



Presentazione delle attività di ricerca del Centro Collaborativo

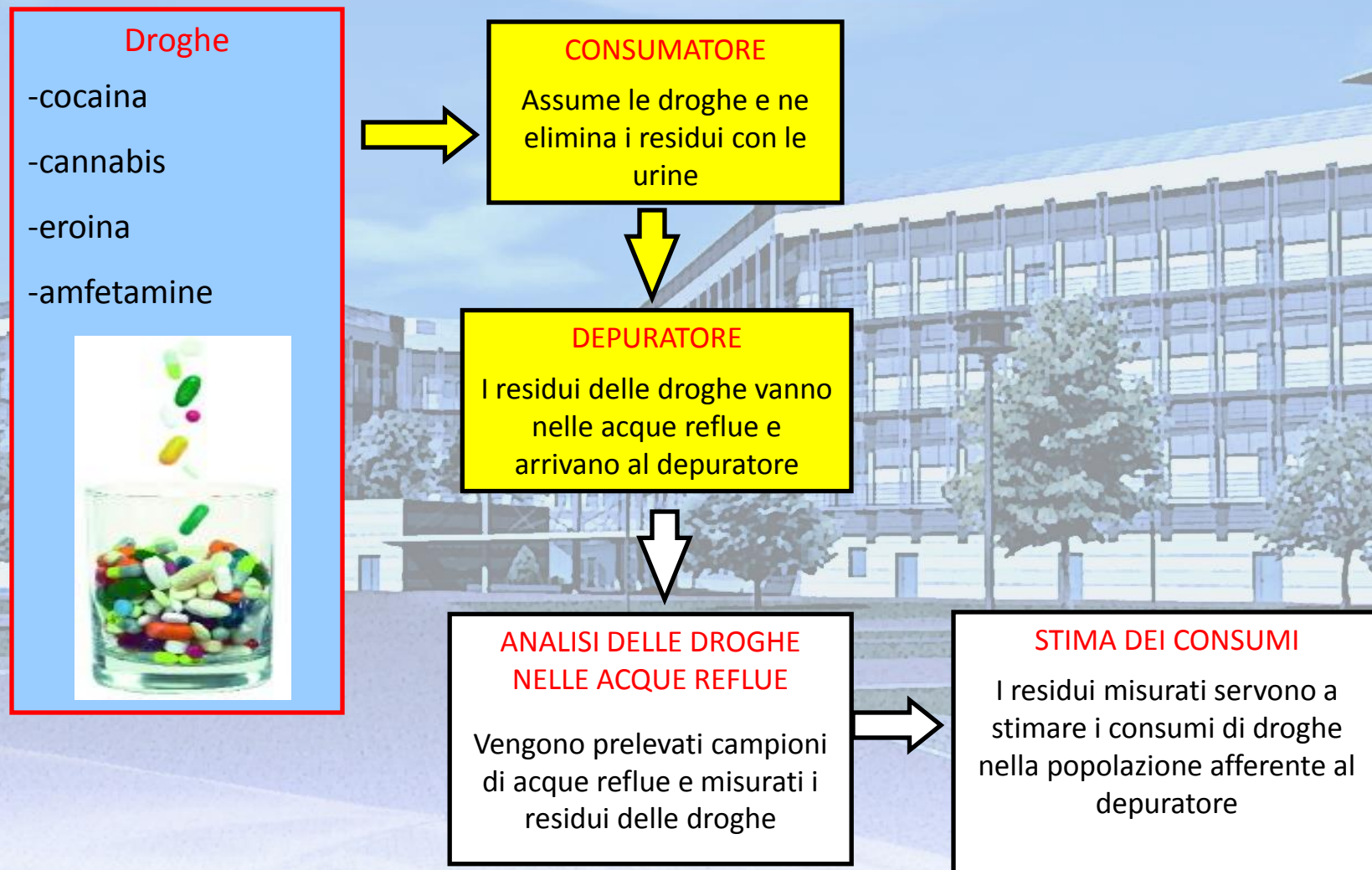
Studio del consumo di sostanze psicoattive mediante analisi delle acque reflue

Ettore Zuccato

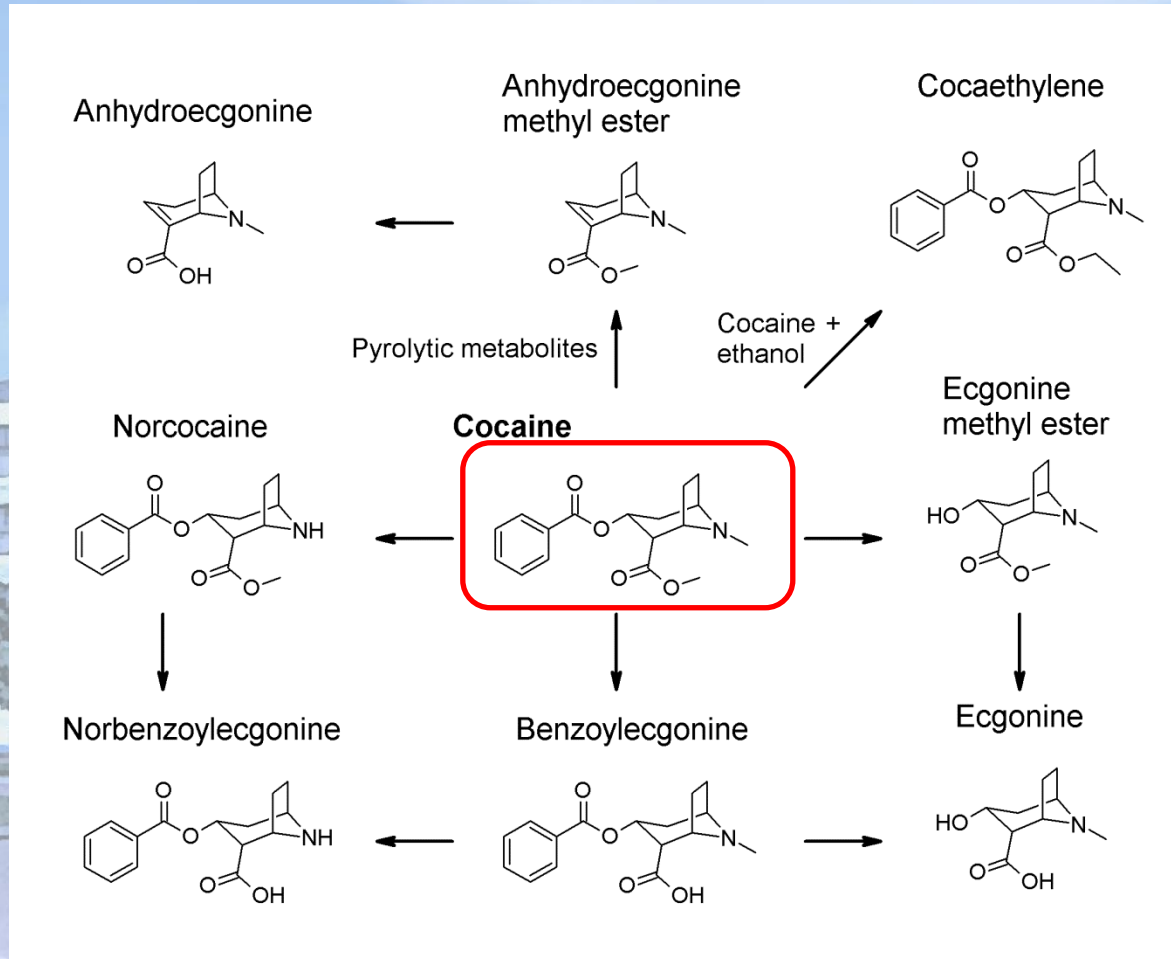
IRCCS Istituto di Ricerche Farmacologiche “Mario Negri”



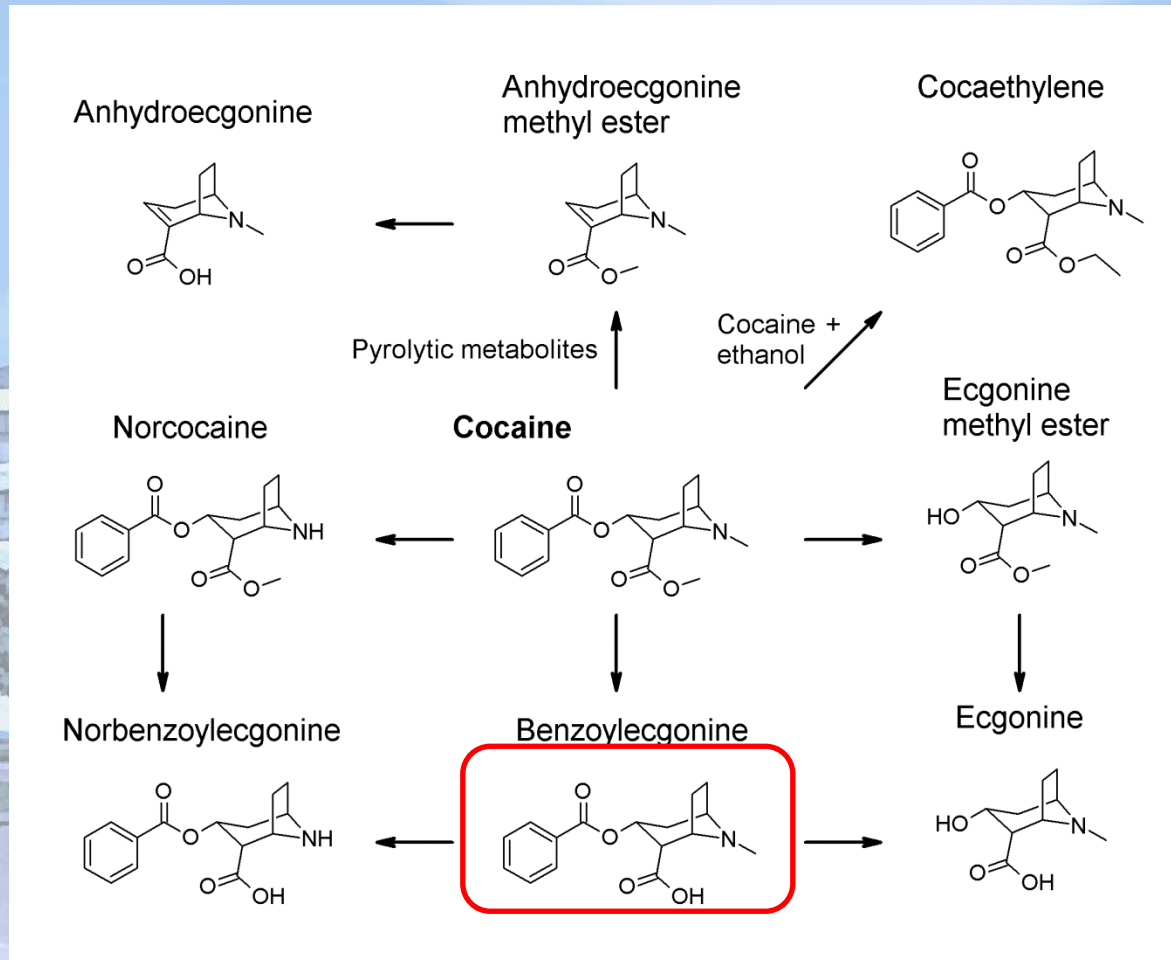
La via delle droghe: dal consumatore al depuratore



