

RIAPAd - New challenges in drug monitoring: **wastewater analysis** as an alternative indicators for rapid epidemiological assessment of drug use trend

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Disclosure of Conflicts of Interest

NONE



RD21/0009/0012



ED431C 2021/06

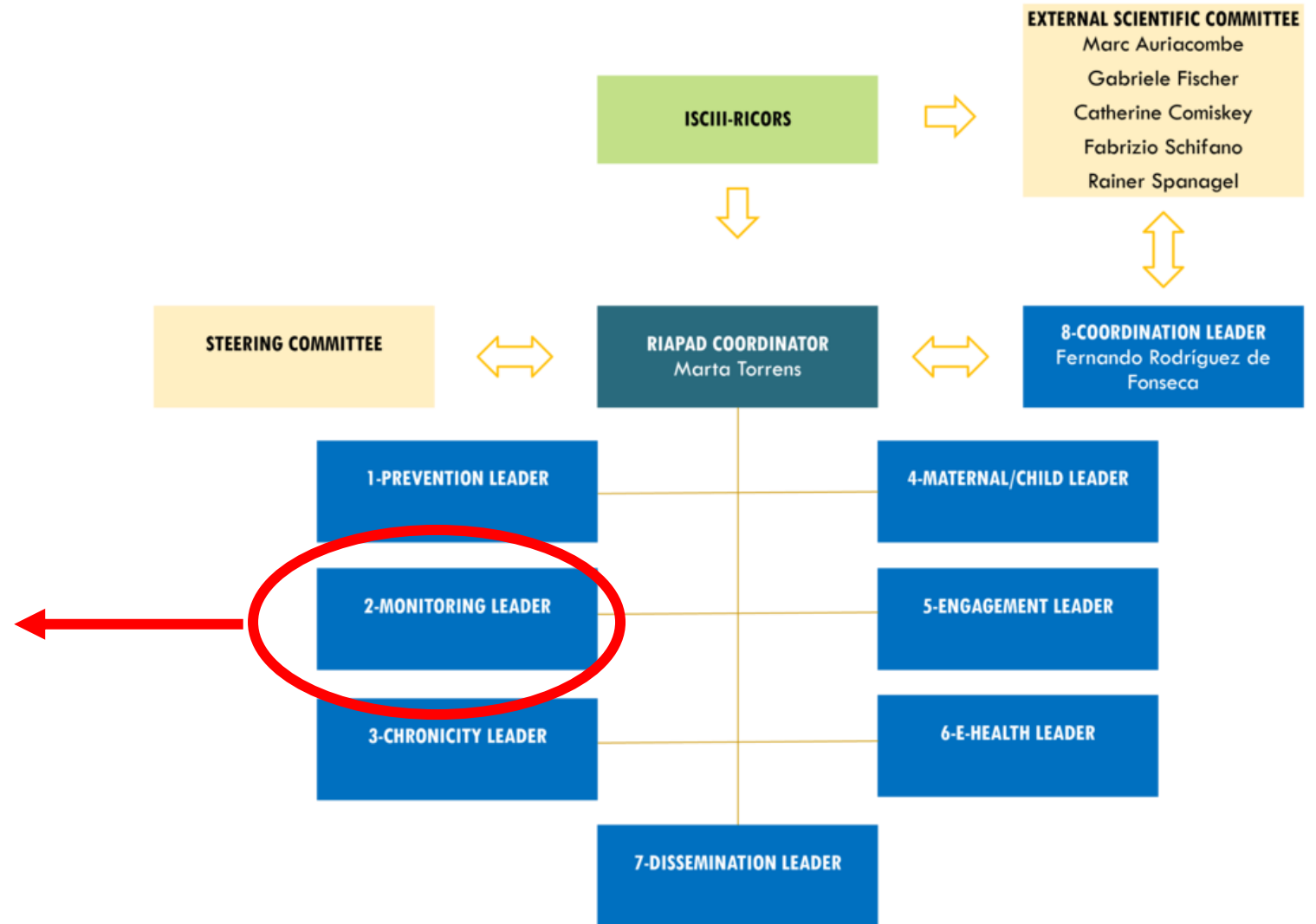


PID2020-117686RB-C32



2020I009

WP3 – Drug use indicators



Observatorio Español de las
Drogas y las Adicciones
(OEDA)

INFORME 2022

Alcohol, tabaco y drogas ilegales en España



- Encuesta sobre alcohol y drogas en España. EDADES, 2020.
- Encuesta sobre uso de drogas en Enseñanzas Secundarias en España. ESTUDES, 2021.
- Tratamiento por consumo de drogas. España, 2020.
- Urgencias hospitalarias en consumidores de drogas. España, 2020.
- Mortalidad relacionada con drogas. España, 2020.
- Infecciones en consumidores de drogas. España, 2020.
- Consumo problemático de drogas. España 2020.
- Sistema Español de Alerta Temprana (SEAT), 2021.



2022
USE AND
CONSEQUENCES

09

ANALYSIS OF
THE EVOLUTION
OF CANNABIS USE
IN SPAIN THROUGH
THE ANALYSIS OF
WASTEWATER FOR
EPIDEMIOLOGICAL
PURPOSES

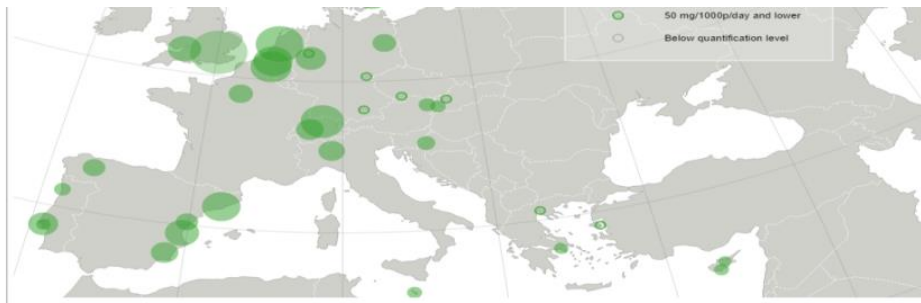


Revised edition September 2022



ESAR-Net

www.esarnet.es



http://www.emcdda.europa.eu/topics/pods/waste-water-analysis_en

- **Wastewater-based epidemiology (WBE) - ESAR-Net (leded USC)**
- Hospital emergency rooms – REDURHE (Similar to Euro-DEAN, Leded G. Burillo)
- Syringe testing – new! starting 2023! SYDRES project (Similar to ESCAPE, leded USC)
- Integrating data



Wastewater-based epidemiology



“Drugs”



