L’eau usée peut-elle influencer des décisions de santé publique?

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McGill

YARGEAU LABORATORY
Controlling
Contaminants of
Concern

CentrEau
Centre québécois de recherche sur l'eau
Quebec Water Research Centre

présente

LES WEBINAIRES HEBDEAU

Conventional approaches to obtain information about a population

Mechanisms to obtain information about a population

Survey (online, over the phone, questionnaires, etc)

Sales reports

Prescription drug trend reports

Statistics on drug seizures

Collecting specimens (eg. respiratory tract specimens using swabs)

Wastewater-based epidemiology approach

Population served by a wastewater treatment plant

Doses per day per 1000 people

Dose (estimates)

Eg. 100 mg for MDMA (Ecstasy)
100 mg for intranasal cocaine
30 mg for oral amphetamines

Excretion rate

Eg. 65% for MDMA (Ecstasy)
45% cocaine excreted as benzoylecgonine
30% excretion of amphetamines

Volumetric flow rate of water treated

Analysis of the concentration of drugs

Zuccato, E., Chiabrando, Castiglioni, S., S., Bagnati, R., Fanelli, R. (2008) Environment Health Perspective

Wastewater-based epidemiology

Some interesting WBE results

Pilot study for illicit drugs monitoring

Wastewater surveillance – Covid -19

Overview of the work at McGill

Start collaboration with Statistique Canada

Read Zuccato et al.

Estimating Community Drug Abuse by Wastewater Analysis

Ettore Zuccato, Chiara Chiabrando, Sara Castiglioni, Renzo Bagnati, and Roberto Fanelli

Project in Mexico

Project in Barbados

Pan-Canadian pilot project

2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020

Methods developed and applied to few municipalities in Quebec & Ontario (in collaboration with C. Metcalfe)

score

Participated along with two municipalities in Quebec

We joined the European SCORE project

Science of the Total Environment 487 (2014) 722–730

Contents lists available at ScienceDirect

Science of the Total Environment

journal homepage: www.elsevier.com/locate/scitotenv

Analysis of drugs of abuse in wastewater from two Canadian cities

Viviane Yargeau [a,*], Bryanne Taylor [b], Hongxia Li [b], Angela Rodayan [a], Chris D. Metcalfe [b]

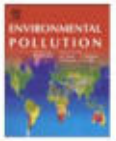
[a] Department of Chemical Engineering, McGill University, Montreal, QC, Canada
[b] Water Quality Centre, Trent University, Peterborough, ON, Canada

Environmental Pollution 158 (2010) 3179–3185

Contents lists available at ScienceDirect

Environmental Pollution

journal homepage: www.elsevier.com/locate/envpol



Illicit drugs in Canadian municipal wastewater and estimates of community drug use

Chris Metcalfe [a,*], Kathryn Tindale [a], Hongxia Li [a], Angela Rodayan [b], Viviane Yargeau [b]

[a] Worsfold Water Quality Centre, Trent University, 1600 West Bank Drive Peterborough, ON, K9J 7B8, Canada
[b] Department of Chemical Engineering, McGill University, 3610 University St., Montreal, QC, H3A 2B2, Canada

Bulletin of Environmental Contamination and Toxicology (2018) 101:1–6
https://doi.org/10.1007/s00128-018-2346-0

Contaminants of Emerging Concern in Wastewaters in Barbados, West Indies

Quincy A. Edwards[1] · Tamanna Sultana[2] · Sergei M. Kulikov[1] · Leah D. Garner-O'Neale[1] · Viviane Yargeau[3] · Chris D. Metcalfe[2]

Trends in Analytical Chemistry 103 (2018) 34–43

Contents lists available at ScienceDirect

Trends in Analytical Chemistry

journal homepage: www.elsevier.com/locate/trac

Multi-year inter-laboratory exercises for the analysis of illicit drugs and metabolites in wastewater: Development of a quality control system

Alexander L.N. van Nuijs [a,*], Foon Yin Lai [a], Frederic Been [a], Maria Jesus Andres-Costa [b], Leon Barron [c], Jose Antonio Baz-Lomba [d], Jean-Daniel Berset [e], Lisa Benaglia [f], Lubertus Bijlsma [g], Dan Burgard [h], Sara Castiglioni [i], Christophoros Christophoridis [j], Adrian Covaci [a], Pim de Voogt [k,l], Erik Emke [k], Despo Fatta-Kassinos [m], Jerker Fick [n], Felix Hernandez [g], Cobus Gerber [o], Iria González-Mariño [p], Roman Grabic [q], Teemu Gunnar [r], Kurunthachalam Kannan [s,t], Sara Karolak [u], Barbara Kasprzyk-Hordern [v], Zenon Kokot [w], Ivona Krizman-Matasic [x], Angela Li [y], Xiqing Li [z], Arndís S.C. Löve [aa], Miren Lopez de Alda [ab], Ann-Kathrin McCall [aj], Markus R. Meyer [ac], Herbert Oberacher [ad], Jake O'Brien [ae], Jose Benito Quintana [p], Malcolm Reid [d], Serge Schneider [af], Susana Sadler Simoes [ag], Nikolaos S. Thomaidis [ah], Kevin Thomas [d,ae], Viviane Yargeau [ai], Christoph Ort [aj]