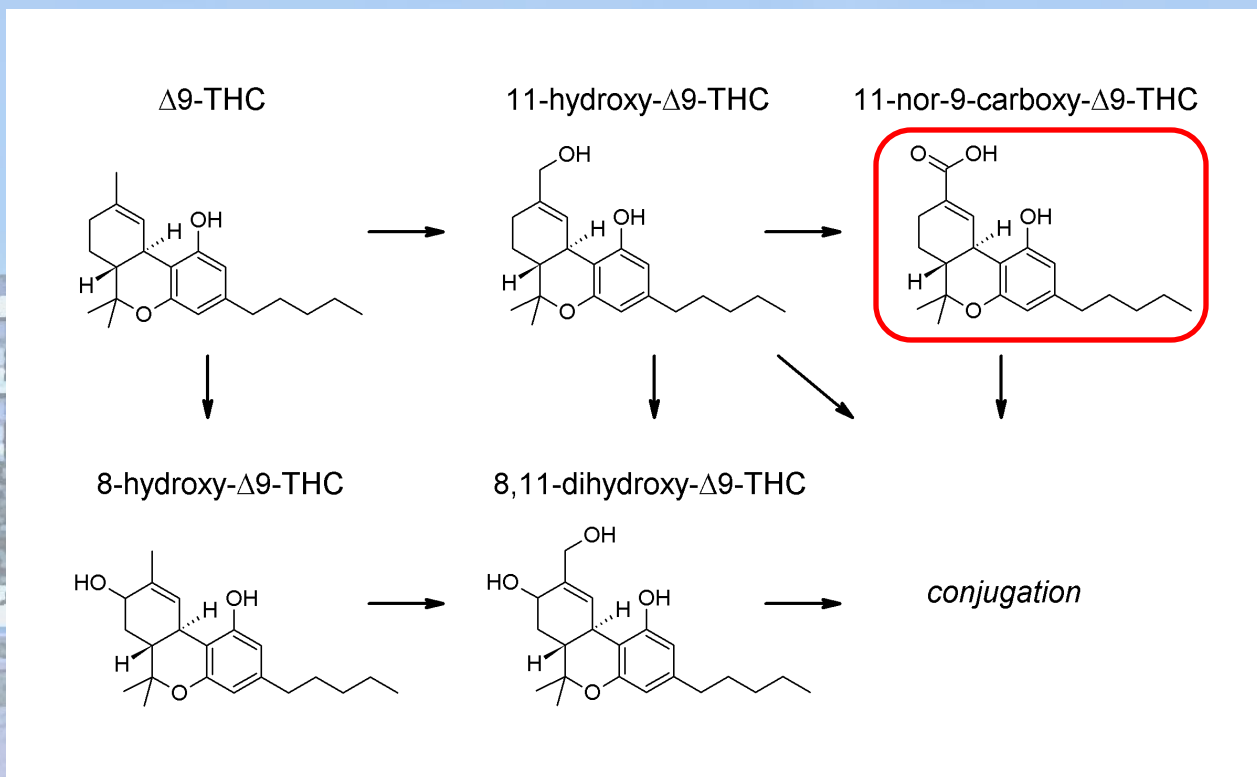
Metabolismo e escrezione urinaria di cocaina



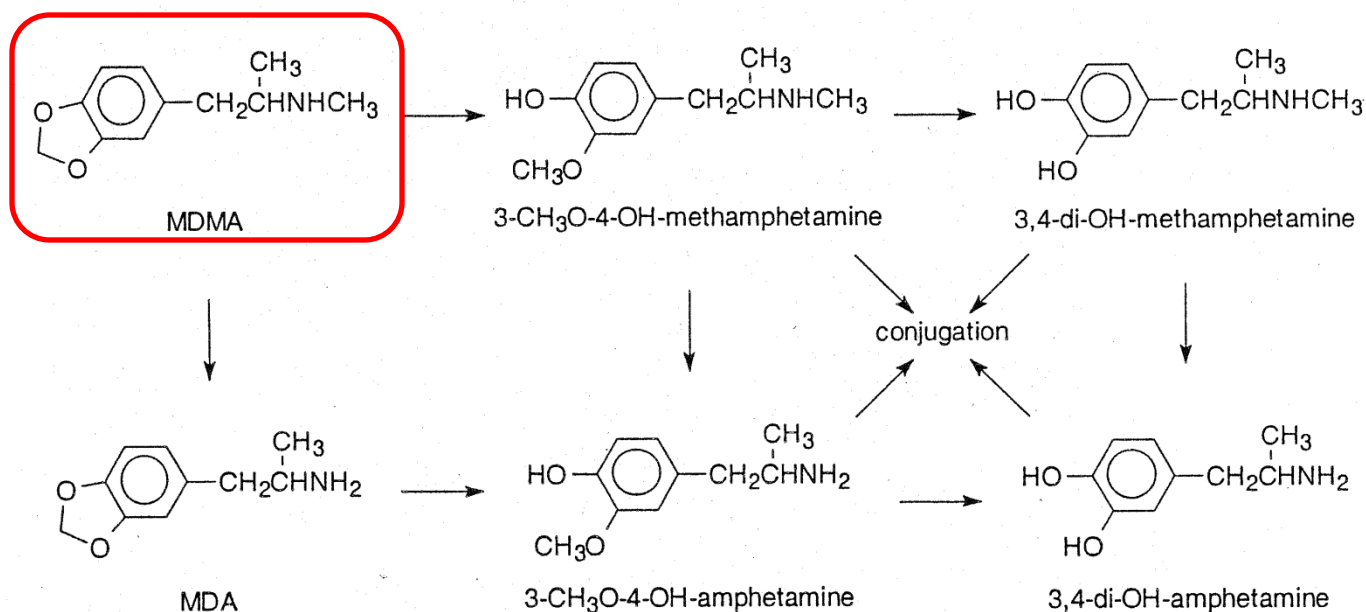
Metabolismo e escrezione urinaria di cocaina



Metabolismo e escrezione urinaria di THC



Metabolismo e escrezione urinaria di MDMA



Target residues selected for drug monitoring in wastewater

DRUG	Target residue	Relation of residue to parent drug
Cocaine	benzoylecgonine (BE)	Major metabolite of cocaine
Heroin	morphine 6-acetylmorphine	Major metabolite of heroin Minor but exclusive metabolite
<i>Amphetamines</i> Amphetamine Methamphetamine Ecstasy	amphetamine methamphetamine MDMA (ecstasy)	Parent drugs and major excretion products
Cannabis (THC)	THC-COOH	Major metabolite of THC

Zuccato et al., 2008

Metodi analitici

Pharmaceuticals: 35 compounds + 6 deuterated standards

Illicit drugs: 27 compounds + 20 deuterated standards

(Castiglioni et al., *J Chrom A*. 2005; Castiglioni et al., *Anal. Chem.* 2006;
Castiglioni et al., *Mass Spectrom Rev.* 2008; Zuccato et al., *Water Res.* 2008)

Filtration (1.6 and 0.45 μm)

Solid Phase Extraction (SPE)

Ultrasonic Solvent Extraction (USE)

Oasis HLB and MCX (60 mg)

Lichrolut EN (200 mg)

HPLC-MS/MS analysis

HPLC Column : C8-C18 and HILIC phases

Mass Spectrometer:

