Emergent Psychoactive Substances: The role of Forensic Toxicology Laboratories in Clinical and Medico-Legal Contexts

Mário Dias

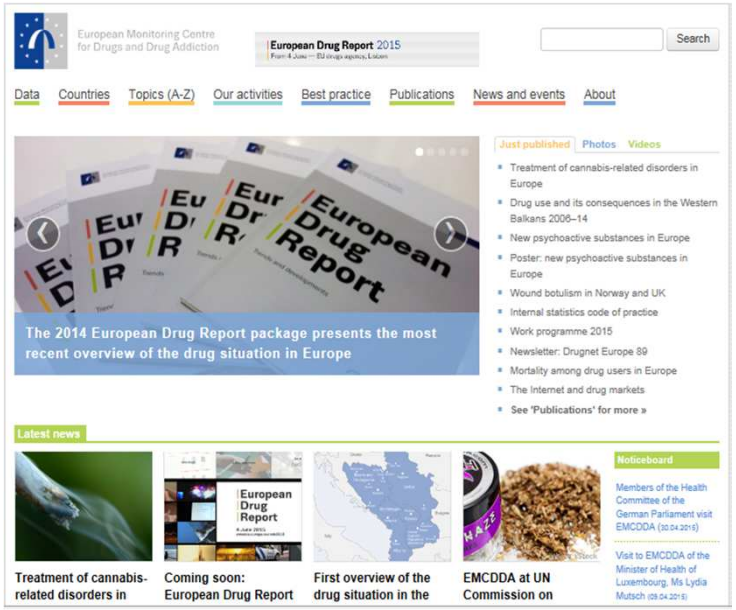
European Workplace Drug Testing Society
28th – 29 th Lisbon Conference

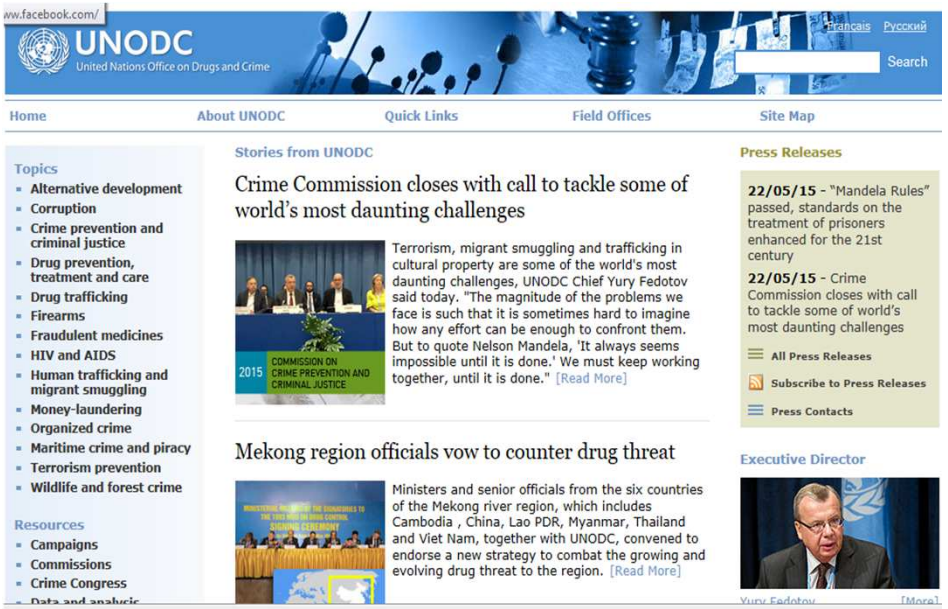
SUMMARY

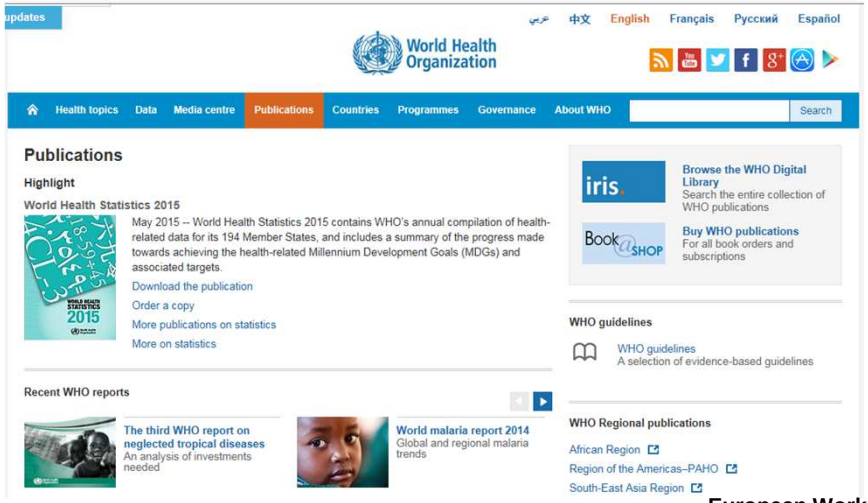
- Introduction
- Aims of forensic laboratories
- Results
- Conclusions

Introduction

Emergent Psychoactive Substances: The role of Forensic Toxicology Laboratories in Clinical and Medico-Legal Contexts



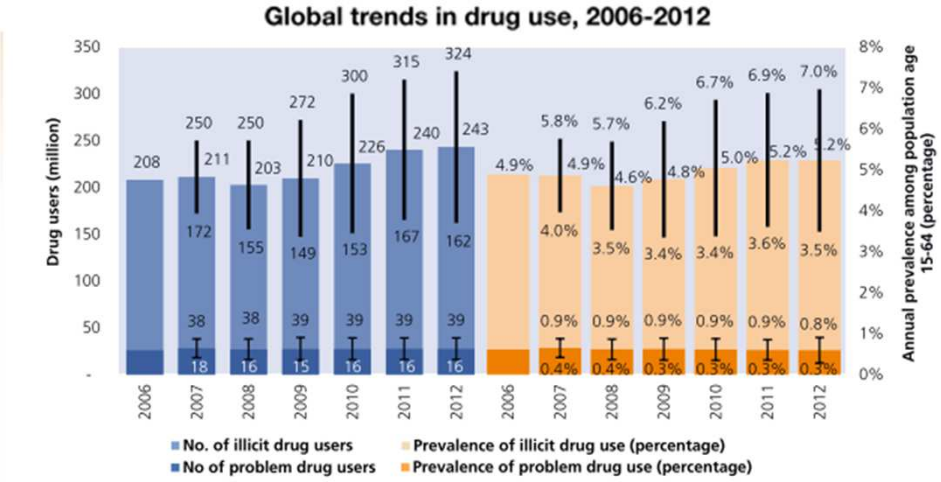




…in 2012, between 162 and 324 million people aged 15–64 were estimated to have used an illicit substance in the preceding year…