Science of the Total Environment 565 (2016) 977–983

Contents lists available at ScienceDirect

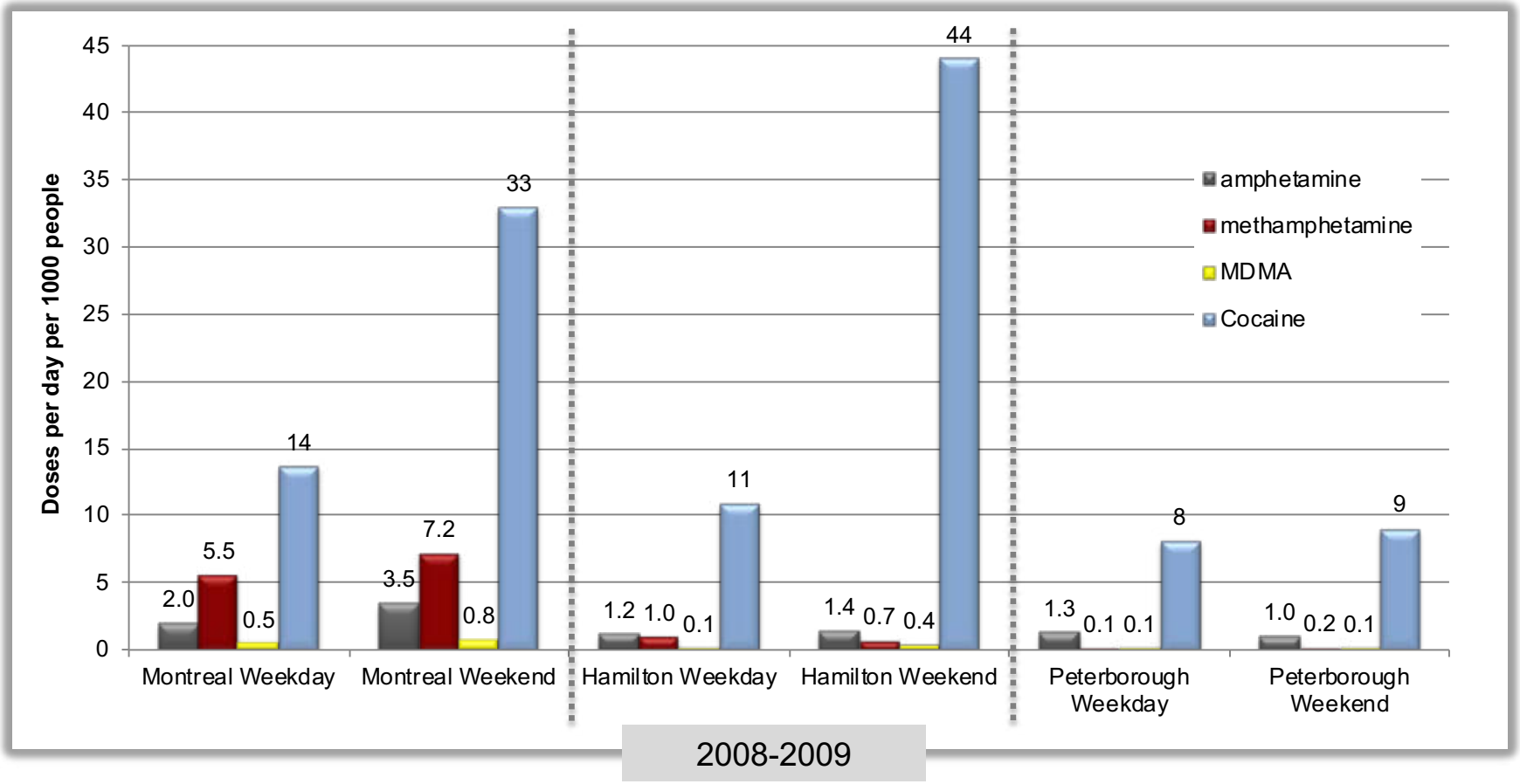
Science of the Total Environment

journal homepage: www.elsevier.com/locate/scitotenv

Comparative measurement and quantitative risk assessment of alcohol consumption through wastewater-based epidemiology: An international study in 20 cities

