples:** ethyl alcohol and other volatile compounds in blood and plasma	X	X	X	X
Programme: Whole Blood Alcohol / Volatiles Survey (AL1) **Organiser:** College of American Pathologists **Frequency:** every four months **Parameters/samples**ethyl alcohol, volatile compounds and ethylene glycol in blood	X	X		
Programme: Toxicology **Organiser:** LGC Standards **Frequency:** yearly **Parameters/samples**Identification and quantification of ethanol in blood			X	
Programme: Vitreous Fluid (VF) **Organiser:** College of American Pathologists **Frequency:** biannual **Parameters/samples:** ethyl alcohol, potassium and sodium in vitreous humour		X		
Programme: Forensic Toxicology Criminalistics (FTC) **Organiser:** College of American Pathologists **Frequency:** biannual **Parameters/samples:** drugs in blood and urine	X	X		
Programme: Forensic Blood Toxicology Proficiency Testing (Quartz) **Organiser:** LGC **Frequency:** quarterly **Parameters/samples** drugs of abuse and psychopharmaceuticals in blood		X	X	X
Programme: Blood Drug Analysis (CTS-5661) **Organiser:** Collaborative Testing Services **Frequency:** yearly **Parameters/samples** drugs of abuse and psychopharmaceuticals in blood		X		
Programme: International Quality Assurance Programme (IQAP-UNODC) Biological Specimens Group. **Organiser:** United Nations Office on Drugs and Crime (UNODC) **Samples:** 4 urine samples **Frequency:** biannual **Parameters:** identification and quantification of most common drugs of abuse		X	X	

2. INSTITUTE OF LEGAL MEDICINE AND FORENSIC SCIENCES OF CATALONIA

2.1. Analytical techniques used and participation in intercomparison exercises.

Analytical techniques used

- Enzyme immunoassay.
- Headspace gas chromatography with flame ionisation detection (HS-GC-FID), detection and quantification of ethanol.
- Gas chromatography coupled with mass spectrometry (GC-MS), detection and quantification of drugs of abuse and psychopharmaceuticals.
- High performance liquid chromatography paired with tandem mass spectrometry (HPLC-MSMS), detection and quantification of drugs of abuse and psychopharmaceuticals.

The intercomparison exercises which the IMLCFC has participated in during 2022 were:

- Blood Ethyl Alcohol Intercomparison Exercise (BAIE) organised by the INTCF Seville Department.
- UNODC-BS: detection of psychopharmaceuticals substances in urine (2 participations).
- LGC STANDARDS: detection and quantification of drugs and psychopharmaceuticals (4 participations), detection and quantification of alcohol and volatile compounds (2 participations), detection and quantification of carboxyhaemoglobin, paracetamol and ethanol (6 participations), detection and quantification of GHB in urine (2 participations).

3. BASQUE INSTITUTE OF FORENSIC MEDICINE

3.1. Analytical techniques used and participation in intercomparison exercises.

Analytical techniques used

- Enzyme immunoassay.
- Headspace gas chromatography with flame ionisation detector (HS-GC-FID).
- Ultra performance liquid chromatography paired with tandem mass spectrometry (UPLC-MSMS).

All reported results for drugs and psychopharmaceuticals have been confirmed with analytical techniques based on mass spectrometry.

The analytical results for ethanol have been obtained with a method validated internally by the laboratory where a double column for confirmation is used. The results are always checked against certified reference material and the interlaboratory exercises they are participating in.

Analytical results for drugs of abuse have always been obtained using methods tested with certified reference material and the interlaboratory exercises which they are participating in.

The intercomparison exercises in which the IVML has participated during 2022 have been:

- Blood and Plasma Ethyl Alcohol Intercomparison Exercise. Organiser: INTCF Seville. Frequency: every four months. Parameters/samples: ethyl alcohol and other volatile compounds in blood and plasma.
- Toxicology Programme. Organiser: LGC Standards. Frequency: monthly. Parameters/samples: quantification of COHb, ethanol and paracetamol in blood.
- Programme: Forensic Blood Toxicology Proficiency Testing (Quartz). Organiser: LGC Frequency: quarterly. Parameters/samples: identification and quantification of drugs of abuse and psychopharmaceuticals in blood.

4. INSTITUTE OF LEGAL MEDICINE AND FORENSIC SCIENCES OF ARAGON

4.1. Analytical techniques used and participation in intercomparison exercises

Analytical techniques used

- Headspace gas chromatography with flame ionisation detection (HS-GC-FID).
- Gas chromatography with mass spectrometry detection (GC-MS).