…this corresponds between 3.5 and 7% of the adult population…

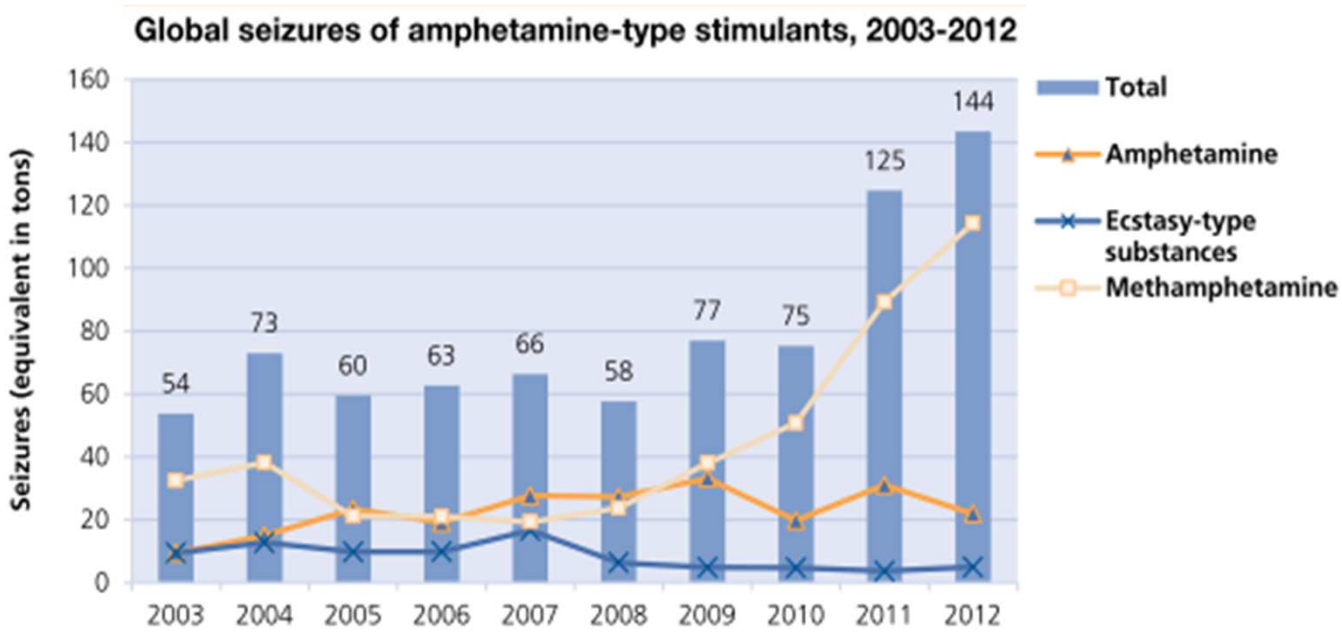
…global prevalence of drug use and the problems related with drug use disorders or dependence is considered to be stable….



(http://www.unodc.org)

Methamphetamine corresponds to 80% of the total of ATS seized worldwide

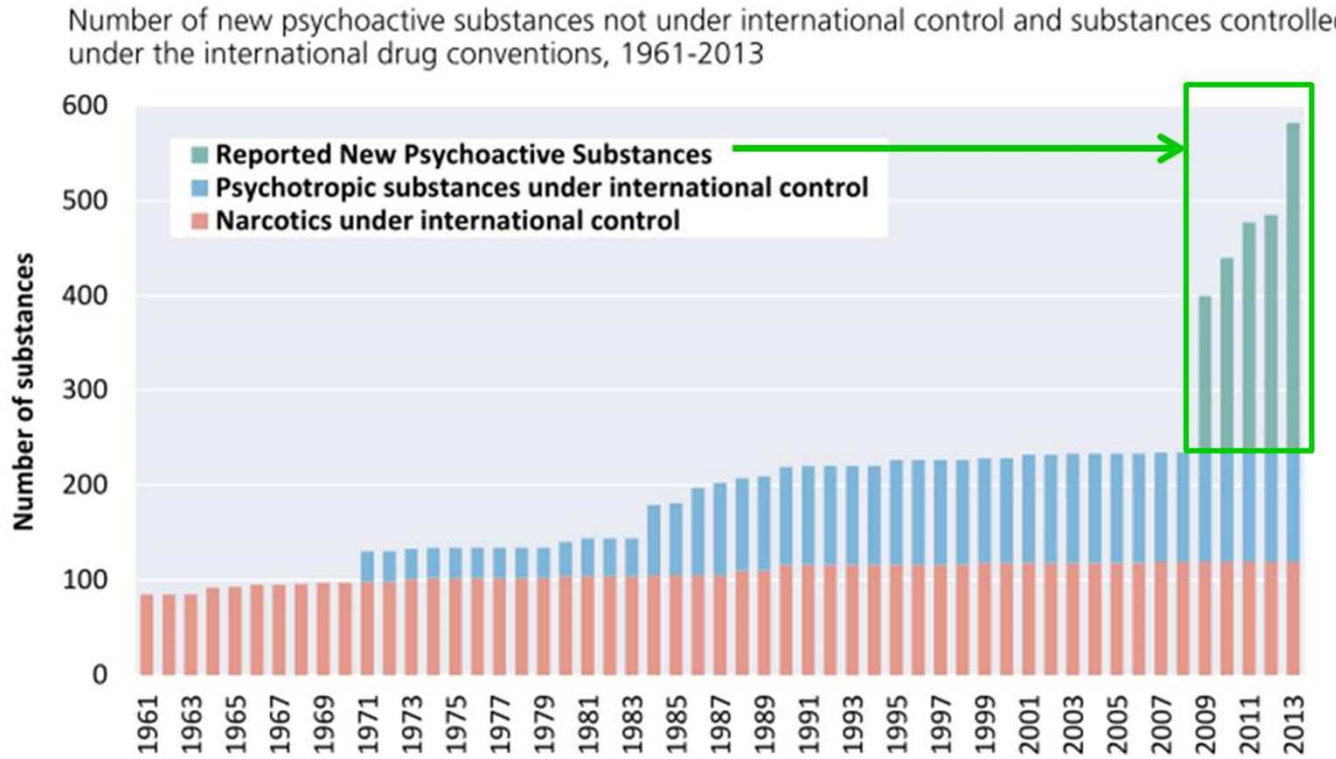
… while there is a reported decrease in ATS use in Western and Central Europe, the estimates for North America indicate an increase in ATS use



(http://www.unodc.org)