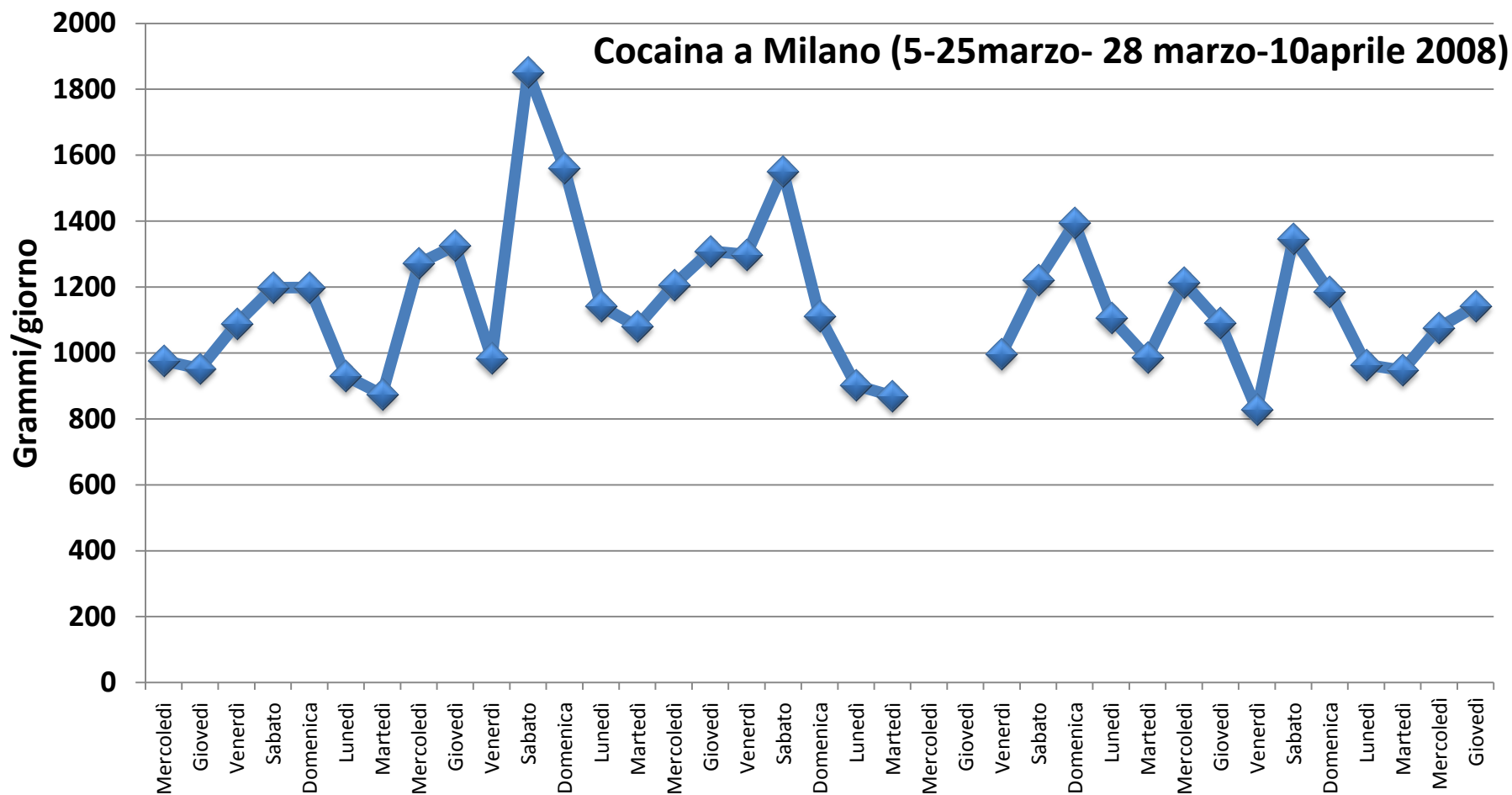
Applied Biosystem-SCIEX API 3000

triple quadrupole

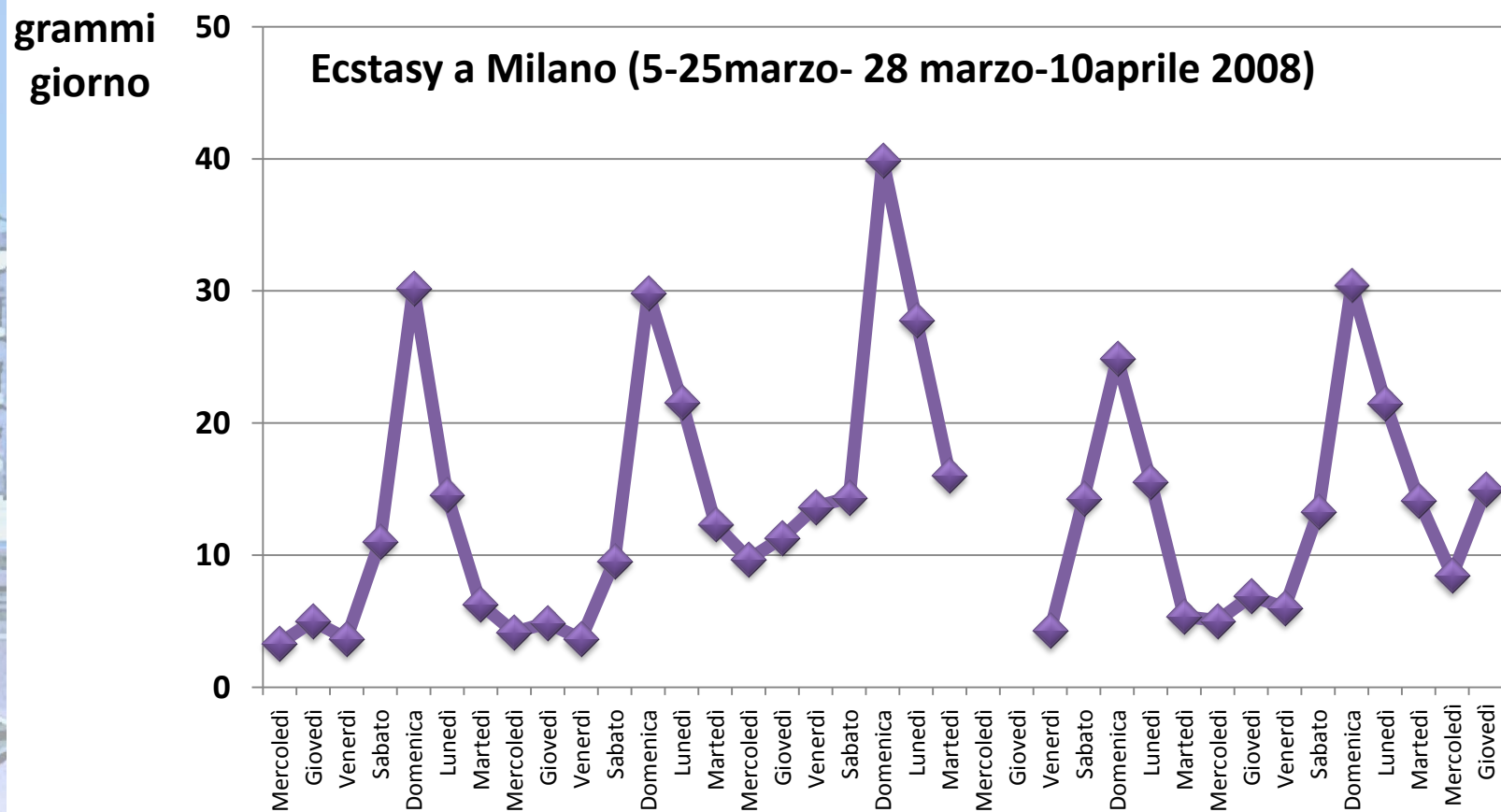
turbo ion spray source



Cocaina: andamento mensile dei consumi a Milano



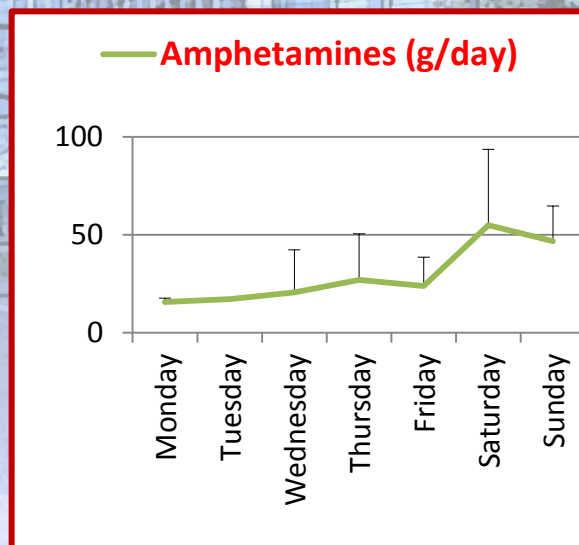
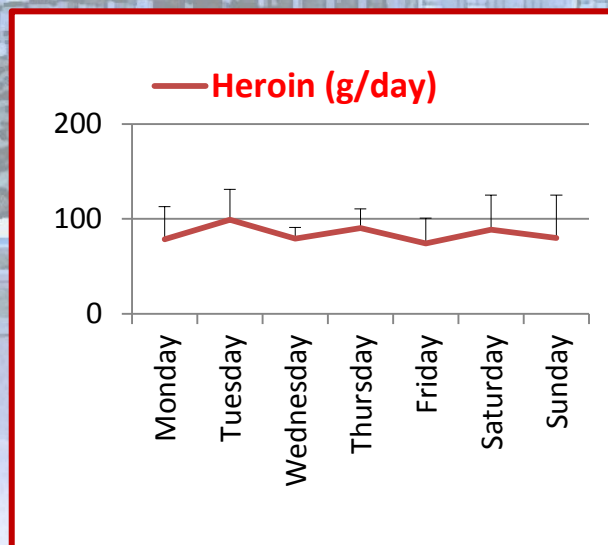
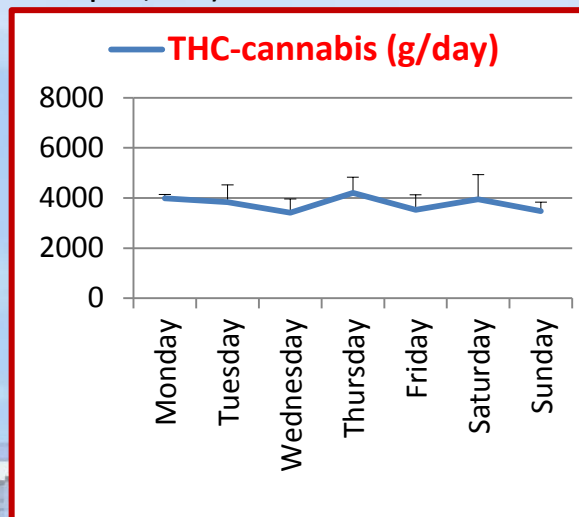
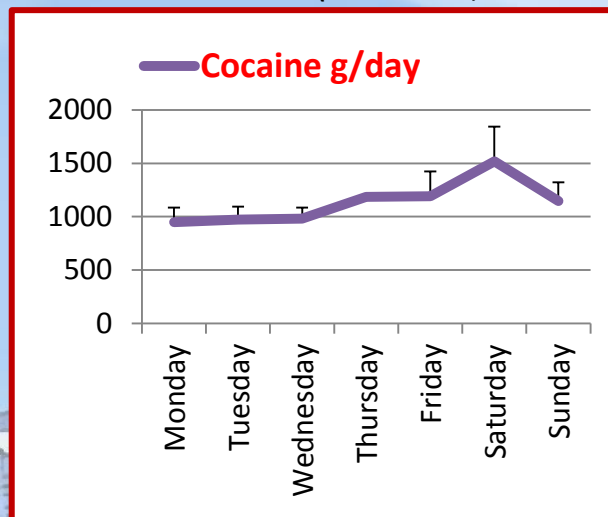
MDMA : andamento mensile dei consumi a Milano