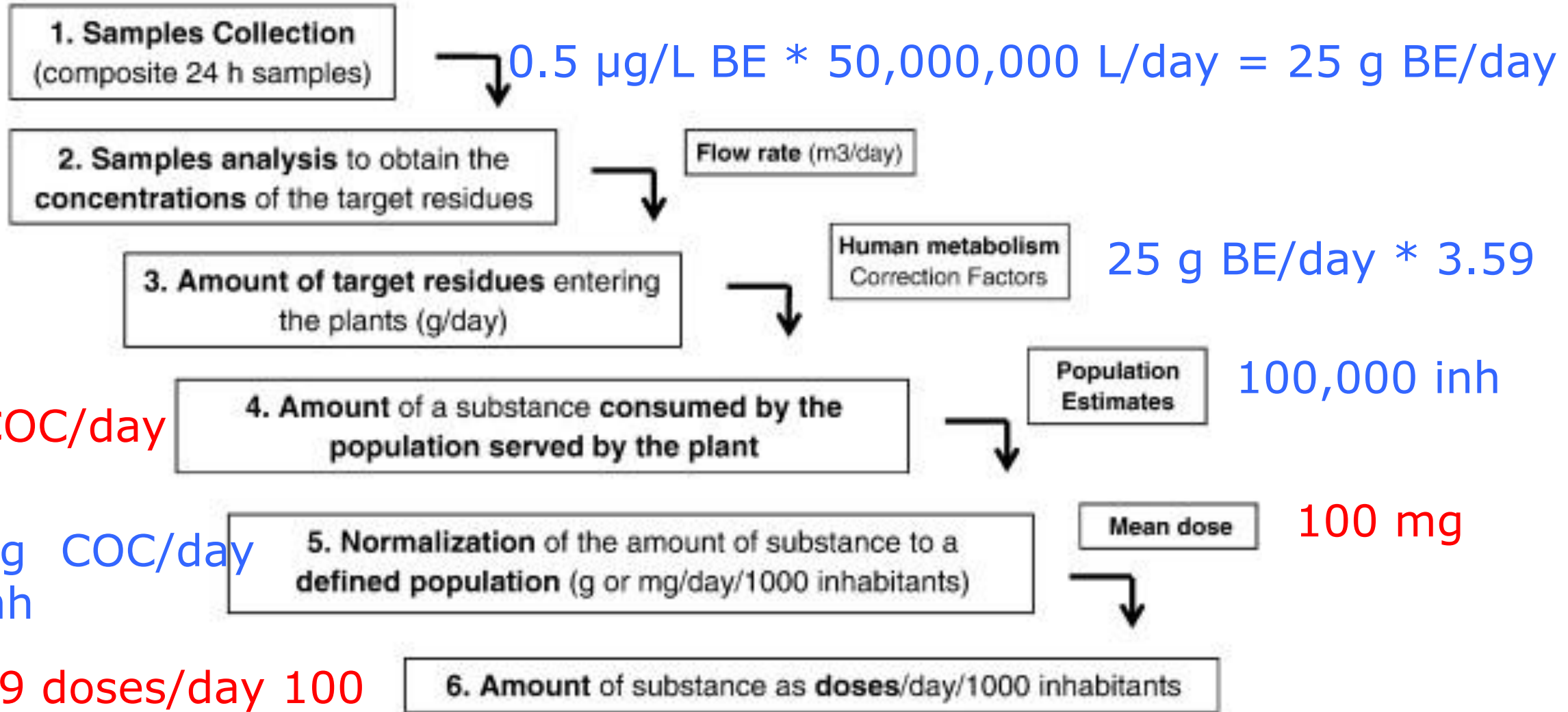
Wastewater

*Urine: metabolites
(biomarkers)*



WBE step-by-step

Wastewater Analysis Approach

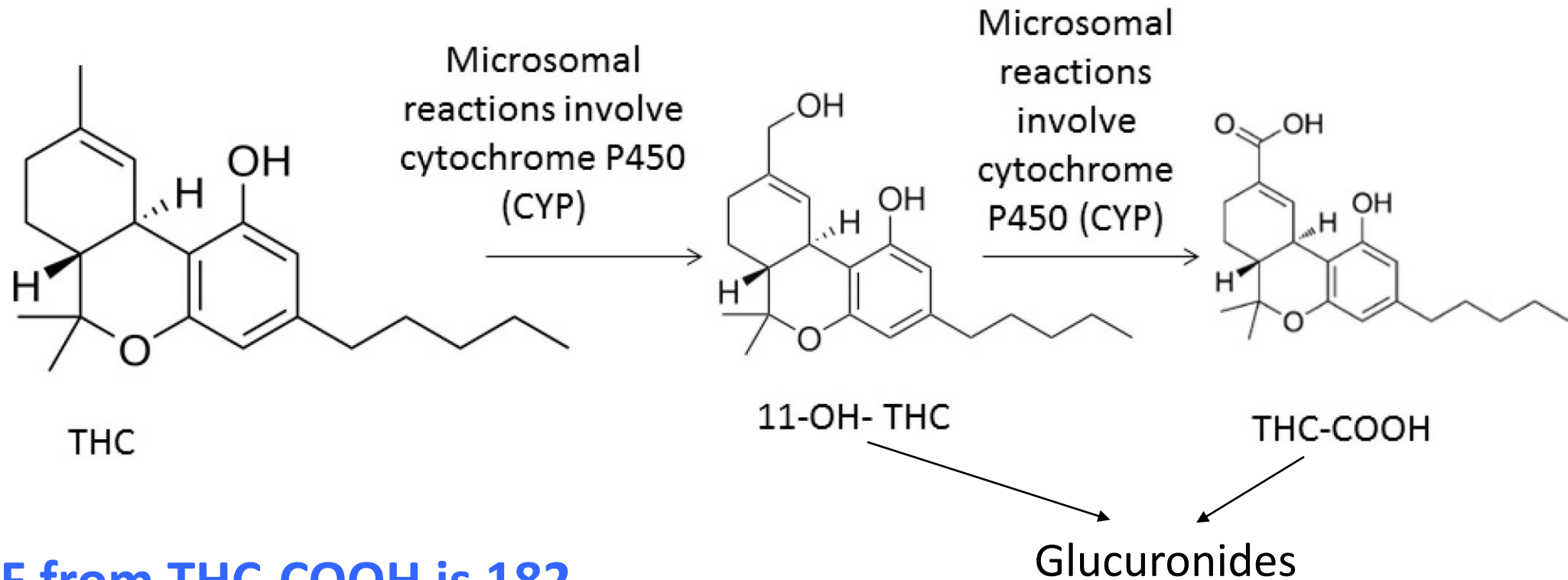


Substance	Biomarker	CF	Ref.
Cocaine	Benzoyllecgonine	3.59	1
Amphetamine	Amphetamine	2.77	2
Methamphetamine	Methamphetamine	2.44	2
MDMA (Ecstasy)	MDMA	4.40	2
THC (Cannabis)	THC-COOH	182 / 36.4	2 / 3
Nicotine	Cotinine	3.41	4
Nicotine	Hydroxycotinine	1.90	4
Ethanol (Alcohol)	Ethyl sulfate	3047	5

1. Castiglioni et al. *Environ. Sci. Technol.* 2013, 47, 1452-1460
2. Gracia-Lor et al. *Sci. Total Environ.* 2016, 573, 1648-1659
3. Postigo et al. *Environ. Int.* 2011, 37, 49-55
4. Rodríguez-Álvarez et al. *Anal. Chem.* 2014, 86, 10274-1028
5. Rodríguez-Álvarez et al. *Sci. Total Environ.* 2015, 536, 91-98