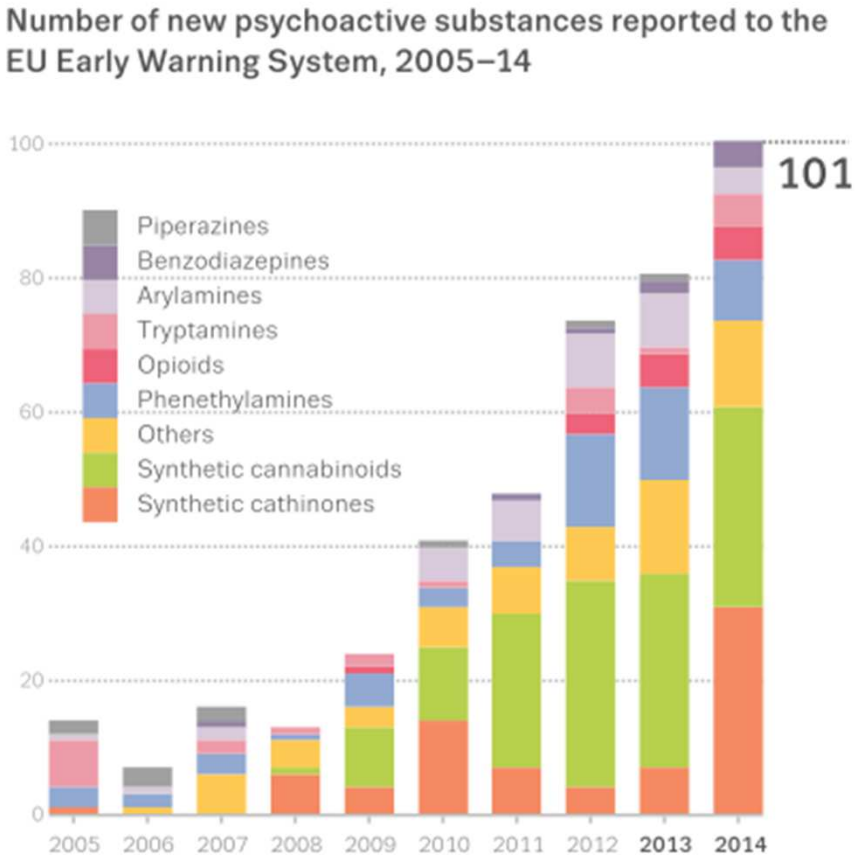
The number of NPS on the global market more than doubled over the period 2009-2013

The number of new psychoactive substances clearly exceeds the number of psychoactive substances controlled at the international level



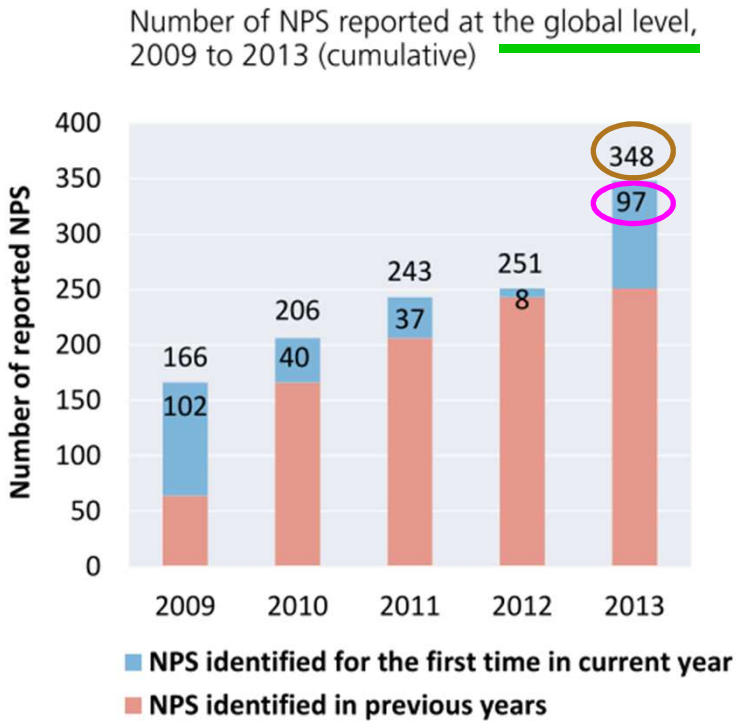
http://www.unodc.org)

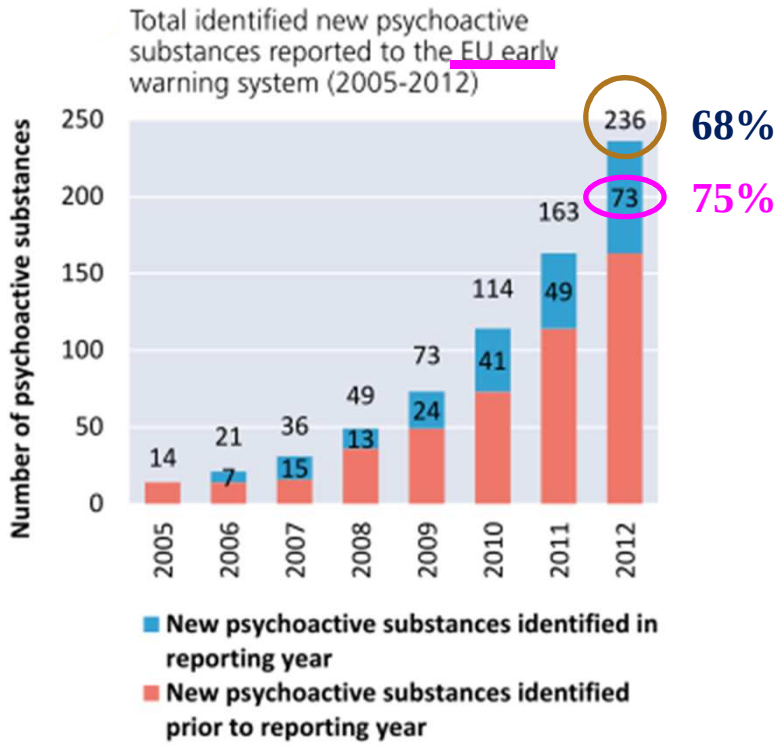
More than 450 substances were notified by the EU Early Warning System in the last years



(http://www.emcdda.europa.eu)

The phenomena of NPS is especially important in Europe because the number of NPS identified for the first time and reported by the EU - EWS in 2012 was around 75% of the total reported at global level