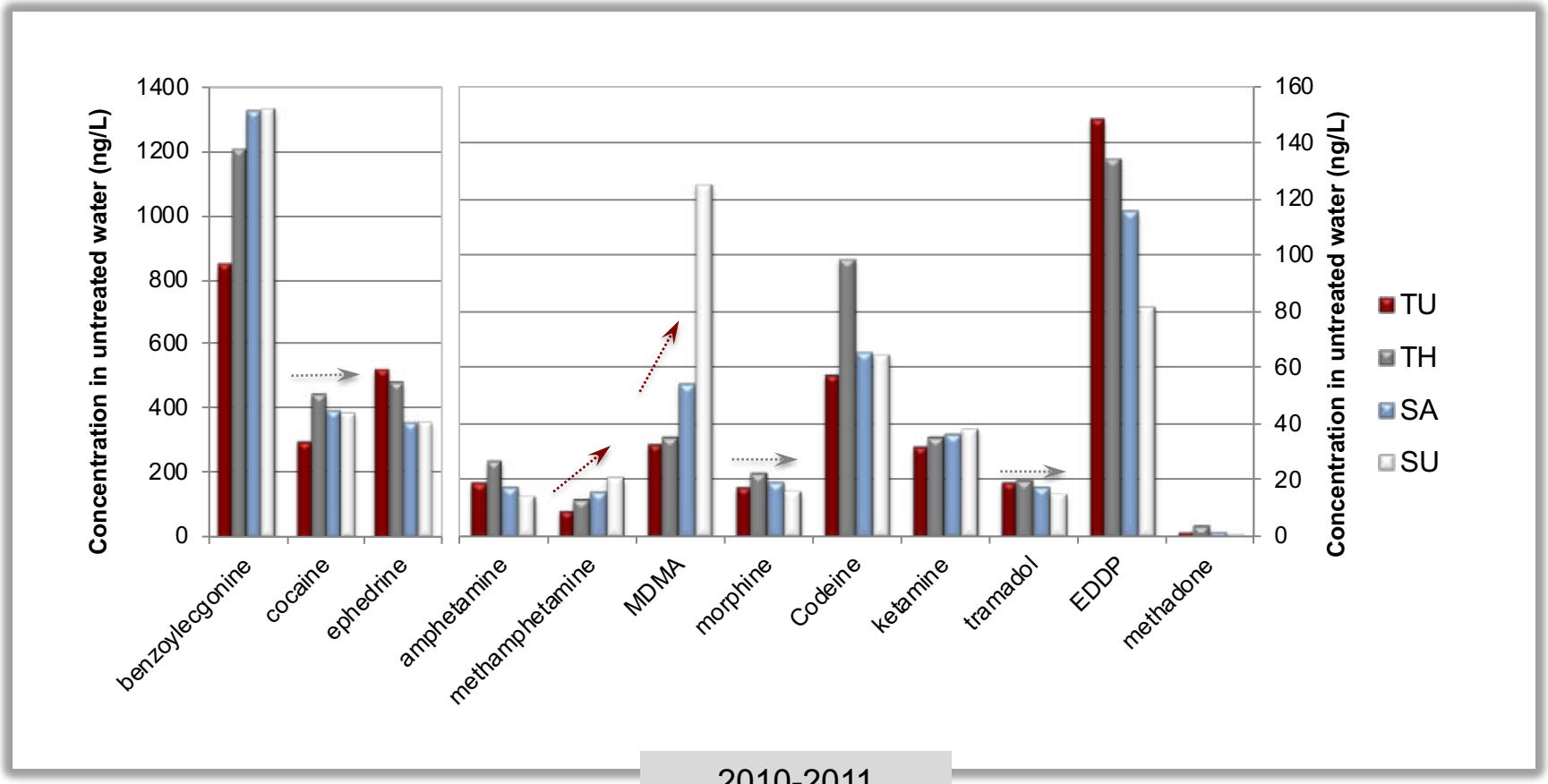
Yeonsuk Ryu [a,b,*], Damià Barceló [c,d], Leon P. Barron [e], Lubertus Bijlsma [f], Sara Castiglioni [g], Pim de Voogt [h,i], Erik Emke [h], Félix Hernández [f], Foon Yin Lai [j], Alvaro Lopes [k], Miren López de Alda [c], Nicola Mastroianni [c], Kelly Munro [e], Jake O'Brien [j], Christoph Ort [l], Benedek G. Plósz [m], Malcolm J. Reid [a], Viviane Yargeau [n], Kevin V. Thomas [a]

First Estimates of Drug Use in Ontario and Quebec



METCALFE, C., TINDALE, K., Li, H., RODAYAN, A., YARGEAU, V. (2010) Environmental Pollution