Consumo di sostanze stupefacenti (profilo settimanale)

Milano, 2006

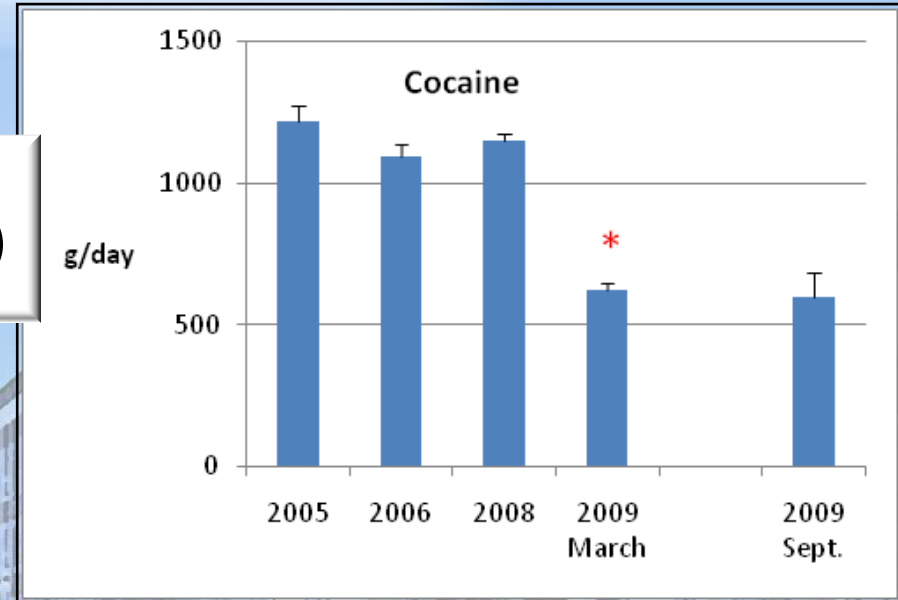
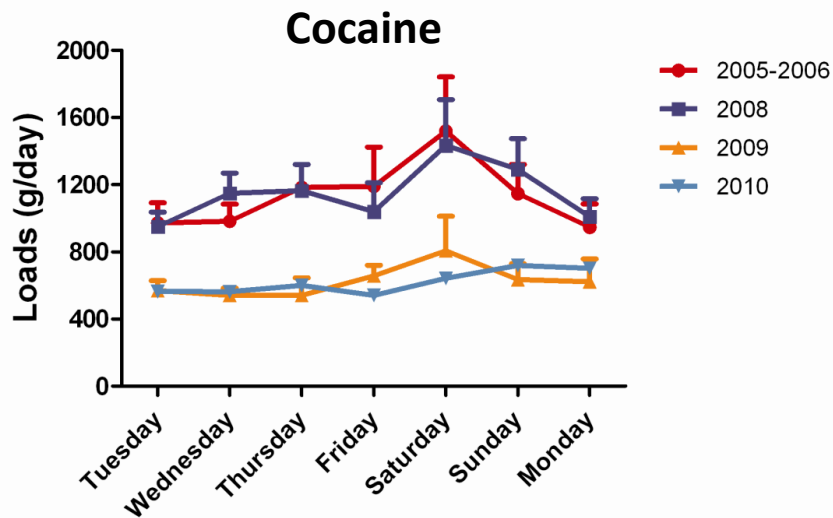
(Zuccato et al., Environ. Health Perspect., 2008)



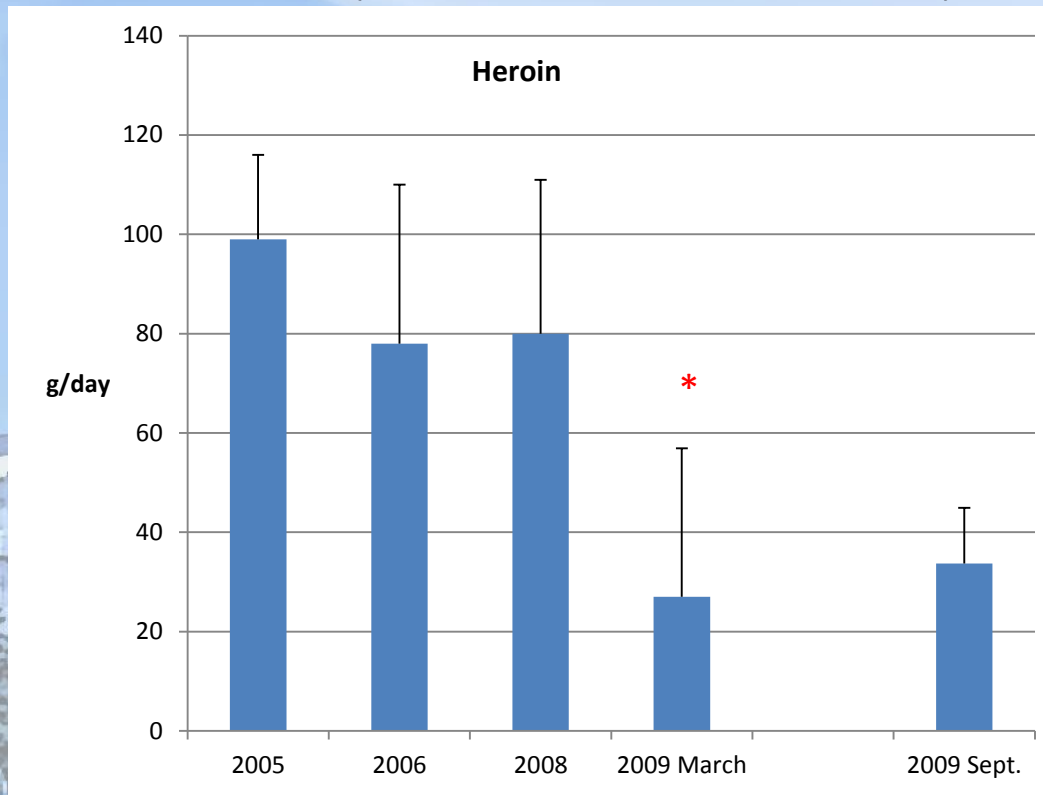
Trend temporale del consumo di cocaina (Milano 2005-2009)

Consumo di cocaina: diminuisce del 45%
nel 2009 ($p < 0.05$, Tukey-Kramer HSD test)

Zuccato et al., *Drugs and Alcohol Dependence*, 2011



Trend temporale del consumo di eroina (Milano 2005-2009)



Consumo di eroina: diminuisce del 66% nel 2009 ($p < 0.05$, Tukey-Kramer HSD test)

Zuccato et al., *Drugs and Alcohol Dependence*, 2011

Indagini epidemiologiche (2008-2009)

National survey 2011



PRESIDENZA DEL CONSIGLIO DEI MINISTRI

Dipartimento Politiche Antidroga

Tabella 3: Prevalenze nella popolazione generale 15 – 64 anni (uso negli ultimi 12 mesi)

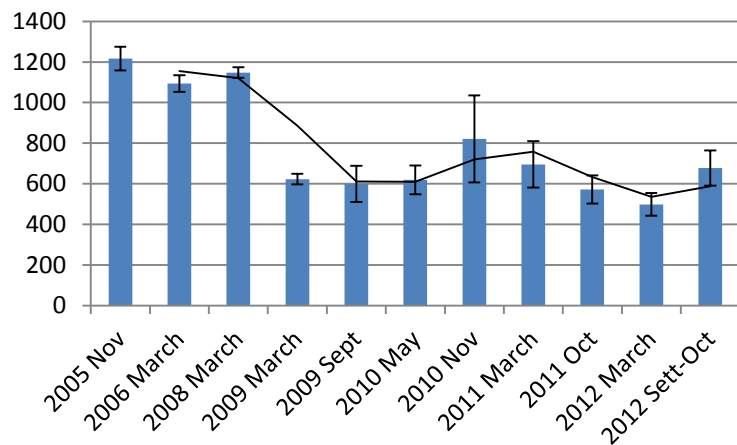
Sostanze	2008	2009	Differenza	Scostamento % ($\Delta\%$)
Eroina	0,39	0,25	-0,14	-35,9
Cocaina	2,1	0,9	-1,2	-57,1
Cannabis	14,3	5,2	-9,1	-63,6
Stimolanti	0,74	0,22	-0,52	-70,3
Allucinogeni	0,65	0,22	-0,43	-66,2

Popolazione
generale:
decrementi %
oscillanti tra i
-35,9 e i -70,3

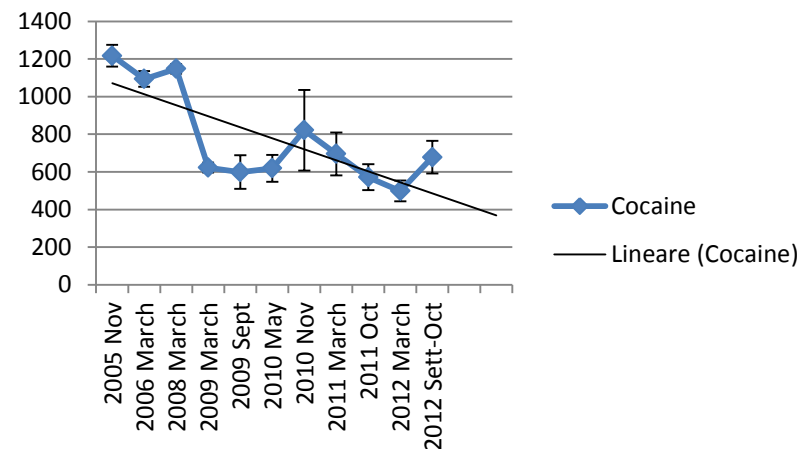
General Population Survey

Studio dell'andamento temporale: Milano 2005-2012 (dati in grammi/giorno)