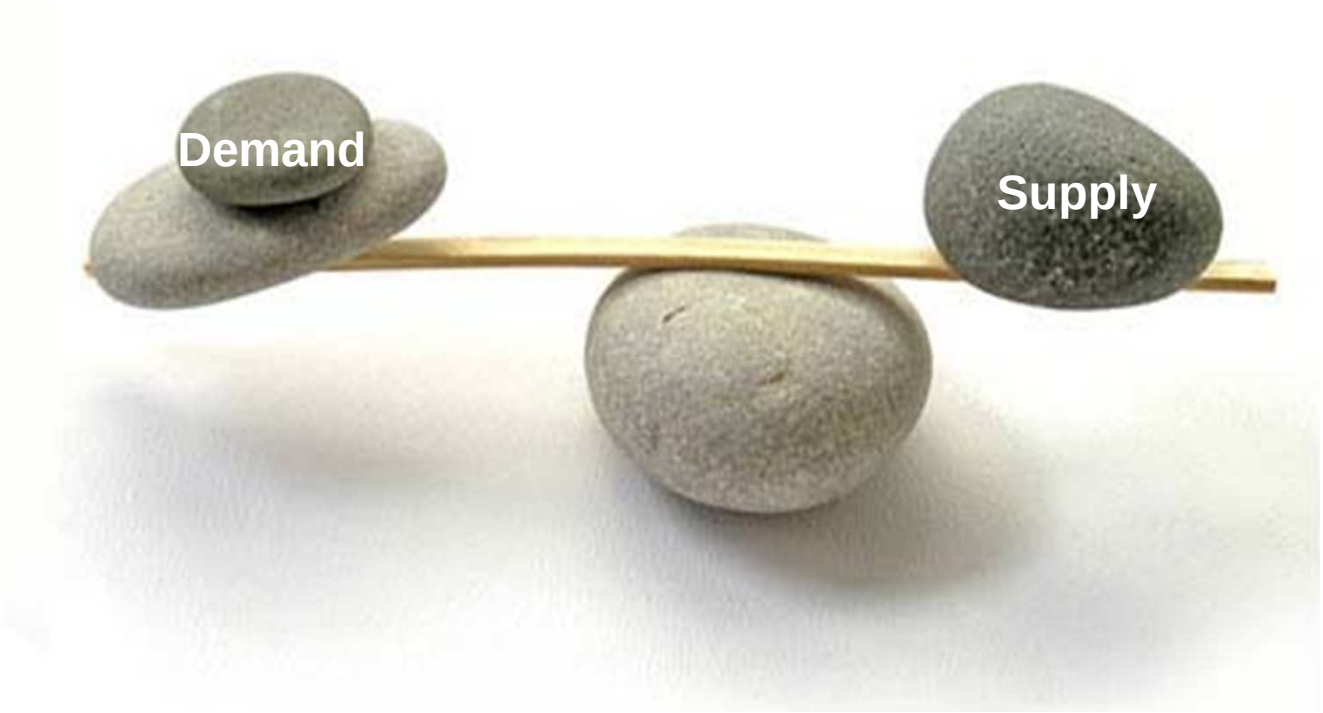




(http://www.unodc.org)

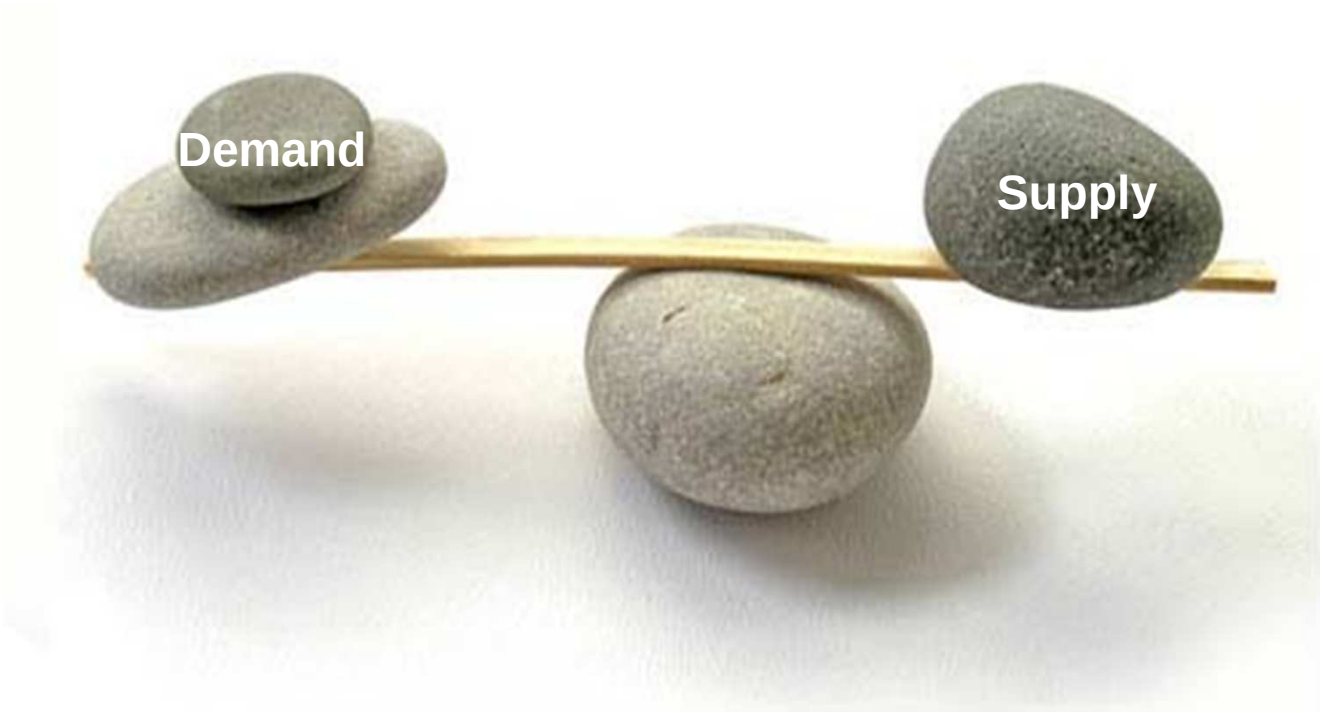
Treatment
Prevention
Epidemiology
Harm reduction

Drug Production
Trafficking
Organized Crime



Workplace Drug Tests
Drugs and Driving
Drug Related deaths
Hospital Emergency Departments
Wastewater

Drug seizures



AIMS

FORENSIC TOXICOLOGY

Identification of substances in **biological fluids and tissues**

Concentrations of **ng/mL**

Analytical identification based on comparison with reference standards and databases

Metabolic profile of the substances

FORENSIC CHEMISTRY

Identification of substances in **non-biological s**

Concentrations of **mg ou Kg**

Analytical identification based on comparison with reference standards and databases and **physicochemical properties and characteristics**

key messages for a suitable quality of the toxicology and chemical results

- Results for serving as a mean of evidence, must correspond to legal requirements and **be consistent to testifying in court**

- The analytical **results may be questioned from diametrically opposed point of view** because, doctors, patients, prosecutors, judges, defenders, accused, victims, employees and employers, have different and even conflicting interests.

- The laboratory **results must be** as **accurate** as possible, all aspects of the laboratory operations must be **reliable**, and reporting must be **timely** in order to be useful.

COUNCIL OF
THE EUROPEAN UNION

EN

Council conclusions on the vision for European Forensic Science 2020 including the creation of a European Forensic Science Area and the development of forensic science infrastructure in Europe

3135th JUSTICE and HOME AFFAIRS Council meeting
Brussels, 13 and 14 December 2011

CONSIDERING Council Framework Decision 2009/905/JHA on Accreditation of forensic service providers carrying out laboratory activities[2], which seeks to ensure that the results of laboratory activities carried out by accredited forensic service providers in one Member State are recognised by the authorities responsible for the prevention, detection and investigation of criminal offences as being equally reliable as the results of laboratory activities carried out by forensic service providers accredited to EN ISO/IEC 17025 within any other Member State, and to achieve this by ensuring that forensic service providers carrying out laboratory activities are accredited by a national accreditation body as complying with EN ISO/IEC 17025,

In order to foster cooperation between police and judicial authorities across the European Union with a view to creating a European Forensic Science Area by 2020, Member States and the Commission will work together to make progress in the following areas, aiming to ensure the even-handed, consistent and efficient administration of justice and the security of citizens:

- accreditation of forensic science institutes and laboratories;
- respect for minimum competence criteria for forensic science personnel;
- establishment of common best practice manuals and their application in daily work of forensic laboratories and institutes;
- conduct of proficiency tests/collaborative exercises in forensic science activities at international level;