Bijlsma et al. Sci. Total Environ. 2021, 772, 144794

29% of COC excreted as BE
If intranasal
MW



- **THC CF from THC-COOH is 182**
- **But... OH-THC may partially be transformed to THC-COOH in sewage**
- **If all OH-THC converted to THC-COOH, CF = 36.4**



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ESAR-Net


European Monitoring Centre
for Drugs and Drug Addiction


**ENERGY
CONTROL**

 GOBIERNO DE ESPAÑA
 MINISTERIO DE SANIDAD, SERVICIOS SOCIALES E IGUALDAD
 SECRETARÍA DE ESTADO DE SERVICIOS SOCIALES E IGUALDAD
DELEGACIÓN DEL GOBIERNO PARA EL PLAN NACIONAL SOBRE DROGAS

SOCIDROGALCOHOL

Sociedad Científica Española
de Estudios sobre el Alcohol,
el Alcoholismo y las otras Toxicomanías



 GOBIERNO DE ESPAÑA
 MINISTERIO DE ECONOMÍA, INDUSTRIA Y COMPETITIVIDAD


AGENCIA
ESTATAL DE
INVESTIGACIÓN



AEI "Excellence Research Networks" 2016
Ref. CTM2016-81935-REDT



ESAR-Net pilot 2018

ESAR-Net



1 week – March-June

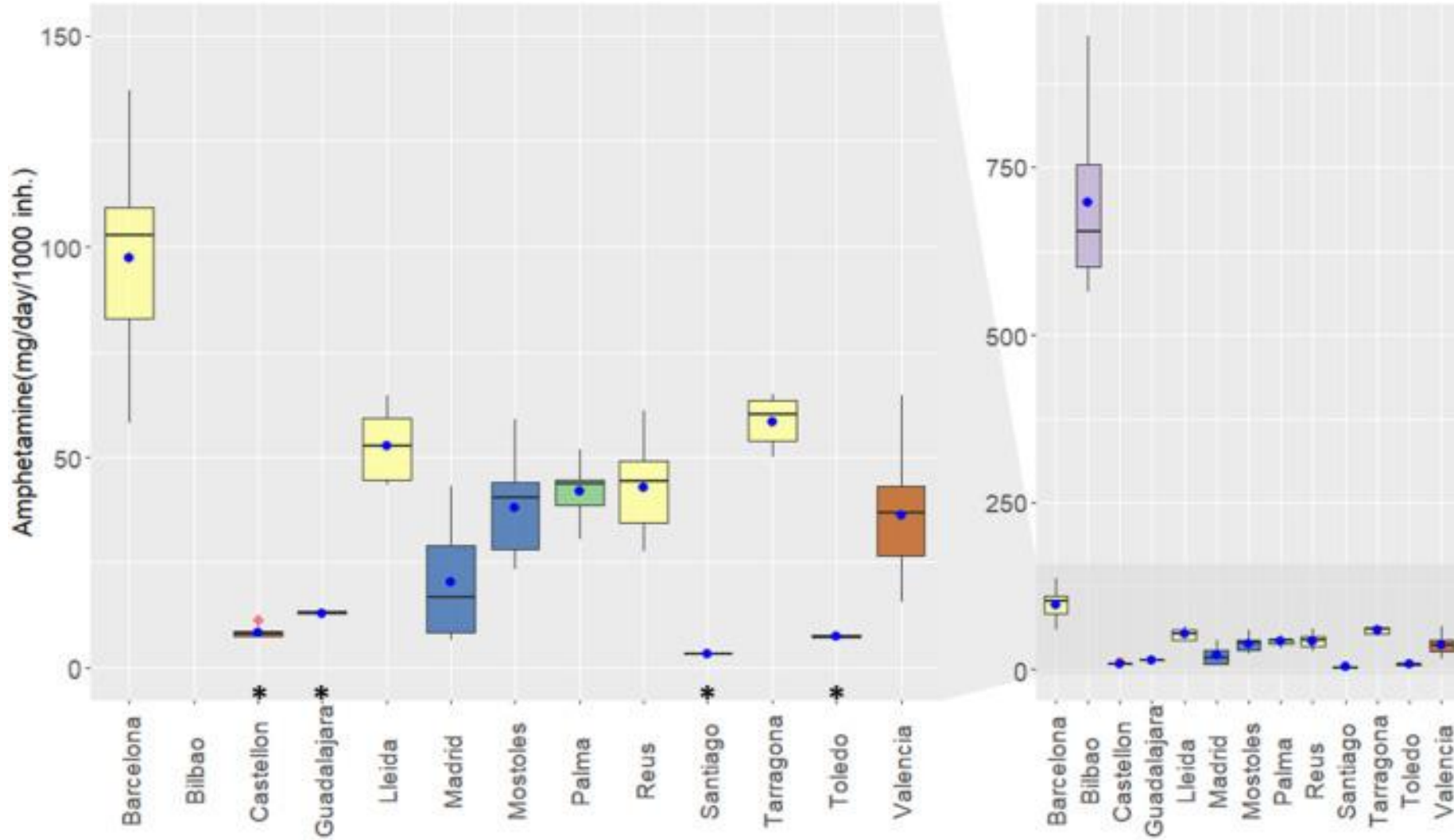
ESAR-Net pilot 2018

- 17 WWTP – 13 locations
- 7 CCAA (regions)
- aprox. 6.1 million people (13 % ES population)
- Illicit drugs: cocaine, cannabis, amphetamine, methamphetamine
MDMA – 4 labs
- Alcohol (1 lab) + tobacco (1 lab)
- Screening of KET and some NPS (1 lab)
- **Exposure to phthalates**