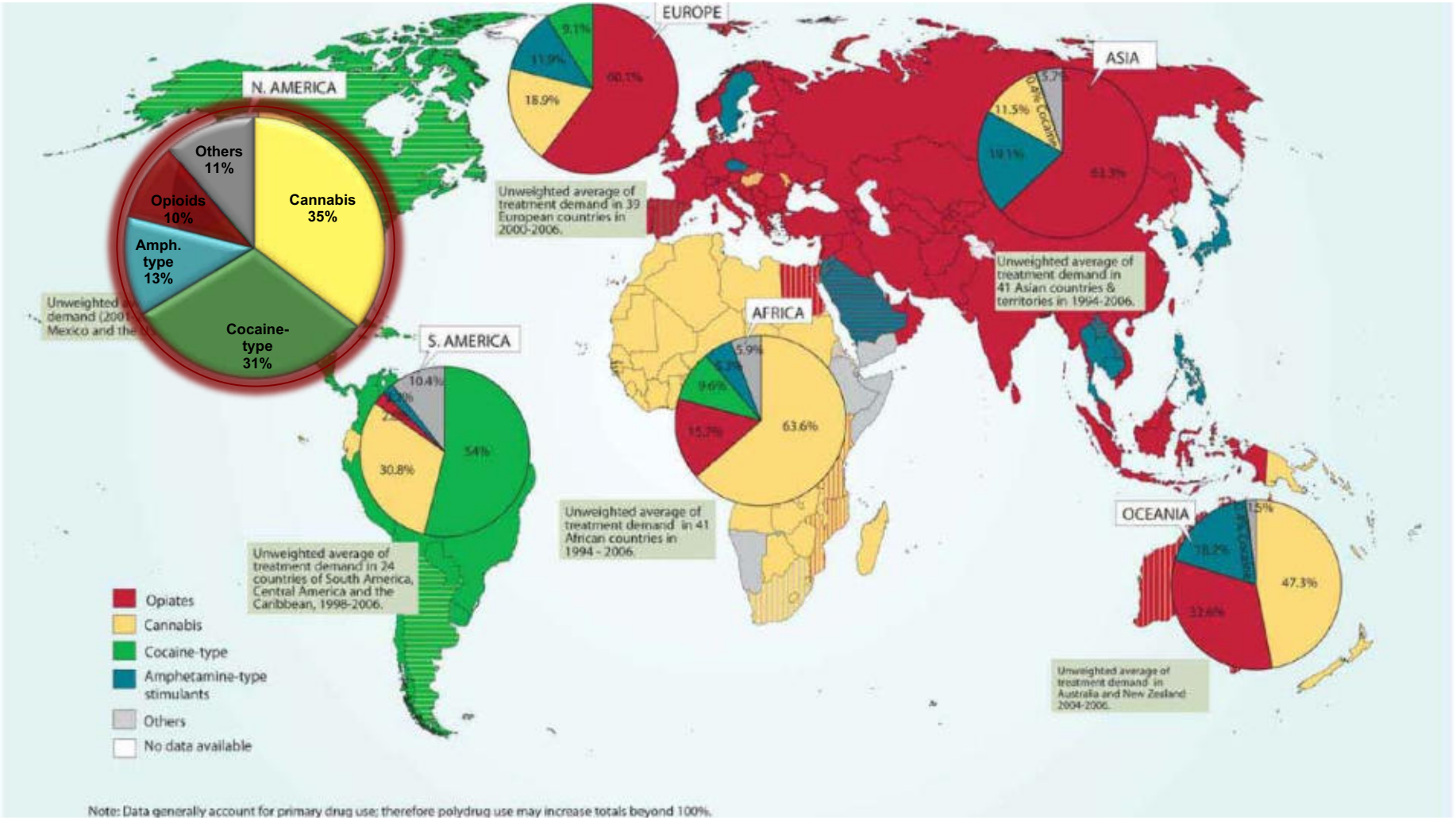
Concentrations & Weekly Variations in Concentration