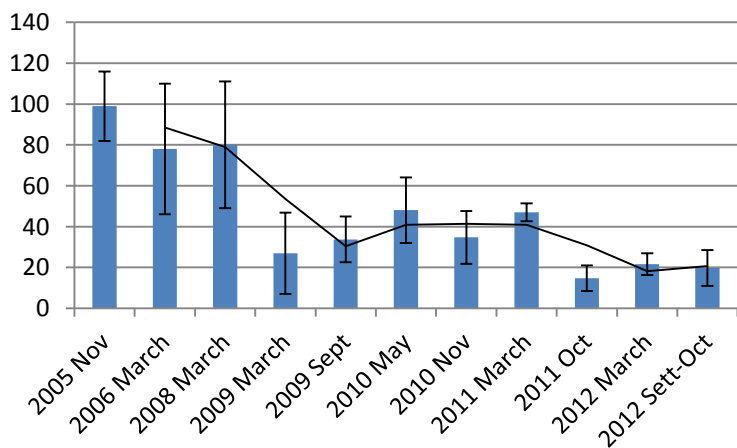
Cocaine



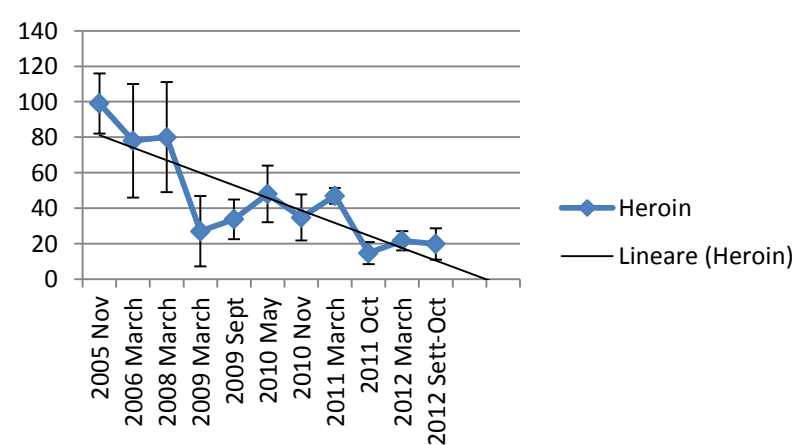
Cocaine



Heroin

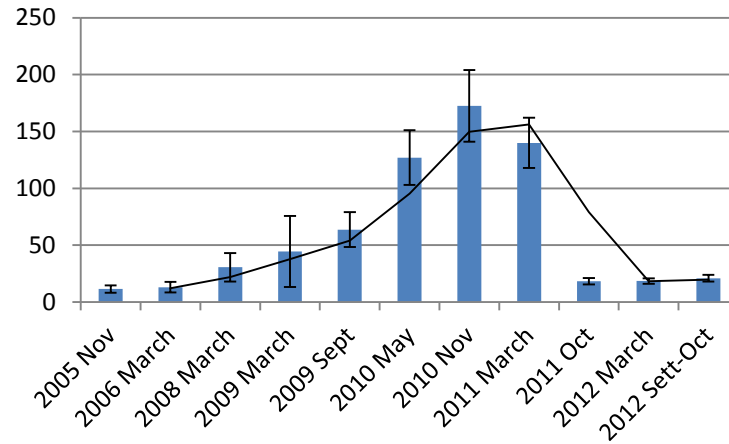


Heroin

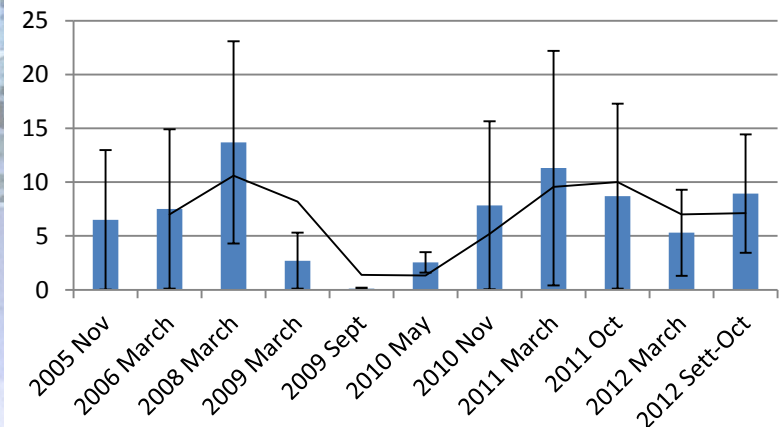


Studio dell'andamento temporale: Milano 2005-2012 (dati in g/giorno)

Metamphetamine



Ecstasy



Progetto AQUA DRUGS

Progetto Aqua Drugs

Rete di rilevamento nazionale per la valutazione del consumo di sostanze stupefacenti nella popolazione mediante analisi delle acque reflue (2010-2013)