ESAR-Net

ESAR-Net pilot 2018

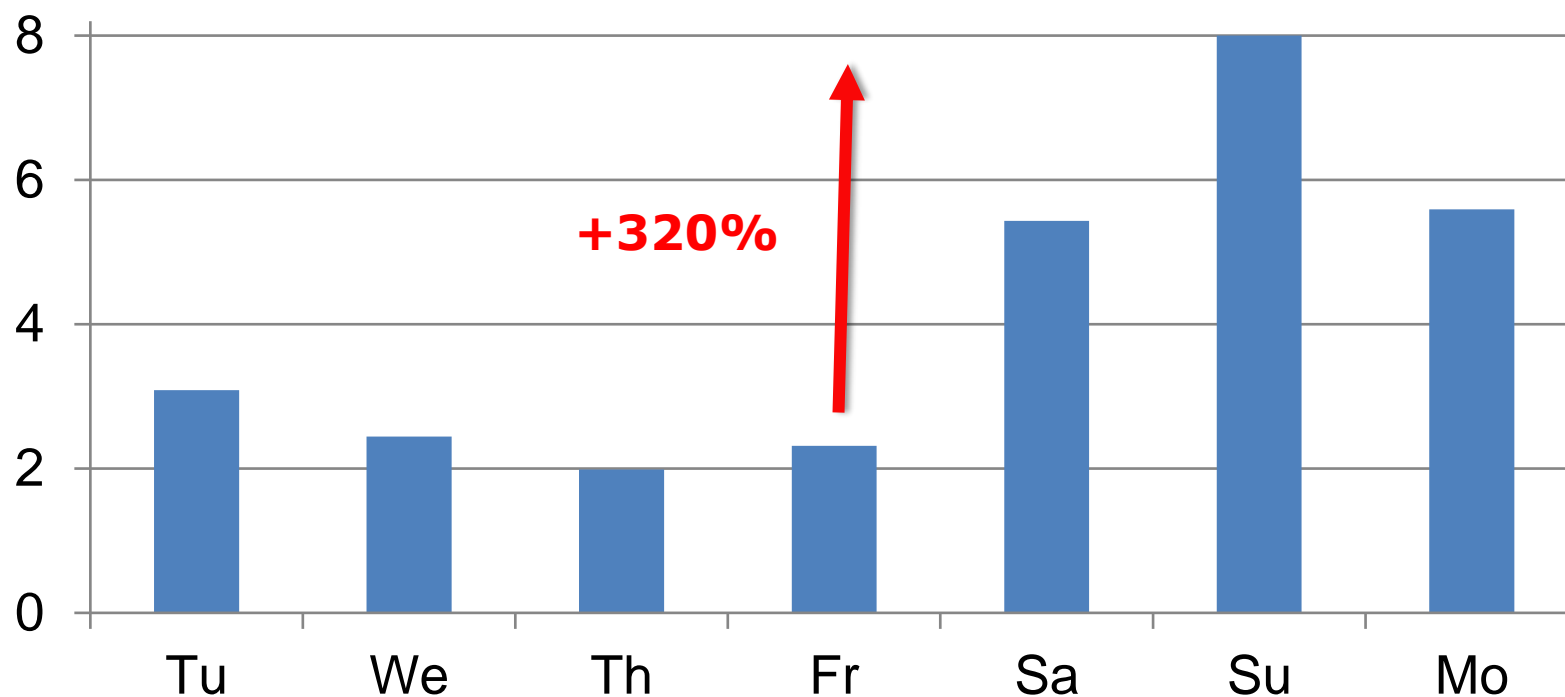


ESAR-Net



ESAR-Net pilot 2018

MDMA Kg/day



ESAR-Net



- ca. 2 Tons of crystal ecstasy / year
- or ca. 9 M tablets ecstasy / year
- RETAIL MARKET (pills) = ca. 90 M€/year

ESAR-Net pilot 2018

Drug	Annual use (Tons)	Annual retail market (M€)
Amphetamine	5-7	102-145
Methamphetamine	0.8-1.2	16-26
MDMA (as tablets)	8.7-8.9	88-92
Cocaine	54-102	3,200-6,000
Cannabis	375-3500	2,100-18,000



ESAR-Net



- ES GDP (2018) = 1,421,000 M€
- Cocaine = 0.2-0.4%

ESAR-Net 2.0



ESAR-Net

<https://www.esarnet.es>



European Monitoring Centre
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ENERGY CONTROL

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GOBIERNO DE ESPAÑA | MINISTERIO DE SANIDAD

SECRETARÍA GENERAL DE SANIDAD

DELEGACIÓN DEL GOBIERNO PARA EL PLAN NACIONAL SOBRE DROGAS

Proyecto: "Exploración de las aguas residuales como indicador complementario, rápido y objetivo sobre el consumo de sustancias de abuso" (nº exp. 2020I009)

ESAR-Net 2.0



2021-2023

- 28 WWTPs 1 week/year
- 10 EDAR 1 additional week/year
- 10 CCAA (out of 17 regions)
- aprox. 7 M

2021-2022:

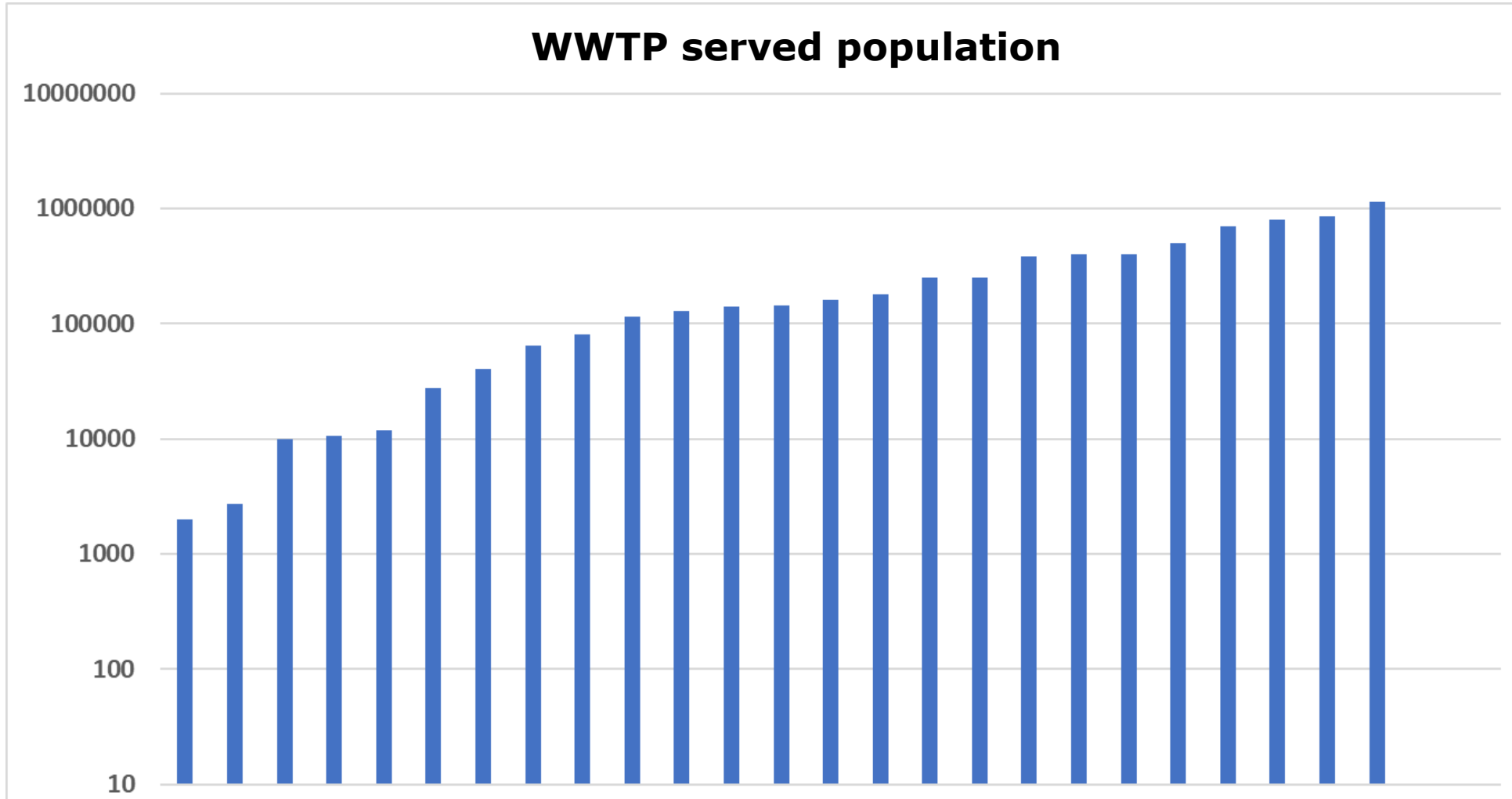
- 3 districts in Barcelona

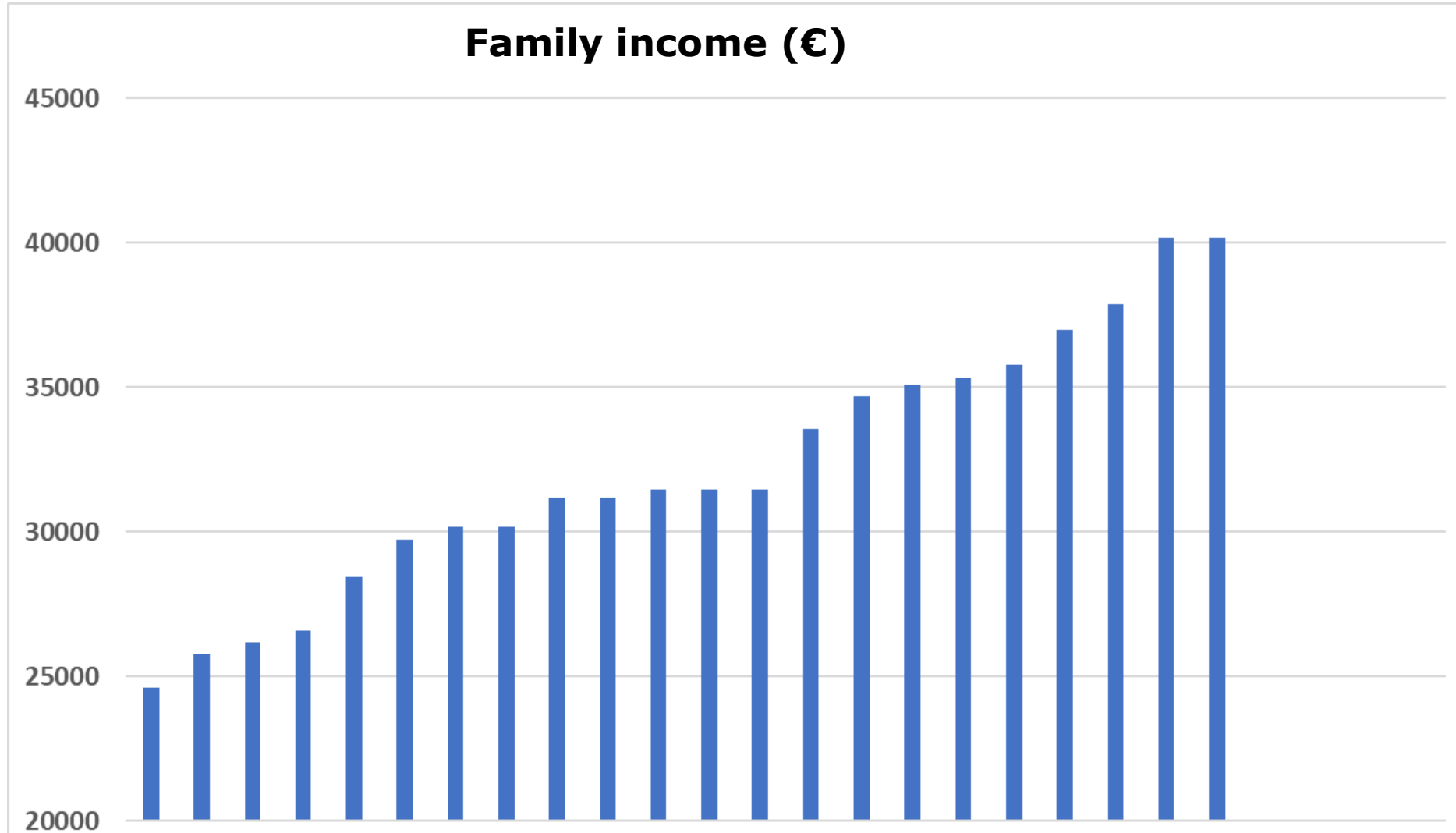
2023:

- Special events



WWTP served population

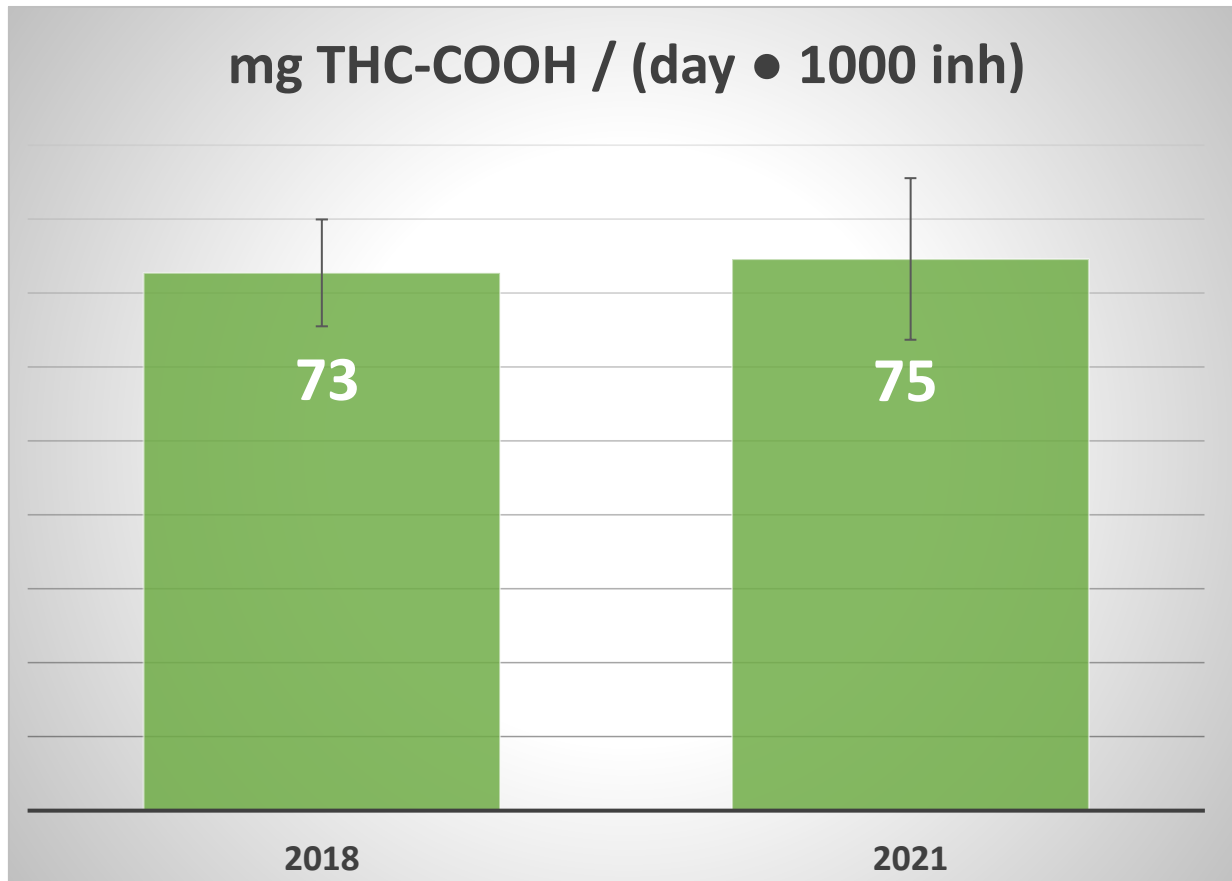




- Ketamine + 20 NPS by SPE-LC-QQQ
- Mostly cathinones
- Ketamine detected in >85% samples
- Mephedrone (MMC) detected in 5 (/10) samples Autumn 2021
- Methylone and 25-C-NBOMe detected in 1 sample each in Spring 2021