IPAC acreditação

DIRECTÓRIO DE ENTIDADES ACREDITADAS

Laboratórios de Ensaio

Laboratórios Clínicos (ISO 15189)

Análises Clínicas

E0014	Instituto Nacional de Saúde Doutor Ricardo Jorge, I.P. / Departamento de Doenças Infecciosas

Genética Humana

E0013	Instituto de Biologia Molecular e Celular / Centro de Genética Preditiva e Preventiva
E0015	Instituto Nacional de Saúde Doutor Ricardo Jorge, I.P. / Departamento de Genética Humana

Laboratórios de Ensaio (ISO/IEC 17025)

Actividades forenses

L0279	Instituto Português do Desporto e Juventude,IP / Autoridade Antidopagem de Portugal - Laboratório de Análises de Dopagem
L0402	Instituto Nacional de Medicina Legal e Ciências Forenses, I.P. / Serviço de Química e Toxicologia Forenses – Delegação do Sul
L0588	Instituto Nacional de Medicina Legal e Ciências Forenses, I.P. / Serviço de Química e Toxicologia Forenses – Delegação do Centro
L0632	Instituto Nacional de Medicina Legal e Ciências Forenses, I.P. / Serviço de Genética e Biologia Forenses – Delegação do Sul
L0655	Instituto Nacional de Medicina Legal e Ciências Forenses, I.P. / Serviço de Genética e Biologia Forenses – Delegação do Centro

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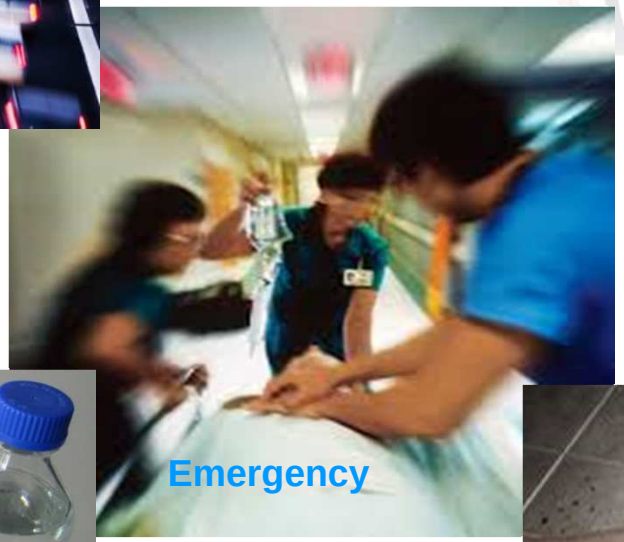
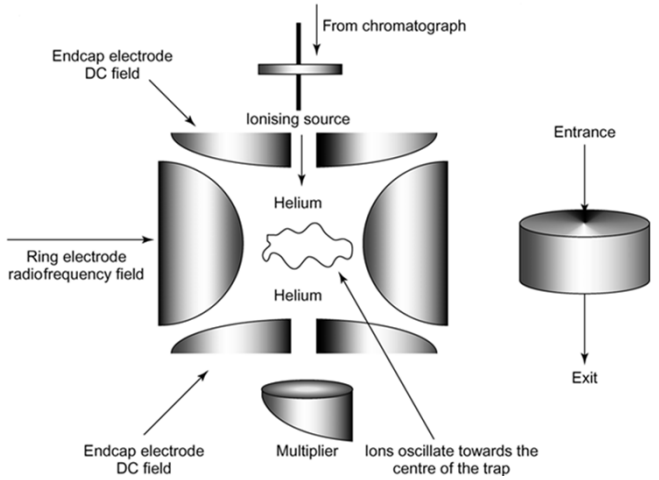
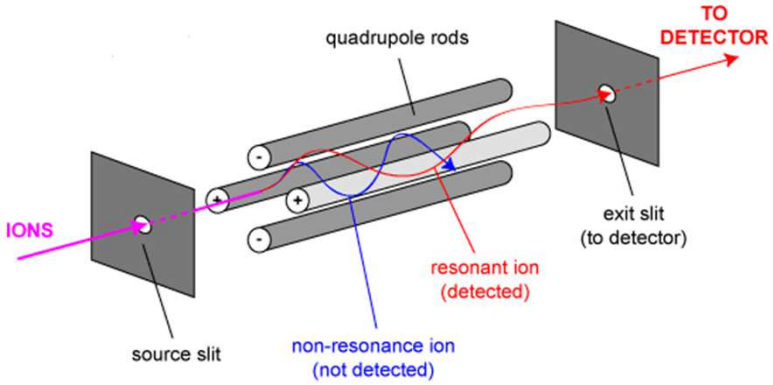


CONFIRMATION

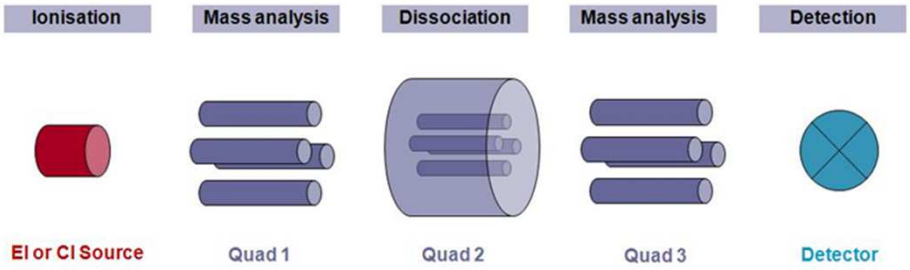
- GC/MS
- GC/MS-MS
- LC/MS-MS
- UPLC/MS-MS



Ion Trap (MS^n)



Quadrupole (MS)



Triple Quadrupole (MS/MS)

RESULTS


Workplace drug test

1. Sample collection (composite 24-h samples)
2. Sample analysis to obtain the concentrations of the target residues
3. Amount of target residues entering the treatment plant (g/day)
4. Amount of a substance consumed by the population served by the treatment plant
5. Normalisation of the amount of substance to a defined population (g or mg/day/1 000 inhabitants)
6. Amount of substance as doses/day/1 000 inhabitants

Flow rate (m^3/day)

Human metabolism correction factors

Population estimates

Mean dose

(http://www.emcdda.europa.eu)

Score 2014

ETAR A	*Concentração (ng/mL)*	
	Amostra 1	*Amostra 2*
Morfina		
Cotinina	471,03	455,5
6-Acetilmorfina	15,03	93,09
MDA		
MDMA	75,85	300,74
Anfetamina	176,27	262,8
Metanfetamina	92,89	150,28
Mefedrona	40,56	264,13
Cetamina		
Benzoilecgonina	211,77	297,57
Cocaina	48,78	112,44
Cocaetileno		
EDDP	23,32	23,96
Metadona	7,89	8,57
THCCOOH	64,15	167,82