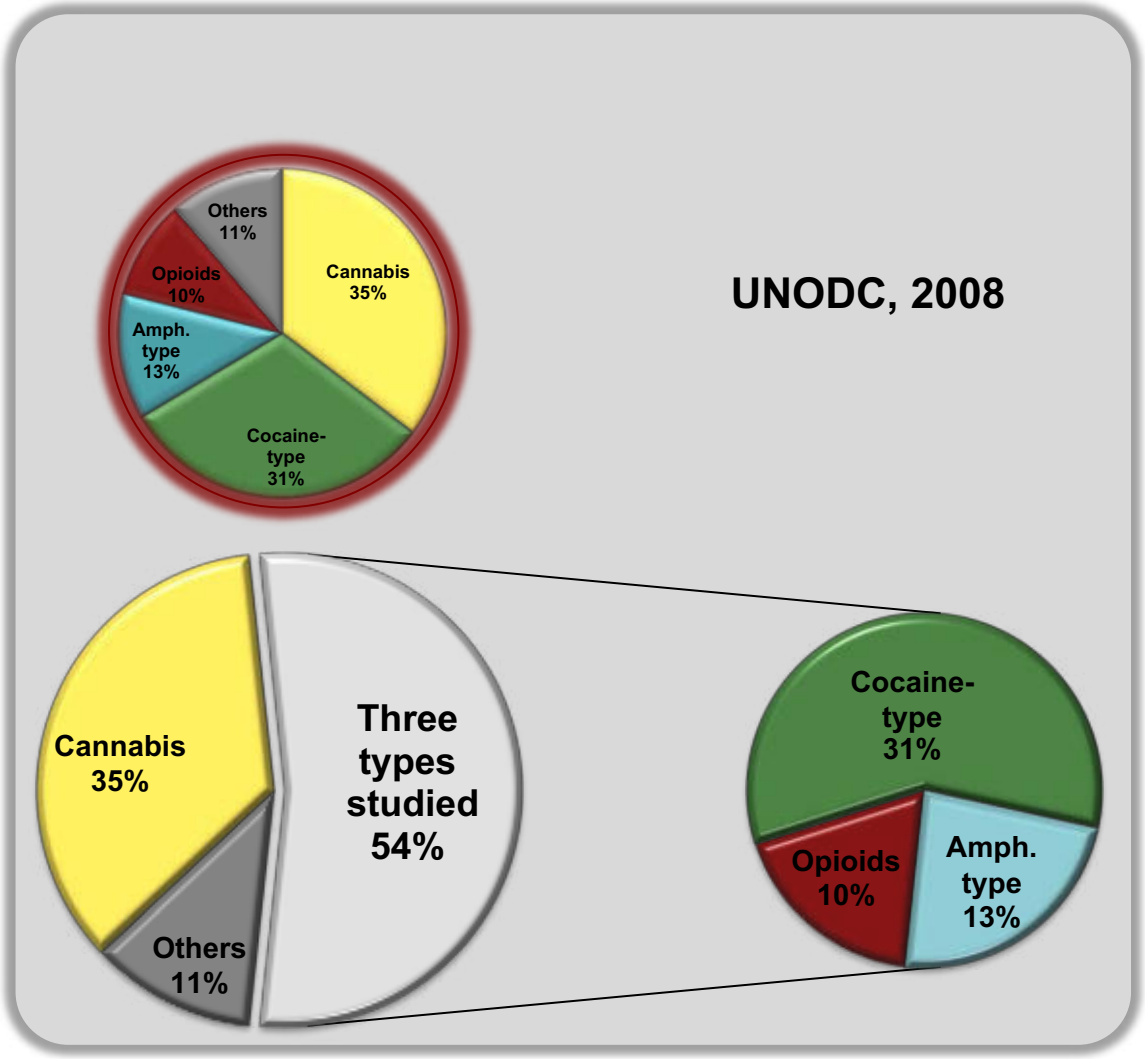
2010-2011

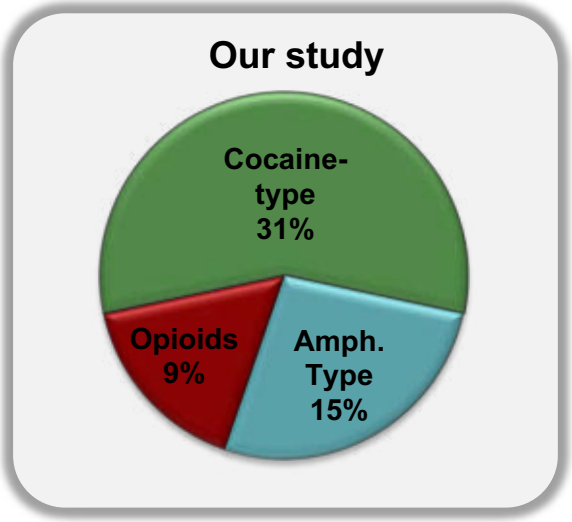
YARGEAU, V., TAYLOR, B., LI, H., RODAYAN, A., METCALFE, C. (2014)
Science of the Total Environment

Are these good estimates?



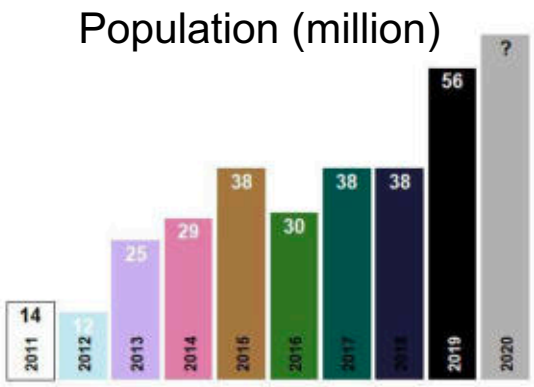
Are these good estimates?