Cannabis 2018 Vs 2021



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Spanish Monitoring Centre for Drugs and Addictions
Government Delegation for the National Plan on Drugs



ESAR-Net

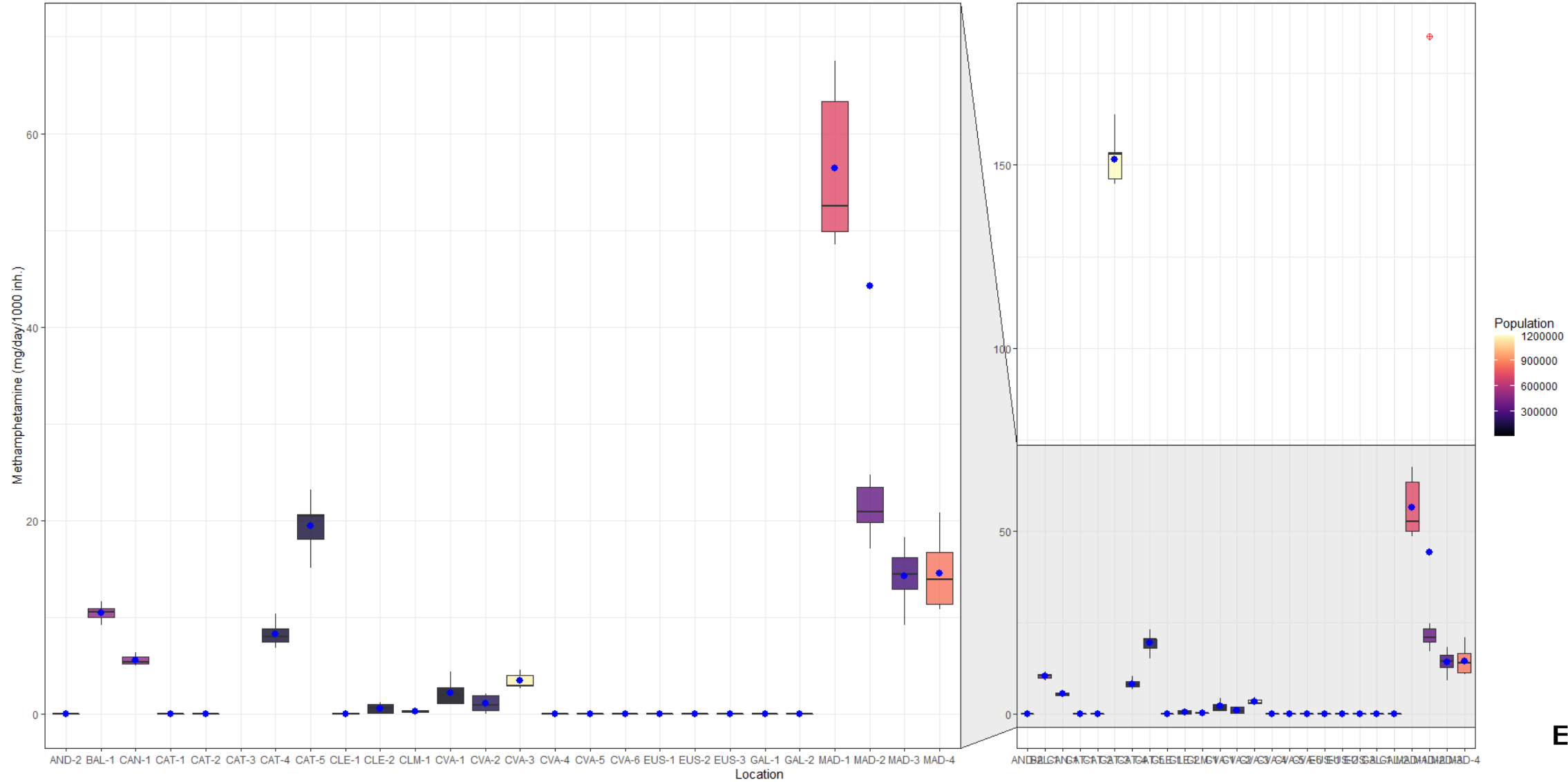
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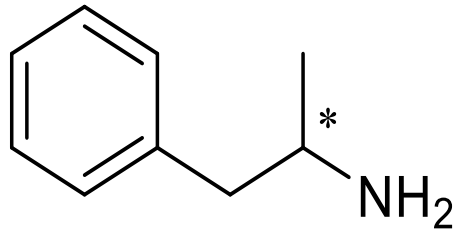


Weighed average (aprox. 4 M inh.), 9 locations: Valencia metro, Toledo, Lleida, Tarragona, Reus, Bilbao metro, Santiago de Compostela, Castellón de la Plana and Madrid (30%), 2018 & 2021.

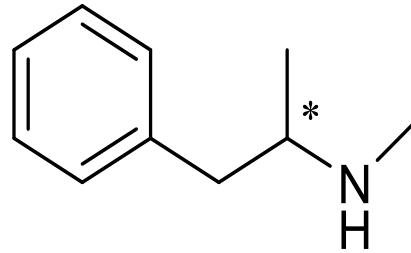
Methamphetamine



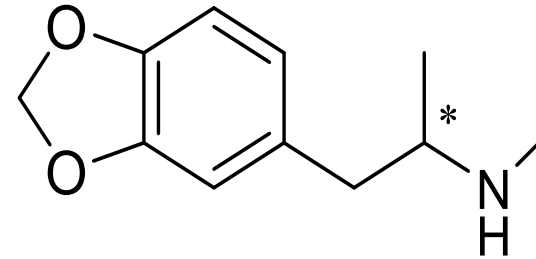
Enantiomeric profiling



AMP



MAMP



MDMA



- The S
- Can b
- Amph
- Selegi
- MDMA

City	Loads of AMP measured by WBE		Expected loads from LIS prescription		AMP from prescription of LIS (%)	
	2018	2019	2018	2019	2018	2019
Bilbao and metropolitan area	203	277	1.52	1.03	0.75	0.37
Madrid	5.4	NC ^a	3.10	4.14	58	NC ^a
Palma	13	–	2.62	NC ^a	20	NC ^a
Santiago de Compostela	13	16	4.96	7.03	37	44

^a NC: not calculated because: R(-)-AMP was below MQL in all samples from Madrid in 2019 and samples from Palma were only collected in 2018.