Score 2015

ETAR A	Concentracao (ng/L)							
	Amostra 0	Amostra 1	Amostra 2	Amostra 3	Amostra 4	Amostra 5	Amostra 6	LDQ (ng/L)
Morfina	147	110	133	193	106	98	136	10
Cotinina	2578	2594	2370	2491	2460	2446	2426	1
6-Acetilmorfina	< 10 (2.6)	< 10 (4.2)	< 10 (5.8)	< 10 (5.5)	< 10 (3.1)	< 10 (6.9)	< 10 (5.3)	2
MDA	_	_	_	_	_	_	_	10
MDMA	20	30	92	259	97	44	29	1
Anfetamina	< 10 (8.0)	< 10 (9.1)	14	28	19	11	< 10 (7.7)	5
Metanfetamina	< 10 (4.3)	< 10 (4.7)	< 10 (4.0)	< 10 (4.6)	< 10 (4.1)	< 10 (3.6)	< 10 (4.1)	1
Mefedrona	_	_	< 10 (6.2)	< 10 (6.4)	< 10 (5.2)	_	_	5
Cetamina	< 10 (2.2)	< 10 (1.8)	< 10 (1.2)	_	< 10 (1.1)	_	_	1
Benzoilecgonina	845	915	1081	1135	835	762	774	1
Cocaína	180	236	273	261	205	221	226	1
Cocaetileno	< 10 (3.7)	< 10 (4.3)	10	13	< 10 (4.5)	< 10 (3.6)	< 10 (5.6)	1
EDDP	122	126	140	144	131	138	137	1
Metadona	66	63	57	66	58	65	66	1
THCCOOH	321	354	355	376	325	319	322	5

Score 2015

ETAR B	Concentracao (ng/L)									
	Amostra 1	Amostra 2	Amostra 3	Amostra 4	Amostra 5	Amostra 6	Amostra 7	Amostra 8	Amostra 9	LDQ (ng/L)
Morfina	319	432	314	406	259	340	313	393	311	10
Cotinina	3017	3455	2820	3049	2735	3255	2875	3331	3766	1
6-Acetilmorfina	–	–	–	< 10 (5.8)	< 10 (6.2)	< 10 (5.8)	< 10 (2.8)	< 10 (4.5)	< 10 (2.8)	2
MDA	–	–	–	–	–	–	–	–	–	10
MDMA	15	15	12	40	96	139	48	18	32	1
Anfetamina	15	16	14	11	21	26	11	< 10 (8.9)	10	5
Metanfetamina	< 10 (6.8)	< 10 (7.0)	< 10 (5.7)	< 10 (5.6)	< 10 (4.5)	< 10 (4.1)	< 10 (5.6)	< 10 (7.6)	< 10 (8.1)	1
Mefedrona	–	–	–	–	–	–	–	–	–	5
Cetamina	–	–	–	–	–	–	–	–	–	1
Benzoilecgonina	467	504	431	578	661	732	481	591	517	1
Cocaina	198	200	163	173	184	200	96	129	108	1
Cocaetileno	< 10 (2.9)	< 10 (2.8)	< 10 (2.2)	< 10 (3.2)	< 10 (1.9)	< 10 (6.0)	< 10 (2.2)	< 10 (1.4)	< 10 (3.0)	1
EDDP	165	180	148	206	207	151	148	198	205	1
Metadona	60	59	51	85	89	69	71	87	80	1
THCCOOH	235	175	131	405	417	355	477	468	477	5

MINISTÉRIO DA SAÚDE

Decreto-Lei n.º 54/2013

de 17 de abril

Artigo 7.º

Precaução sanitária

5 - Os médicos que, ao prestarem cuidados de saúde ou ao realizarem perícias médico-legais, encontrem indícios de um dano à saúde potencialmente imputável ao consumo de uma substância, notificam, de imediato, a autoridade de saúde competente e o SICAD.

Ficha de Notificação de casos desencadeados pelo consumo de novas substâncias psicoativas*

* "Um novo estupefaciente ou um novo psicotrópico, puro ou numa preparação, que não seja controlado pela Convenção Única das Nações Unidas de 1961 sobre os estupefacientes, nem pela Convenção das Nações Unidas de 1971 sobre substâncias psicotrópicas, mas que possa constituir uma ameaça para a saúde pública comparável à das substâncias enumeradas nessas convenções."
in Decisão 2005/387/JAI do Conselho relativa ao intercâmbio de informações, avaliação de riscos e controlo de novas substâncias psicoativas.

Instituição de Saúde

Região de Saúde | **Data do Episódio** (dd/mm/aaaa) | **Data da notificação** (dd/mm/aaaa)

Idade | **Data de nascimento** (dd/mm/aaaa) | **Naturalidade**

Distrito de residência | **Concelho de residência**

Diagnóstico Clínico

CID 10 | **Tem conhecimento de algum episódio anterior deste utente?**

Consulte CID 10 em http://www.dgtaxsus.gov.br/cid10/V2008/Web4Help/cid10.htm

Nome do produto suspeito/ designação comercial

Sintomas Físicos

- ☐ Coma
- ☐ Paragem respiratória
- ☐ Insuficiência renal
- ☐ Arritmias/ Insuficiência cardíaca aguda
- ☐ Outros

Quais?

Sintomas Mentais

- ☐ Estado confusional agudo
- ☐ Episódio psicótico agudo (delírio e/ou alucinações visuais e sinestésicas)
- ☐ Ansiedade
- ☐ Outros

Quais?

Situação atual

- ☐ Sem sequelas
- ☐ Sequelas físicas
- ☐ Sequelas mentais
- ☐ Outras

Quais?

Óbito? | **Autópsia?**

Internamento? | **Se sim, qual a duração? (em dias)**

Foi identificado o local de aquisição da(s) substância(s)? | **Se sim, qual/ onde?**

Nome do Clínico

Contacto telefónico | **E-mail**

Imprimir | **Submeter** (clicar apenas uma vez) | 1/1

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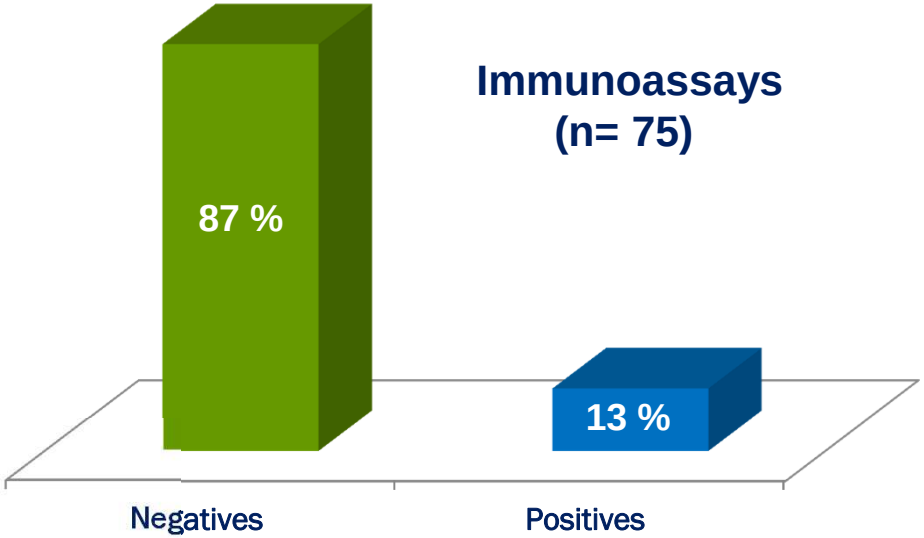