12 Centri principali

3 Centri Sentinella

Milano
Roma
Napoli

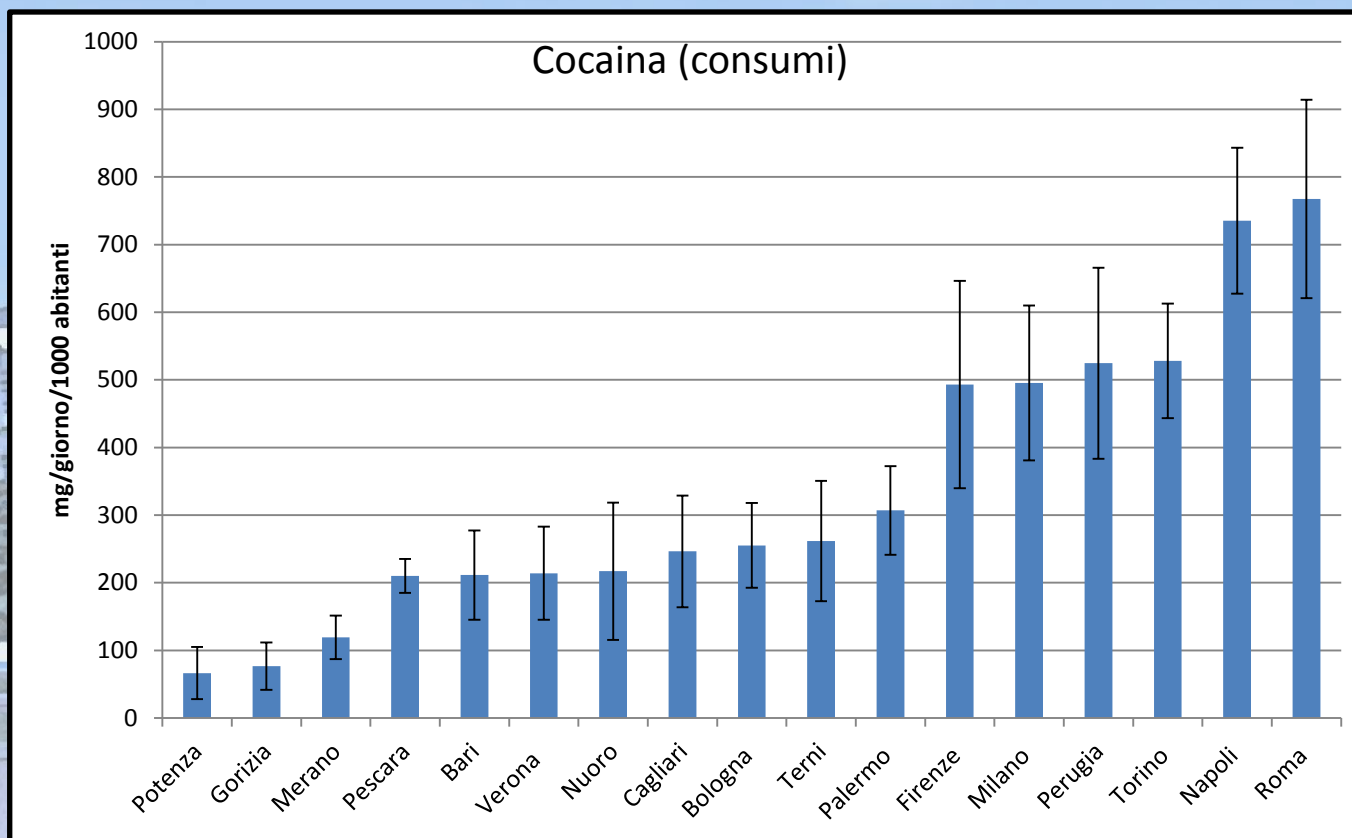
9 Centri Operativi

Torino
Verona
Bologna
Firenze
Pescara
Cagliari
Bari
Palermo
Perugia

5 Centri minori

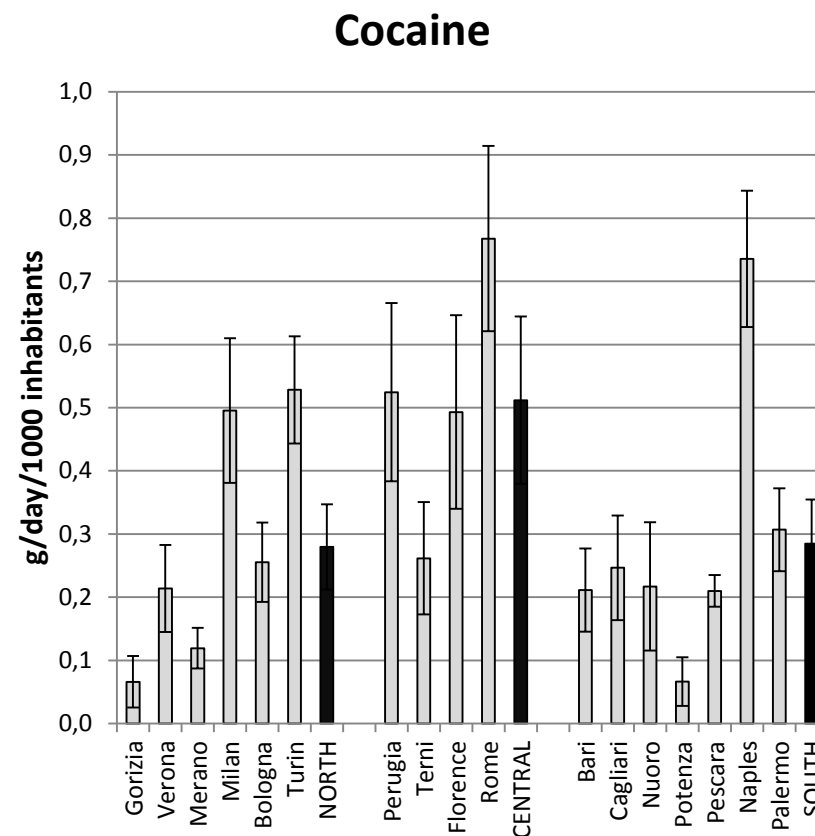
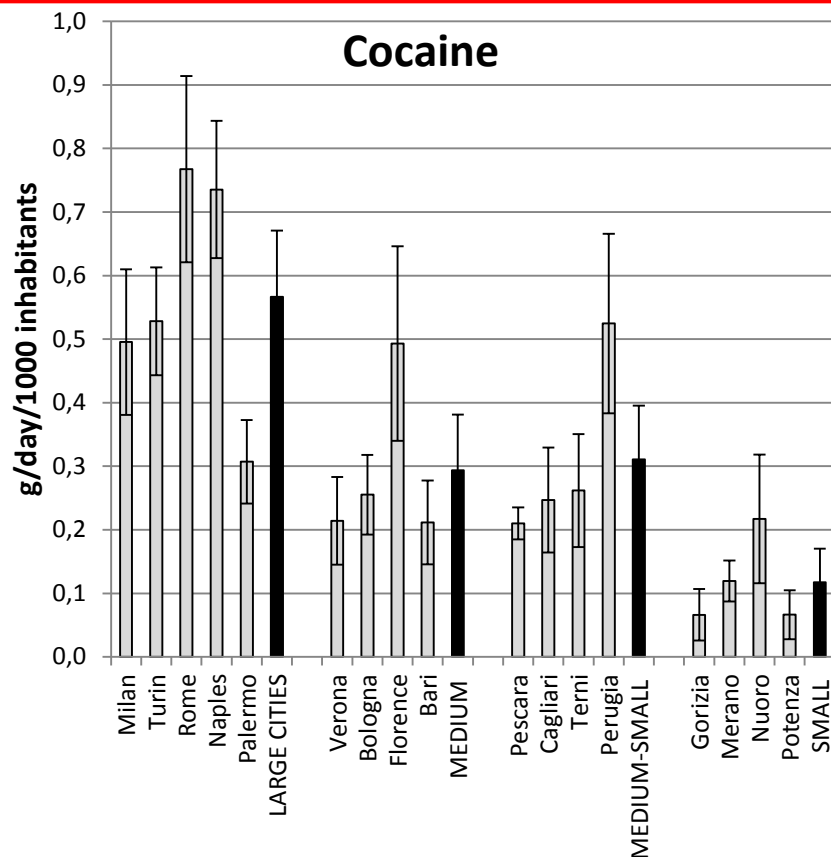
Merano
Gorizia
Terni
Nuoro
Potenza

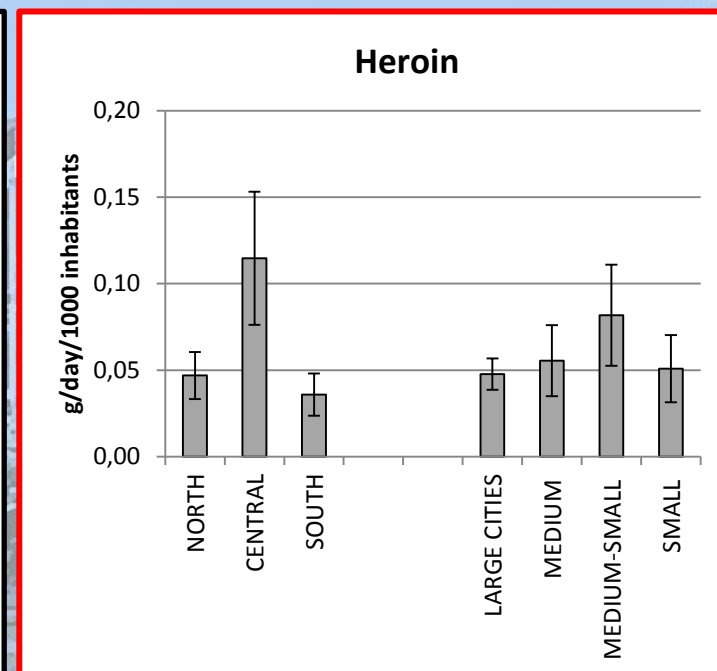
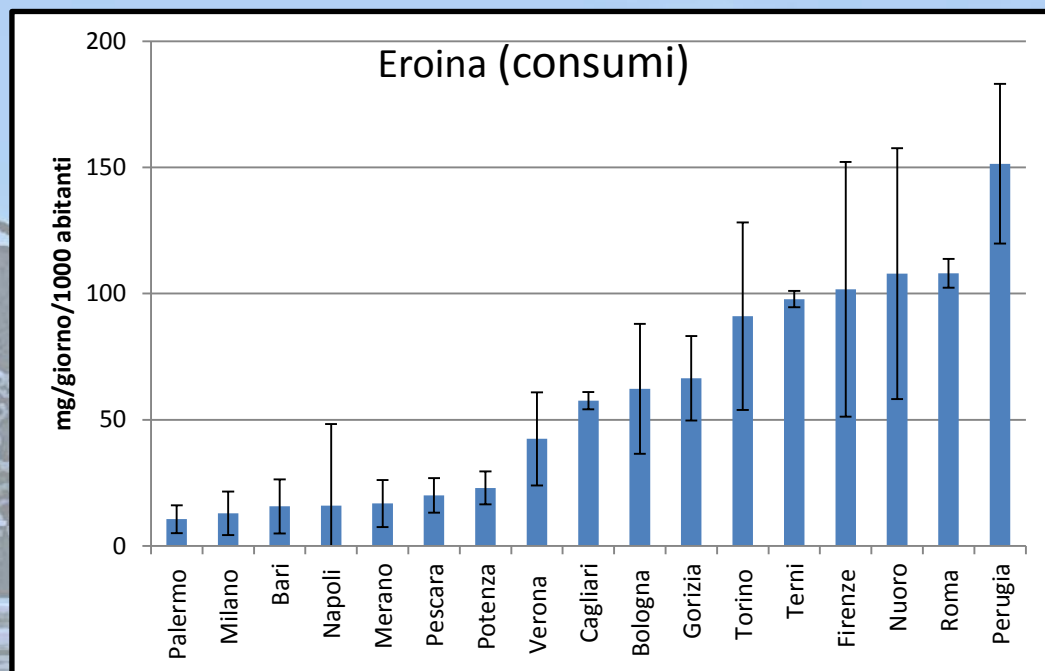
Stima dei consumi di cocaina in Italia (mg di cocaina pura/ giorno/ 1000 abitanti) (Medie \pm SD, n=7). Ottobre 2011



Zuccato E., et al. 2012

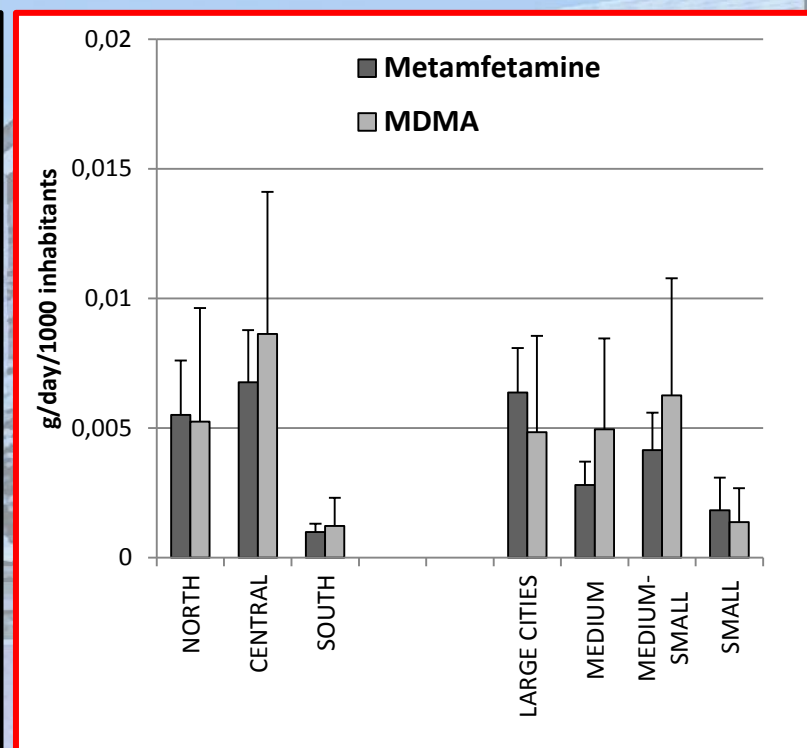
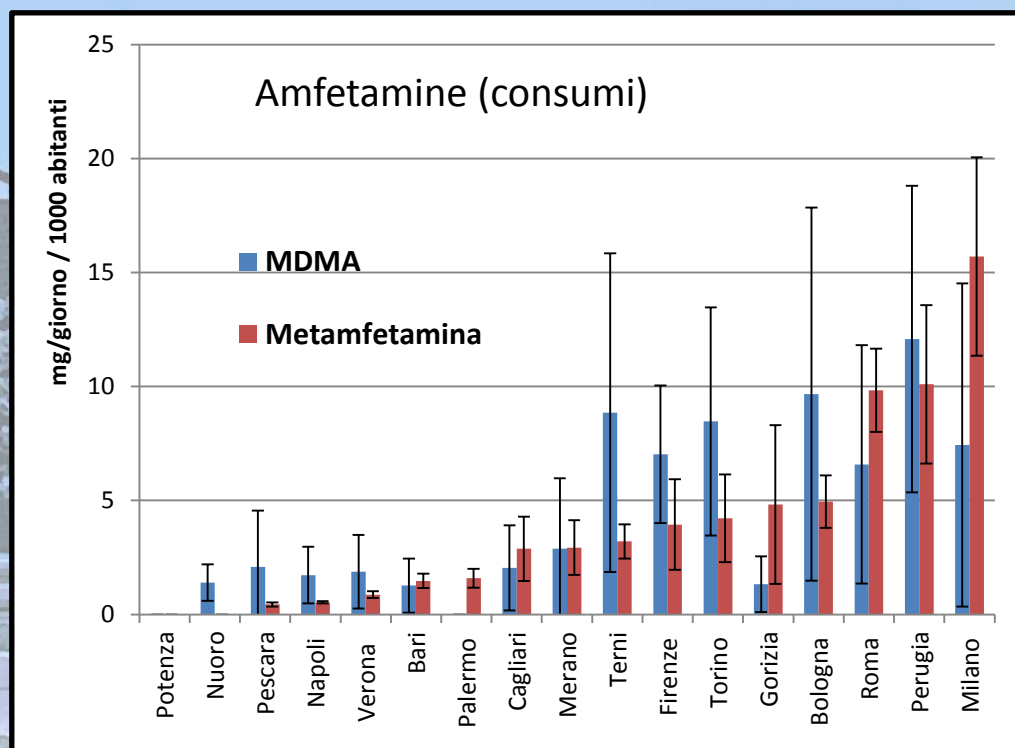
Consumi di cocaina in Italia: distribuzione geografica e demografica