The intercomparison exercises the IMLA laboratory has participated in during 2022 were:

- Blood Ethyl Alcohol Intercomparison Exercise organised by the INTCF.

5. INSTITUTE OF LEGAL MEDICINE AND FORENSIC SCIENCES OF MURCIA

5.1. Analytical techniques used and participation in intercomparison exercises

Analytical techniques used

- Headspace gas chromatography with flame ionisation detection (HS-GC-FID).
- Gas chromatography coupled with mass spectrometry (GC-MS).

The intercomparison exercises which the IMLCFM participated in during 2021 were:

- Blood Ethyl Alcohol Intercomparison Exercise (BAIE) organised by the INTCF Seville Department.

6. INSTITUTE OF LEGAL MEDICINE AND FORENSIC SCIENCES OF THE BALEARIC ISLANDS

6.1. Analytical techniques used and participation in intercomparison exercises

Analytical techniques used

- Enzyme immunoassay.
- Headspace gas chromatography with flame ionisation detection (HS-GC-FID), detection and quantification of ethanol.
- Gas chromatography coupled with mass spectrometry (GC-MS), detection and quantification of drugs of abuse and psychopharmaceuticals.

The intercomparison exercises performed by the IMLCFIB in 2022 were as follows:

- Blood Ethyl Alcohol Intercomparison Exercise (BAIE) organised by the INTCF Seville Department.
- UNODC ICE PROGRAMME: Interlaboratory Exercise on Psychopharmaceuticals Substances in Urine (2020-1-BS).
- FTC-B 2021 programme, Forensic Toxicology, Criminalistics, organised by the College of American Pathologists: Interlaboratory Exercise on Psychopharmaceuticals Substances in Blood.

7. INSTITUTE OF LEGAL MEDICINE AND FORENSIC SCIENCES OF VALENCIA

7.1. Analytical techniques used and participation in intercomparison exercises:

Analytical techniques used

- Enzyme immunoassay.
- Headspace gas chromatography with flame ionisation detection (HS-GC-FID).

The intercomparison exercises performed by the IMLCFV in 2021 were as follows:

- Blood Ethyl Alcohol Intercomparison Exercise. Organiser: INTCF Seville Frequency: Four-monthly parameters/samples: ethyl alcohol and other volatile compounds in blood and plasma.

8. LUIS CONCHEIRO INSTITUTE OF FORENSIC SCIENCES (INCIFOR)

8.1. Analytical techniques used and participation in intercomparison exercises:

Analytical techniques used

- Thermo Fisher Indiko Plus enzyme immunoassay.
- Agilent Headspace gas chromatography with flame ionisation detection (HS-GC-FID) for detection and quantification of ethanol.
- High performance liquid chromatography with diode-array detector (HPLC-DAD) for detection and quantification of drugs of abuse and psychopharmaceuticals.
- Gas chromatography coupled with mass spectrometry (GC-MS) for detection and quantification of drugs of abuse and psychopharmaceuticals.

The controls and benchmarking exercises in which INCIFOR periodically participates are as follows:

- Three INTCF checks per year. The controls are for the determination of ethanol, methanol and other volatile compounds in blood and plasma samples.
- Two controls per year to determine LGC ethanol/methanol and other volatile compounds in blood, accredited according to the ISO/IEC 17043 standard.
- An annual LGC urine ethanol control, accredited according to the ISO/IEC 17043 standard.

9. DATA ANALYSIS AND STATISTICAL PROCESSING

The data received in each request (date of accident, date of death, role, age, gender, type of vehicle, autonomous region, province, requesting body, sending body, etc), and the data from the toxicological studies obtained by the INTCF, were recorded in the LIMS Labware (Laboratory Information Management System) information management system of the INTCF.

LIMS queries were performed through various searches using the Data Explorer module, and the data was exported to a standardised Microsoft Excel template.

The data were cross-checked with those recorded independently by the DGT and a selection of cases was made.

The analytical data received from the different IMLCFs and INTCF departments were compiled all together in the same standardised Microsoft Excel template.