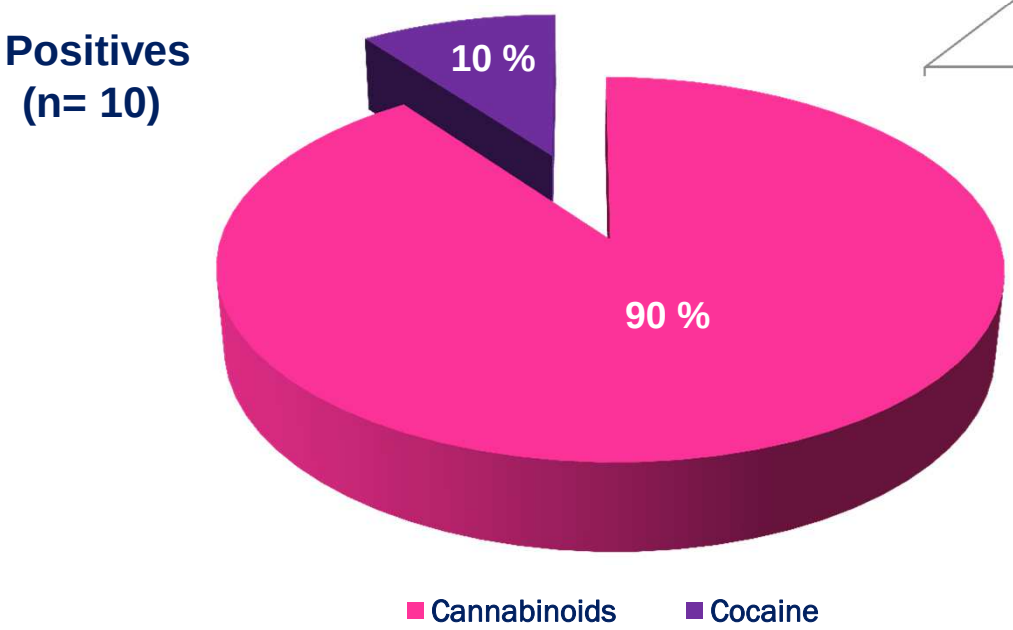

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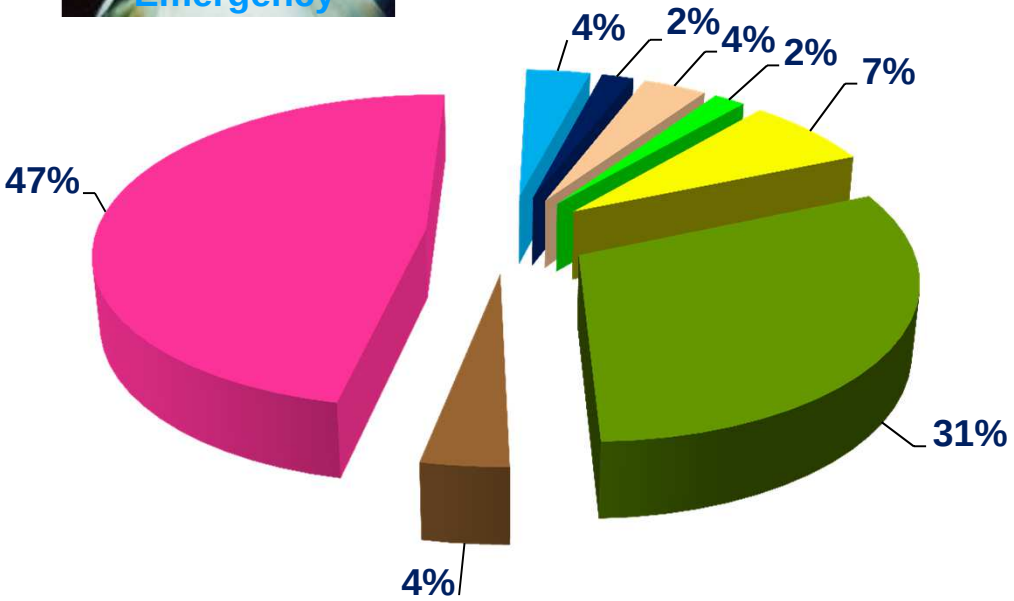
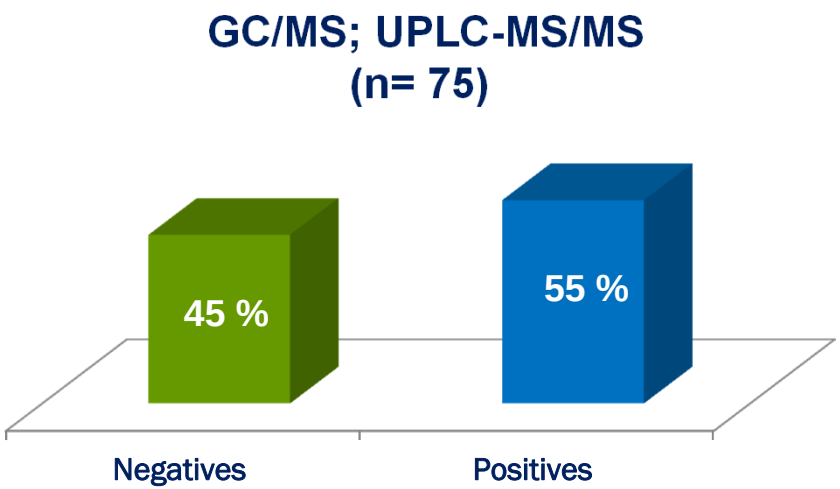
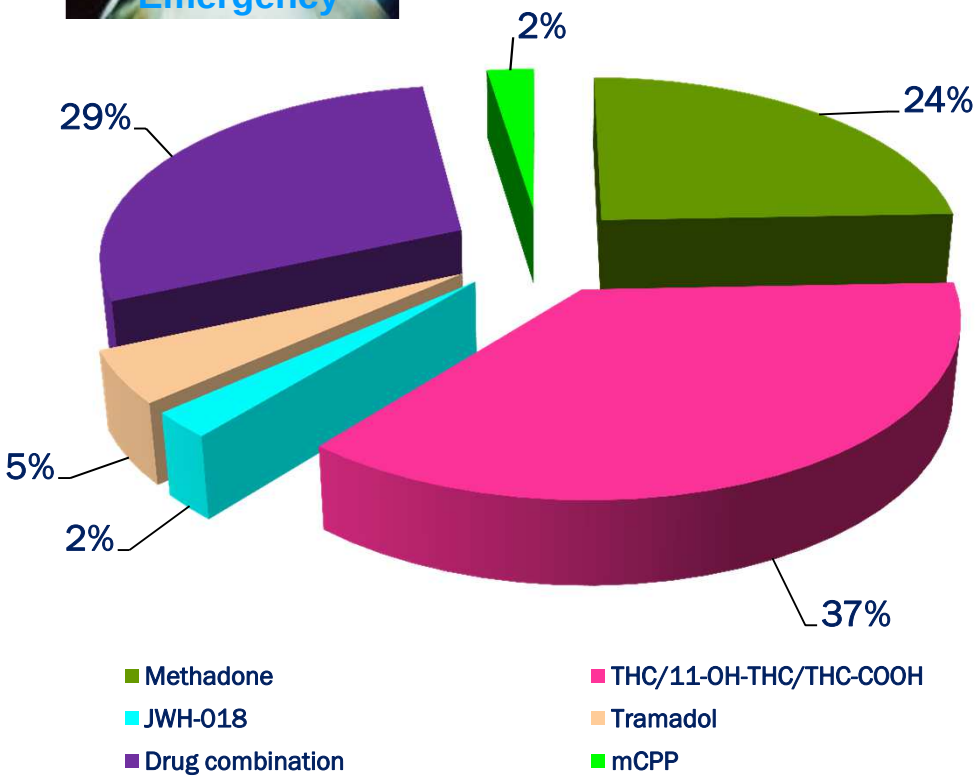
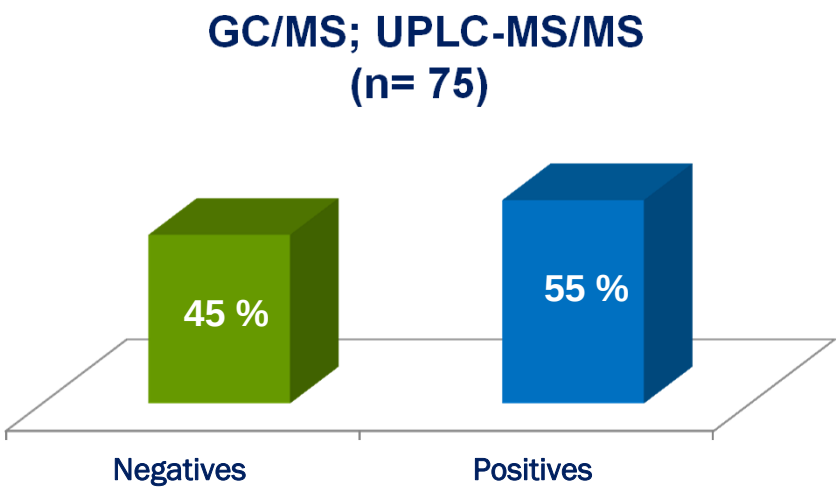