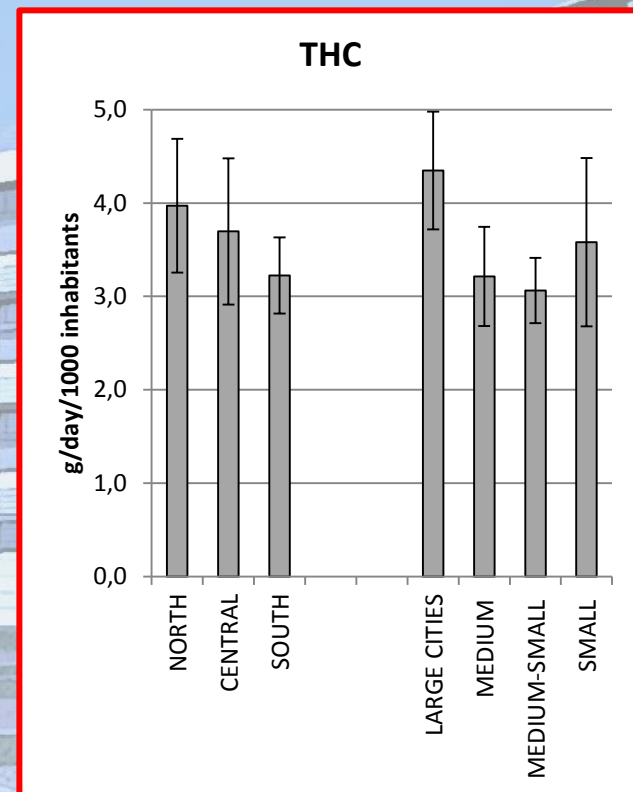
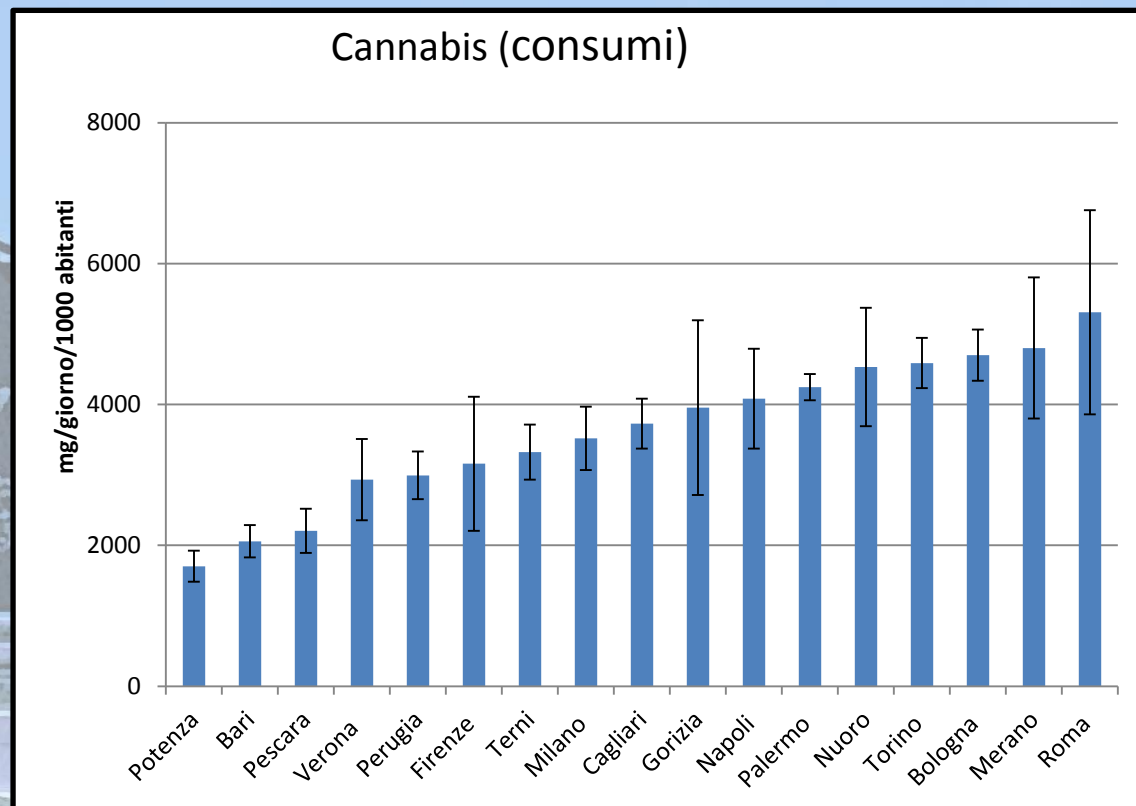
Zuccato E., et al. 2012

Stima dei consumi di amfetamine (mg di sostanze pure/giorno/1000 abitanti) (Medie \pm SD, n=7). Ottobre 2011



Zuccato E., et al. 2012

Stima dei consumi di cannabis (mg di THC/giorno/1000 abitanti) (Medie \pm SD, n=7). Ottobre 2011



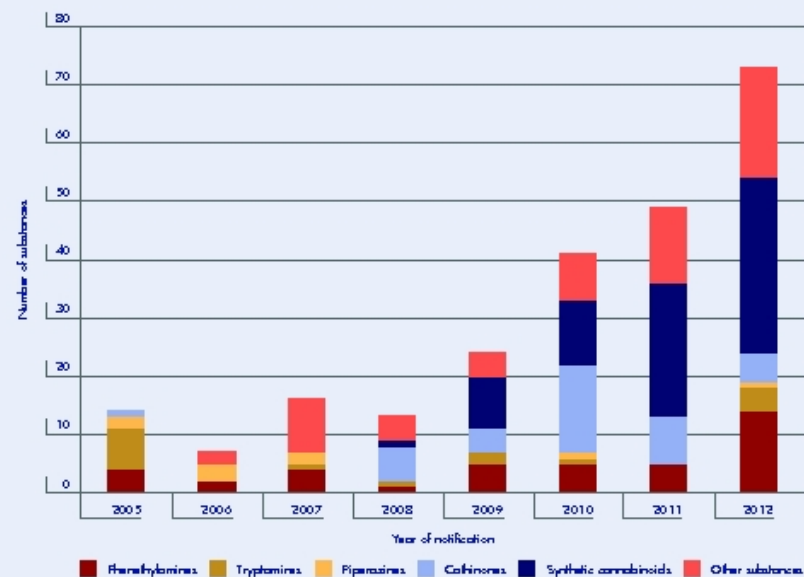
Zuccato E., et al. 2012

New Drugs



NUOVE SOSTANZE
PSICOATTIVE - NSP

Number of new psychoactive substances notified to the European Early warning system, 2005–2012



Source: EMCDDA/EWS.

Identificazione di nuove sostanze in reflui urbani

Problematiche da affrontare

- Decine/centinaia di sostanze differenti
- Strutture chimiche differenti
- Utilizzo limitato – presenza di livelli molto bassi nelle acque reflue
- Metabolismo umano sconosciuto
- Assenza di standard per l'identificazione e la quantificazione
- Acque reflue: matrici molto complesse contenenti migliaia di sostanze differenti