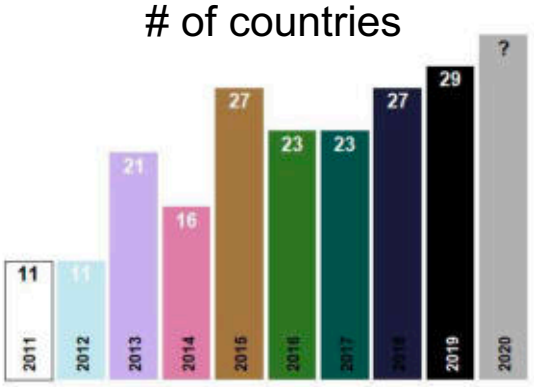


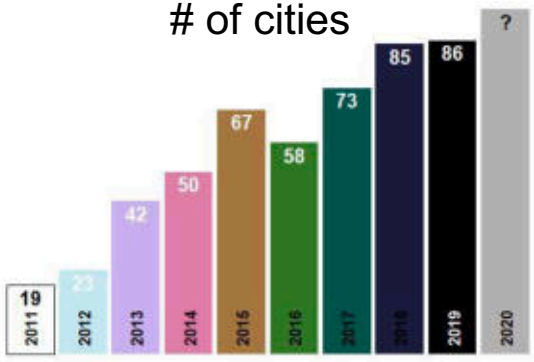


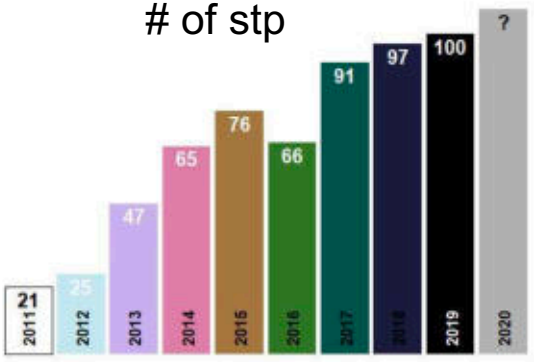
Europe^{+}-wide testing platform

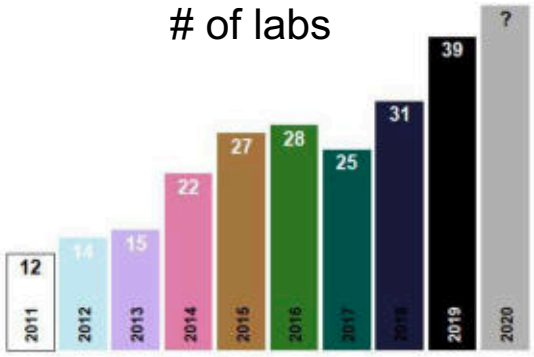
- Develop best practices for sewage epidemiology
- Increase the spatio-temporal resolution of available data
- Coordinate the development of new biomarkers in sewage