(, ADHD)
son)

Enantiomeric profiling

2018-2019

- Samples from Madrid (1 WWTP), Palma, Santiago and Bilbao metro from 2018-2019 – pure S-MAMP
- (Pseudo)ephedrine synthetic path

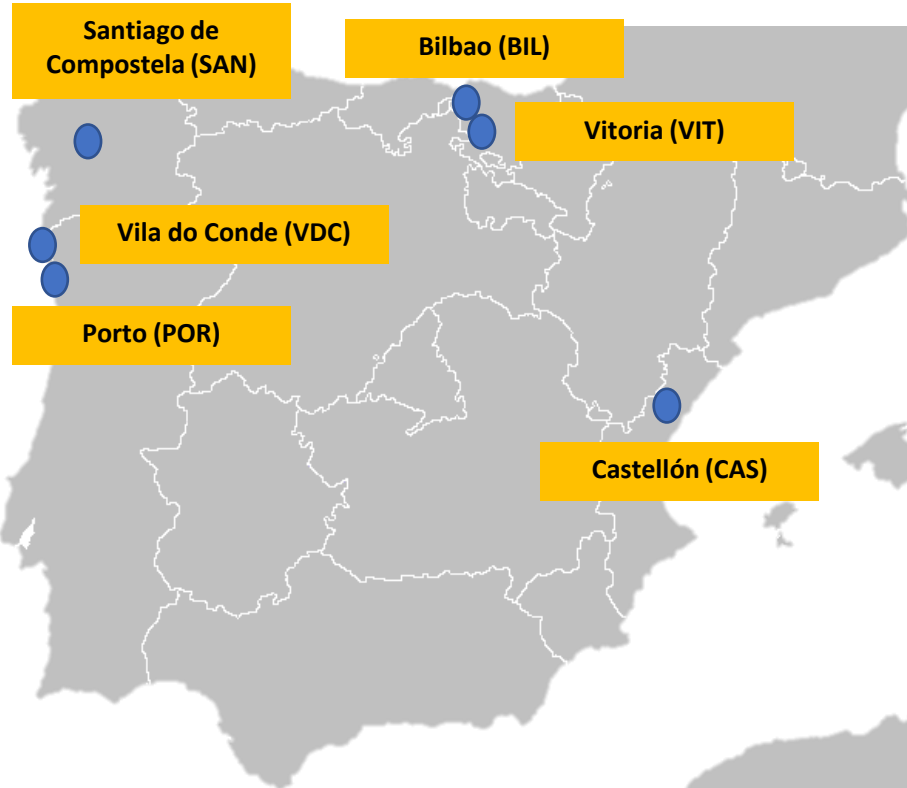


2021

- Spring: pure S-MAMP except in Madrid (4 WWTP) and Palma – 10-50% R-MAMP (2 samples almost pure R-MAMP)
- Autumn: Madrid (2 WWTP) – 10-20% R-MAMP
- Change in origin (partly from BMK/P2P synthesis)?