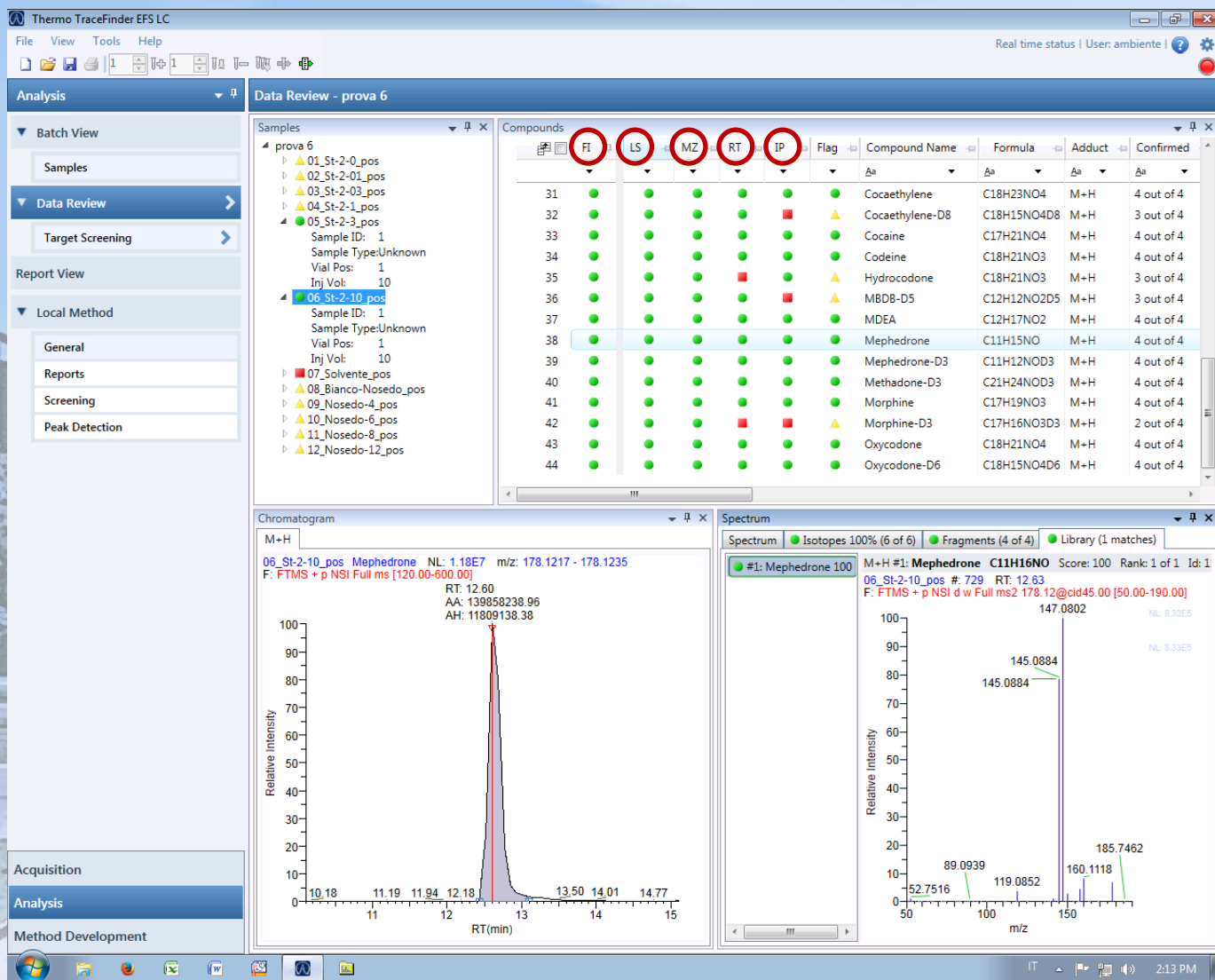
Analisi/screening in spettrometria di massa ad alta risoluzione (LTQ Orbitrap)



Utilizzo di software specifici per l'identificazione di sostanze 'incognite' -
Trace Finder



Trace finder screening in reflui urbani



MZ = massa/carica

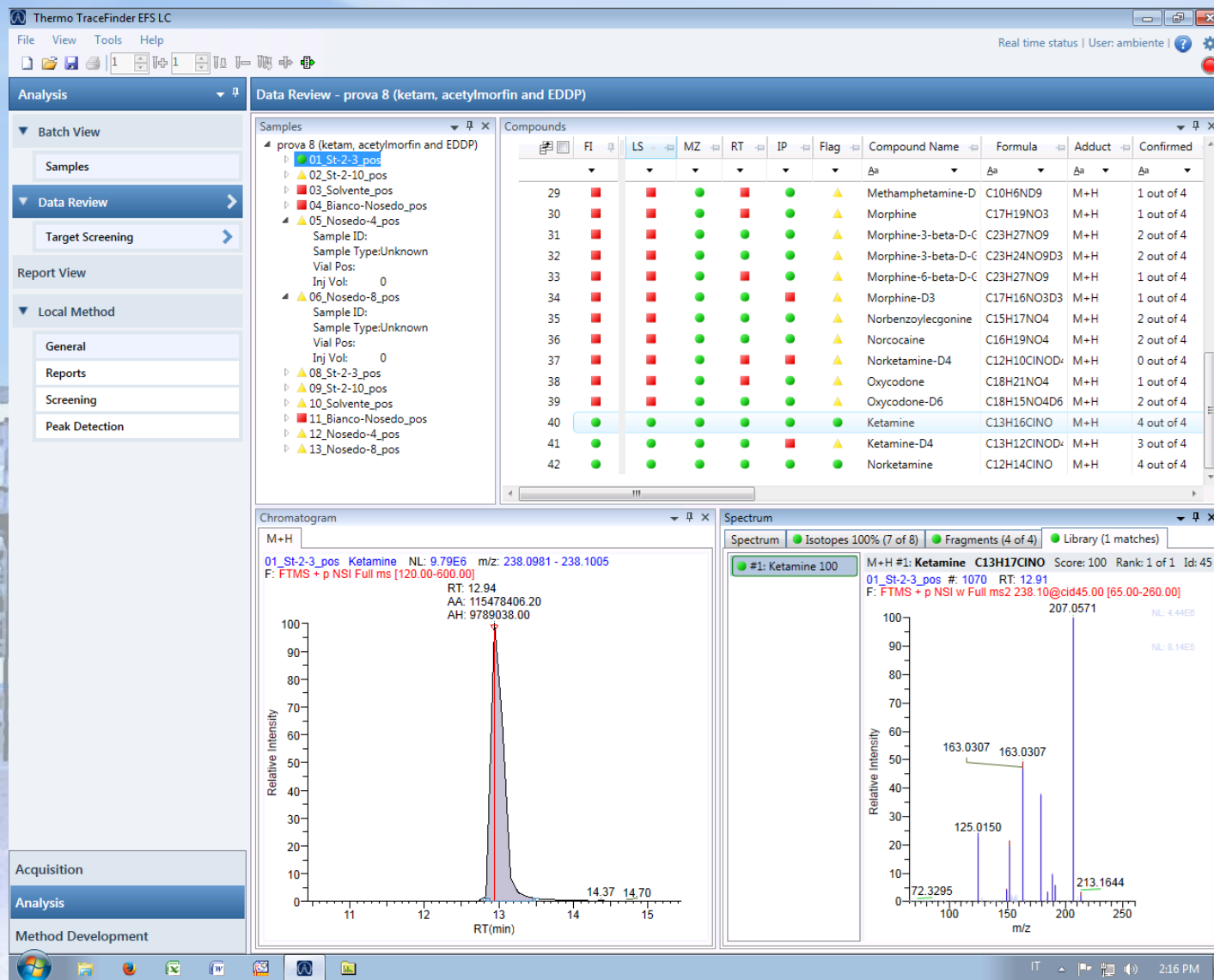
RT = tempo di ritenzione

FI = frammenti

IP = pattern isotopico

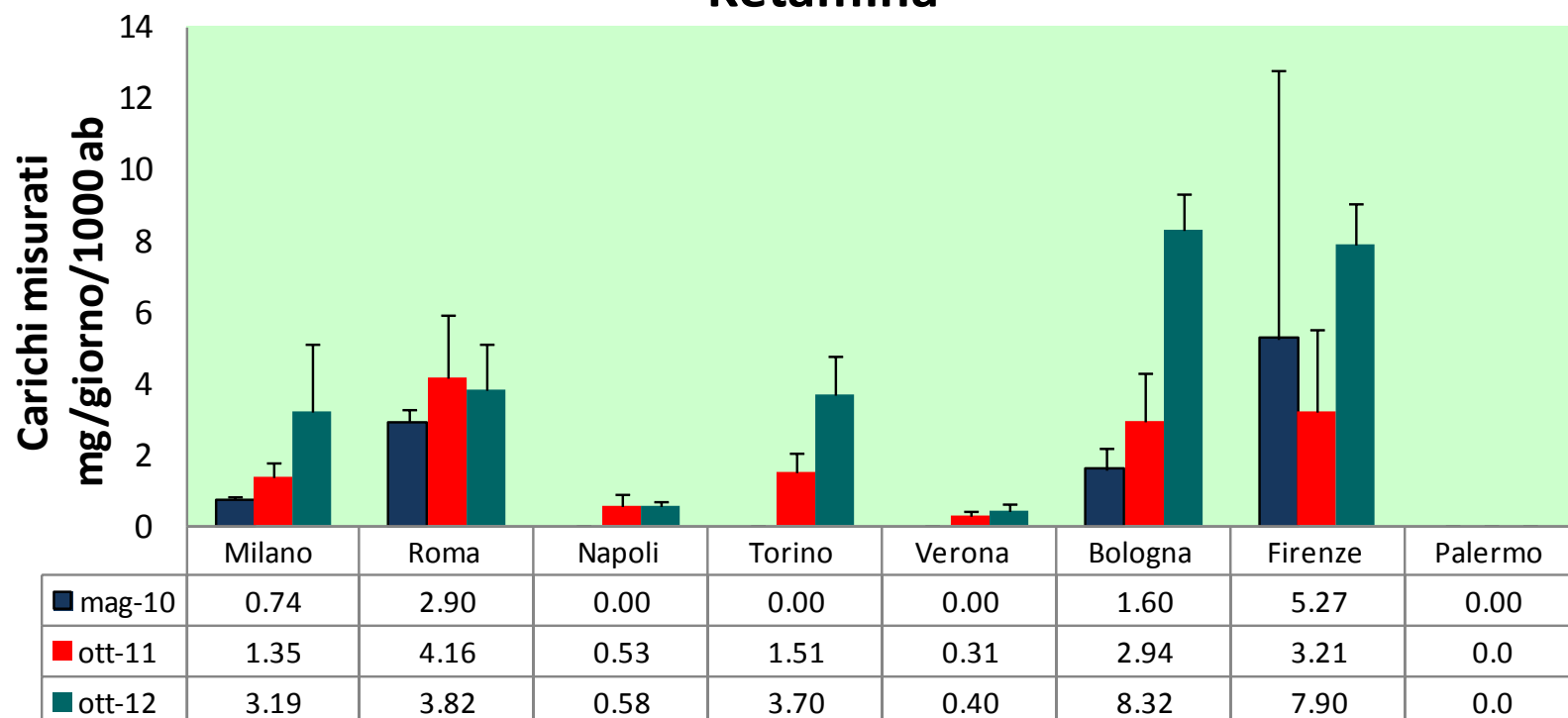
LS = ricerca su librerie (spettri MS/MS)

Trace finder screening in reflui urbani



Ketamina in Italia 2010-2012

Ketamina



Trace finder screening in reflui urbani