The statistical data and final graphs were obtained manually by using filters and graph creation in Excel, as well as by using the Qlik Sense *advanced analytics tool.*

Bibliography

BIBLIOGRAPHY

1. Royal Decree 1428/2003, of 21 November, approving the General Traffic Regulations for the application and development of the text of the Traffic, Circulation of Motor Vehicles and Road Safety Act, approved by Royal Legislative Decree 339/1990, of 2 March. Available at: https://www.boe.es/eli/es/rd/2003/11/21/1428/con
2. D'Orazio AL, Mohr ALA, Chan-Hosokawa A, Harper C, Huestis MA, Limoges JF, Miles AK, Scarneo CE, Kerrigan S, Liddicoat LJ, Scott KS, Logan BK. Recommendations for Toxicological Investigation of Drug-Impaired Driving and Motor Vehicle Fatalities-2021 Update. *J Anal Toxicol.* 2021. Jul 10;45(6):529-536. Available at: https://doi.org/10.1093/jat/bkab064
3. Law 18/2021, of 20 December, which amends the combined text of the Traffic, Circulation of Motor Vehicles and Road Safety Act, approved by Royal Legislative Decree 6/2015, of 30 October, with regard to the points-based driving licence. Available at: https://www.boe.es/diario_boe/txt.php?id=BOE-A-2021-21006 (last accessed: 25 June 2023).
4. Systematic review on drugs and driving. National Road Safety Observatory. November 2021. Directorate General of Traffic. Available at: https://www.dgt.es/export/sites/web-DGT/.galleries/Images/conoce-la-dgt/que-hacemos/conocimiento-investigacion/revision-sistematica-sobre-drogas-y-conduccion/REVISION- SYSTEMATICS-DRUGS.pdf (last accessed: 25 June 2023).
5. Drug use, impaired driving and traffic accidents. European Monitoring Centre for Drugs and Drug Addiction, 2014. Available at: https://www.emcdda.europa.eu/publications/insights/2014/drugs-and-driving_en (last accessed: 25 June 2023).
6. Logan BK, D'Orazio AL, Mohr ALA, Limoges JF, Miles AK, Scarneo CE, Kerrigan S, Liddicoat LJ, Scott KS, Huestis MA. Recommendations for Toxicological Investigation of Drug-Impaired Driving and Motor Vehicle Fatalities-2017 Update. *J Anal Toxicol*. 2018 42(2):63-68. Available at: https://doi.org/10.1093/jat/bkx082
7. Martínez MA. Qualitative criteria in forensic toxicology. *Rev. Esp. Med. Legal.* 2012 38(2): 68-75. Available at: 10.1016/j.reml.2012.03.004
8. Martínez MA. Quantitative criteria in forensic toxicology. *Rev. Esp. Med. Legal*. 2014 40(1): 30-38. Available at: 10.1016/j.reml.2013.03.002
9. Society of Forensic Toxicologists. Available at: https://www.soft-tox.org/ (last accessed: 25 June 2023).
10. García-Rodríguez S, Giménez MP. Human resources in a forensic toxicology laboratory. *Rev Toxicol*. 2005 22: 1-11. Available at: http://rev.aetox.es/wp/wp-content/uploads/hemeroteca/vol22-2/revtox.22.2.2005.pdf

11. The International Association of Forensic Toxicologists (TIAFT). Laboratory Guidelines (source: number 4, p. 23-26). Available at: http://www.tiaft.org/tiaft-guidelines.html TIAFT-Bulletin XXXI, (last accessed: 25 June 2023).
12. Society of Forensic Toxicologists / American Academy of Forensic Sciences (SOFT/AAFS). Forensic Toxicology Laboratory Guidelines, 2006 Version. Available at: http://www.duirob.com/old%20duirob.com%20taken%20down%202010/articles/SOFT%20Guidelines%202006.pdf (last accessed: 25 June 2023).
13. Society of Toxicological and Forensic Chemistry (GTFCH). Guidelines and recommendations. Available at: https://www.gtfch.org/cms/index.php/en/guidelines (last accessed: 25 June 2023).
14. European Union Decision 2002/657/EC. Available at: https://eur-lex.europa.eu/legal-content/ES/TXT/?uri=celex%3A32002D0657 (last accessed: 25 June 2023).
15. U.S. Department of Health and Human Services, Food and Drug Administration (FDA). Center for Veterinary Medicine, May 1, 2003. Guidance for Industry. Mass Spectrometry for Confirmation of the Identity of Animal Drug Residues (FDA Guidance Document 118). Available at: https://www.fda.gov/regulatory-information/search-fda- guidance-documents/cvm-gfi-118-mass-spectrometry-confirmation-identity-animal- drug-residues (last accessed: 25 June 2023).
16. World Anti-Doping Agency. WADA-Technical Document-TD2003IDCR. Available at: https://www.wada-ama.org/sites/default/files/td2019dl_final_eng_clean.pdf (last access: 25 June 2023).
17. UNE EN ISO/IEC 10725:2017 Standard. General requirements for the competence of testing and calibration laboratories. Available at: https://www.une.org/encuentra-tu-norma/busca-tu-norma/norma?c=N0059467

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