COVID-19 crisis

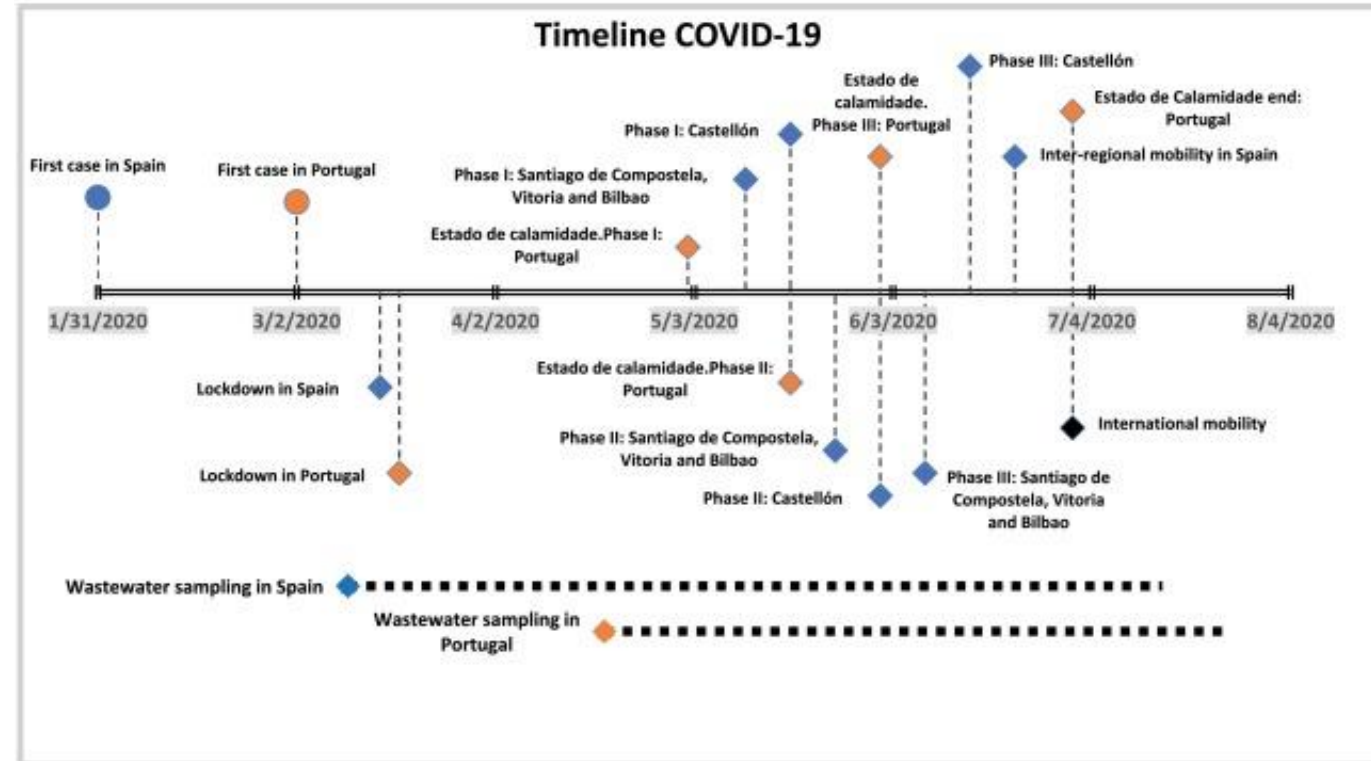


Science of The Total Environment

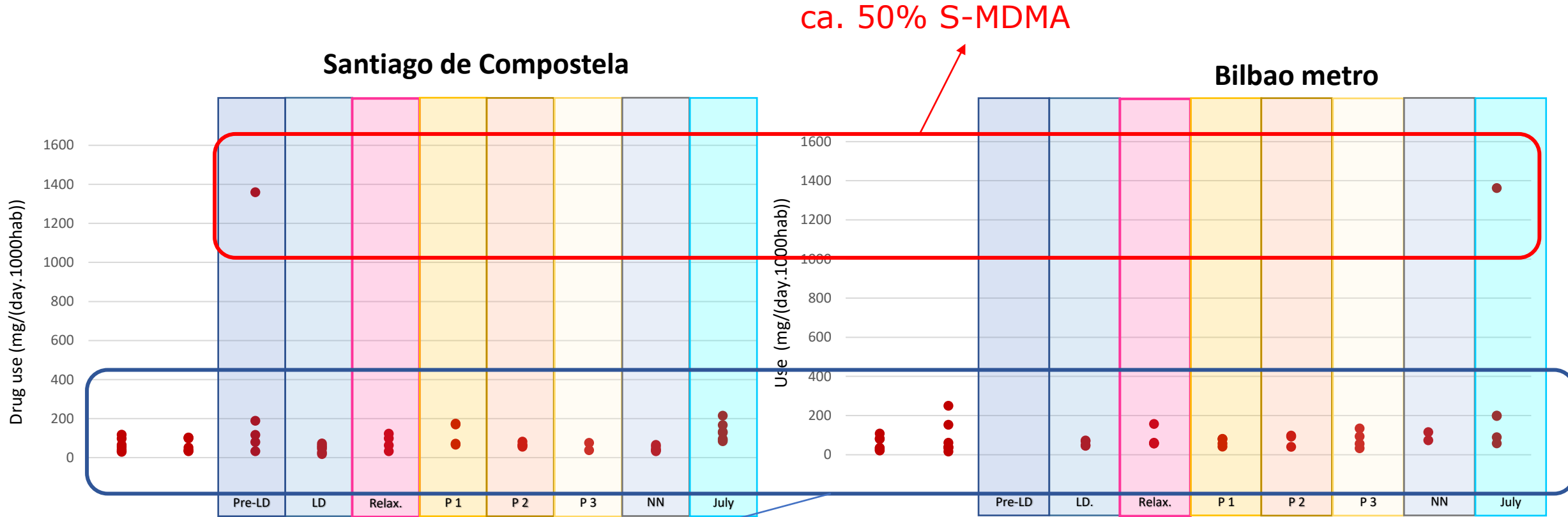
Volume 836, 25 August 2022, 155697



Use of illicit drugs, alcohol and tobacco in Spain and Portugal during the COVID-19 crisis in 2020 as measured by wastewater-based epidemiology



COVID-19 crisis

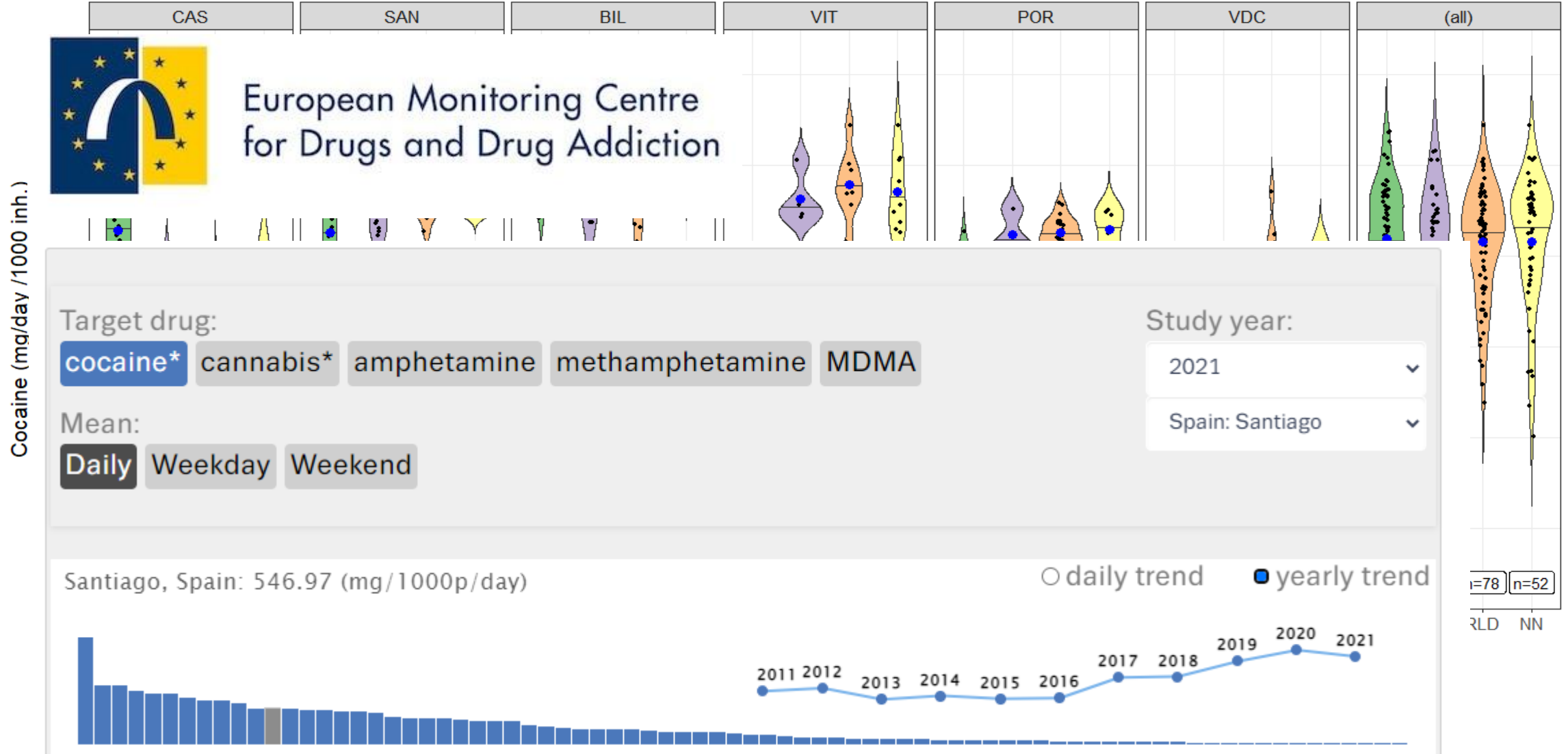


Cae un grupo criminal que tenía 25 armas y traficaba con drogas en Ugao y Amurrio

EITB.EUS

Publicado: 10/07/2020 11:51 (UTC+2) Última actualización: 10/07/2020 14:47 (UTC+2)

COVID-19 crisis



- New improved method for cannabinoids: CBD + Δ 9-THC + Δ 8-THC (metabolites)
- Benzodiazepines
- Special events & settings (prisons)

What else could be done?

- Cocaine metabolites: crack use, alcohol+cocaine co-consumption
- Opioids
- Further (prescription) pharmaceuticals
- ...

ACKNOWLEDGEMENTS

- USC team: Rosario Rodil, Rosa Montes, Andrea Estévez-Danta, Xiana González-Gómez, Carlos Pernas
- ESAR-Net and RIAPAd members and collaborators
- CIIMAR/UPorto: Miguel Santos, Ricardo Capela
- EMCDDA: João Matias
- Energy Control: Mireia Ventura
- Ai Laket!!: Unai Pérez de Sanromán Landa
- WWTP operating companies and municipal authorities

THANKS FOR YOUR ATTENTION!