Emergency


2%
24%
29%
5%
2%
37%
Methadone
THC/11-OH-THC/THC-COOH
JWH-018
Tramadol
Drug combination
mCPP


GC/MS; UPLC-MS/MS
(n= 75)
45 %
55 %
Negatives
Positives

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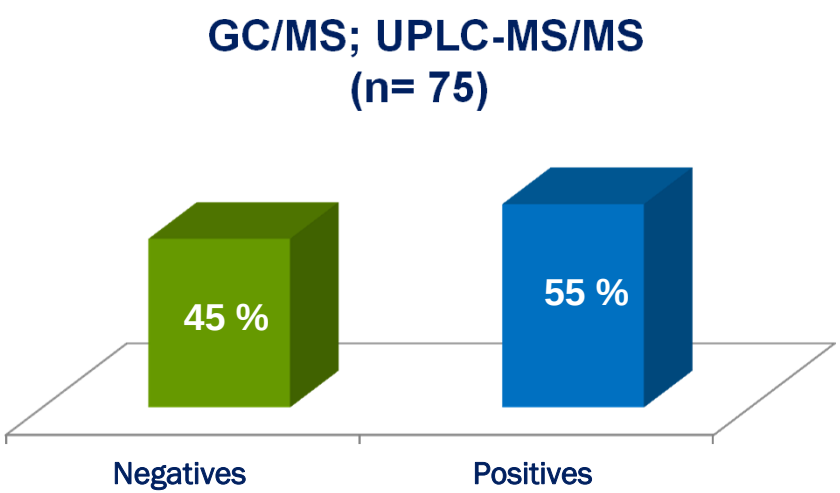
Results				
Sample	Immunoassay		GC-MS / UPLC-MS-MS	
2	Negative		Positive	**Methadone**
3	Negative		Positive	**Methadone**
5	Positive	Cannabinoids	Positive	**THC-COOH; JWH-018**
7	Positive	Cannabinoids	Positive	**Morphine; THC-COOH**
10	Negative		Positive	**THC-COOH**
11	Negative		Positive	**JWH-018**
13	Negative		Positive	**Methadone; THC-COOH**
18	Positive	Cannabinoids	Positive	**THC-COOH**
20	Negative		Positive	**Methadone**
22	Negative		Positive	**Methadone**
23	Negative		Positive	**Methadone; THC-COOH**
24	Positive	Cannabinoids	Positive	**THC-COOH**
27	Positive	Cannabinoids	Positive	**Morphine; THC-COOH**
30	Negative		Positive	**Methadone**
34	Positive	Cannabinoids	Positive	**THC; 11-OH-THC; THC-COOH**
35	Negative		Positive	**Morphine; Benzoylecgonine**
36	Negative		Positive	**THC-COOH**
37	Negative		Positive	**THC-COOH**
38	Positive	Cannabinoids	Positive	**THC-COOH**
39	Negative		Positive	**mCPP**
40	Positive	Cannabinoids	Positive	**THC-COOH**
42	Negative		Positive	**Methadone**
44	Negative		Positive	**Methadone; THC-COOH**
46	Positive	Cocaine	Positive	**THC-COOH**
48	Negative		Positive	**Methadone**
51	Positive	Cannabinoids	Positive	**THC-COOH**
53	Negative		Positive	**Methadone**
55	Negative		Positive	**Methadone ; THC-COOH**
56	Negative		Positive	**Methadone; Morphine; THC-COOH**
57	Negative		Positive	**Methadone**
60	Negative		Positive	**Cocaine; Benzoylecgonine; THC-COOH**
61	Negative		Positive	**Tramadol**
62	Negative		Positive	**Methadone; THC-COOH**
65	Negative		Positive	**Methadone; MDA; THC-COOH**
66	Negative		Positive	**Methadone**
67	Negative		Positive	**THC-COOH**
68	Negative		Positive	**Tramadol**
69	Negative		Positive	**THC-COOH**
70	Negative		Positive	**THC; THC-COOH**
71	Negative		Positive	**THC; 11-OH-THC; THC-COOH**
73	Negative		Positive	**THC-COOH**



CONCLUSIONS

The indicator of consume based on emergence hospital admissions, complemented with analytical confirmation by LC and GC techniques is an important tool for monitoring trends of drug use

The forensic toxicology labs are equipped with analytical equipment that allow the detection of drugs in low concentrations, including in wastewater samples

Guidelines for analytical strategies and data collection in the area of emergence hospital admissions and wastewater would allow a comparability of data between countries and also a better monitoring of trends drug use

The results demonstrate the importance that the implementation of a European Network of Laboratories of Forensic Toxicology could have for a better monitoring of pattern of drug users

Thank you for your attention !