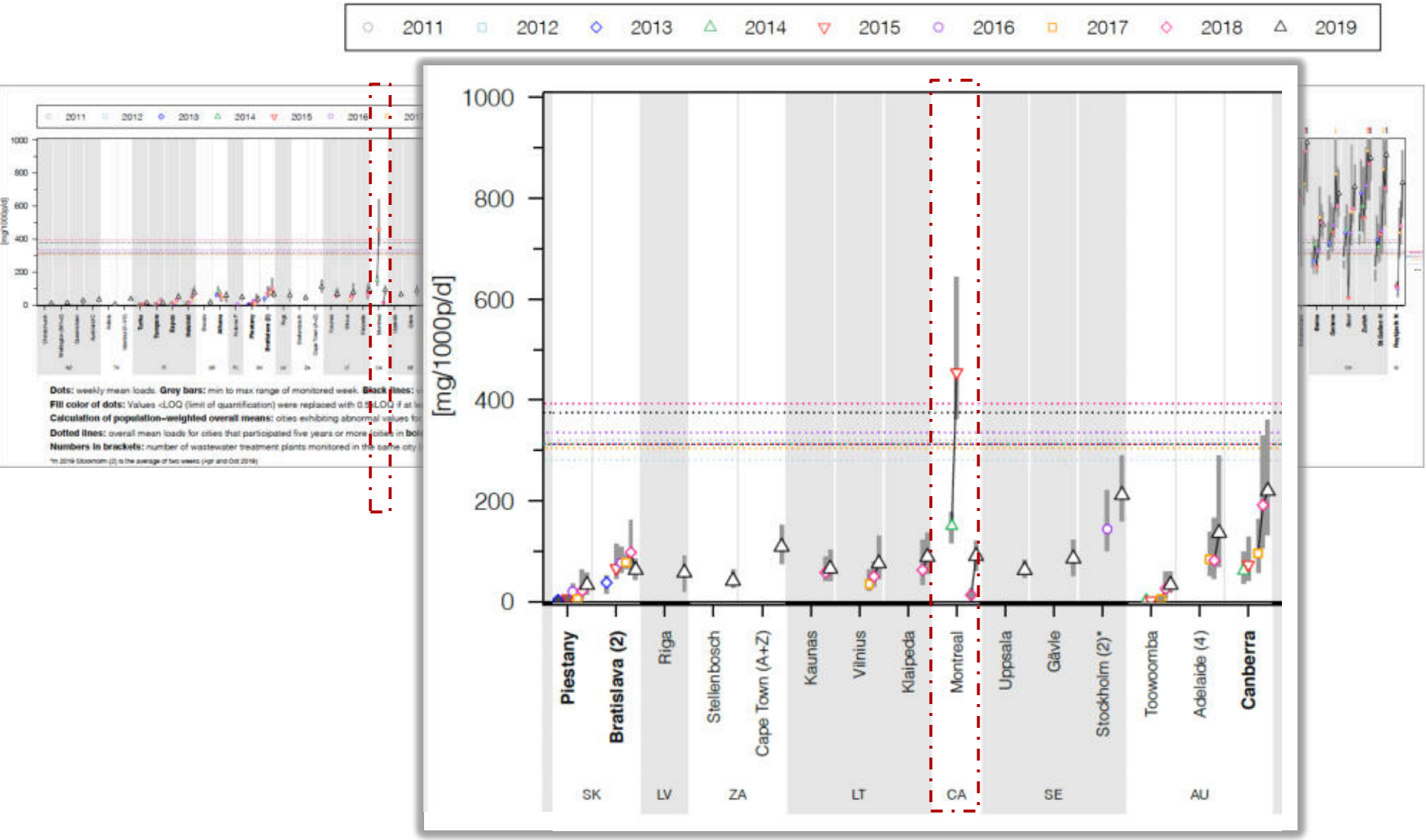




score

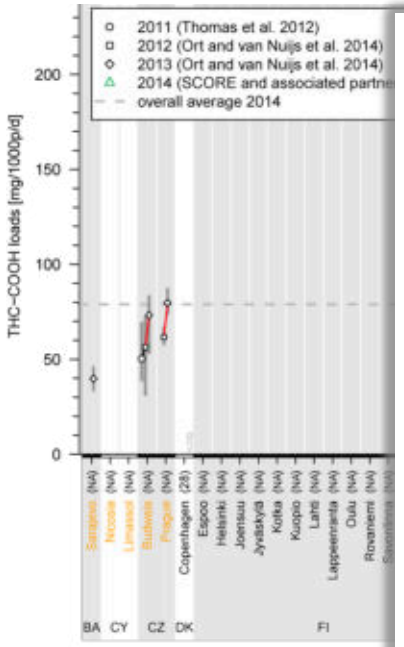
Sewage Analysis CORe group Europe

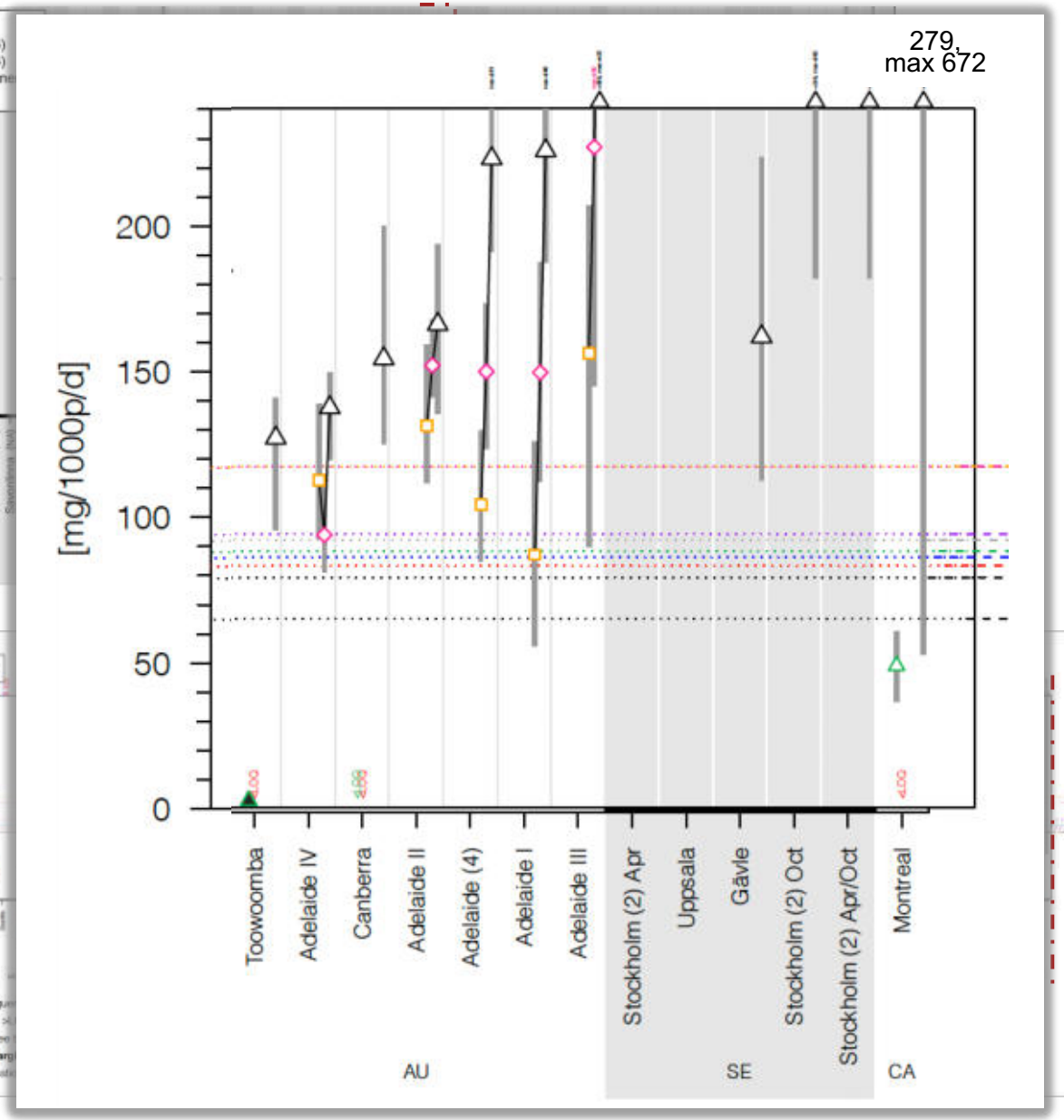
Cocaine


2011
2012
2013
2014
2015
2016
2017
2018
2019
[mg/1000p/d]
1000
800
600
400
200
0
Piestany
Bratislava (2)
Riga
Stellenbosch
Cape Town (A+Z)
Kaunas
Vilnius
Klaipeda
Montreal
Uppsala
Gävle
Stockholm (2)*
Toowoomba
Adelaide (4)
Canberra
SK
LV
ZA
LT
CA
SE
AU

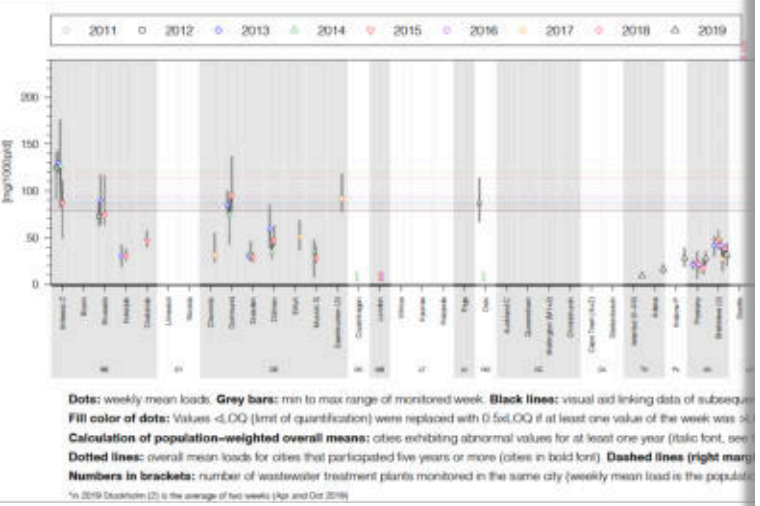
THC-COOH (cannabis)

Earlier Results





2019 Results

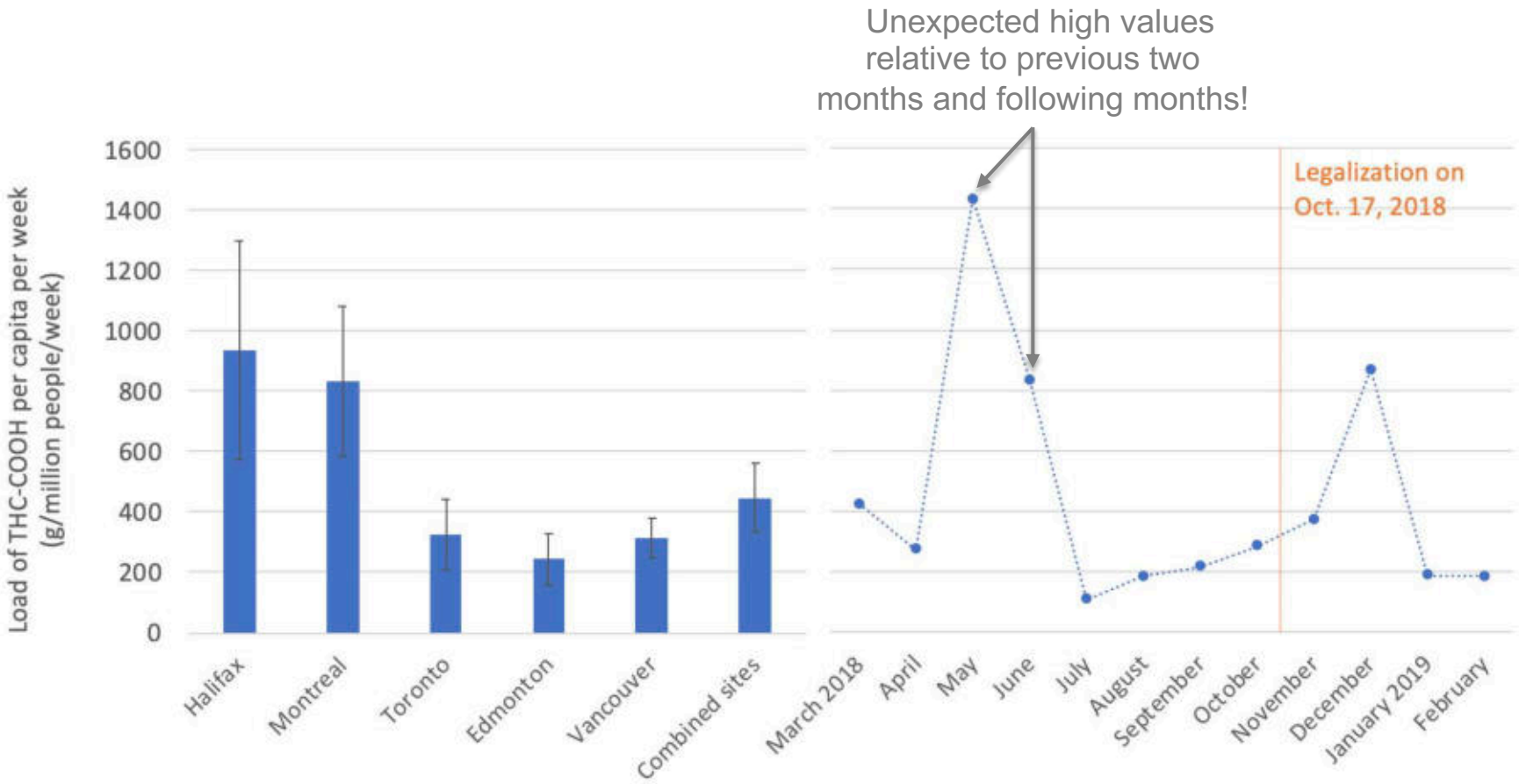


Statistics Canada on-going pilot study

LEGEND
1 – Vancouver
2 – Surrey
3 – Edmonton
4 – Toronto
5 – Montreal
6 – Halifax

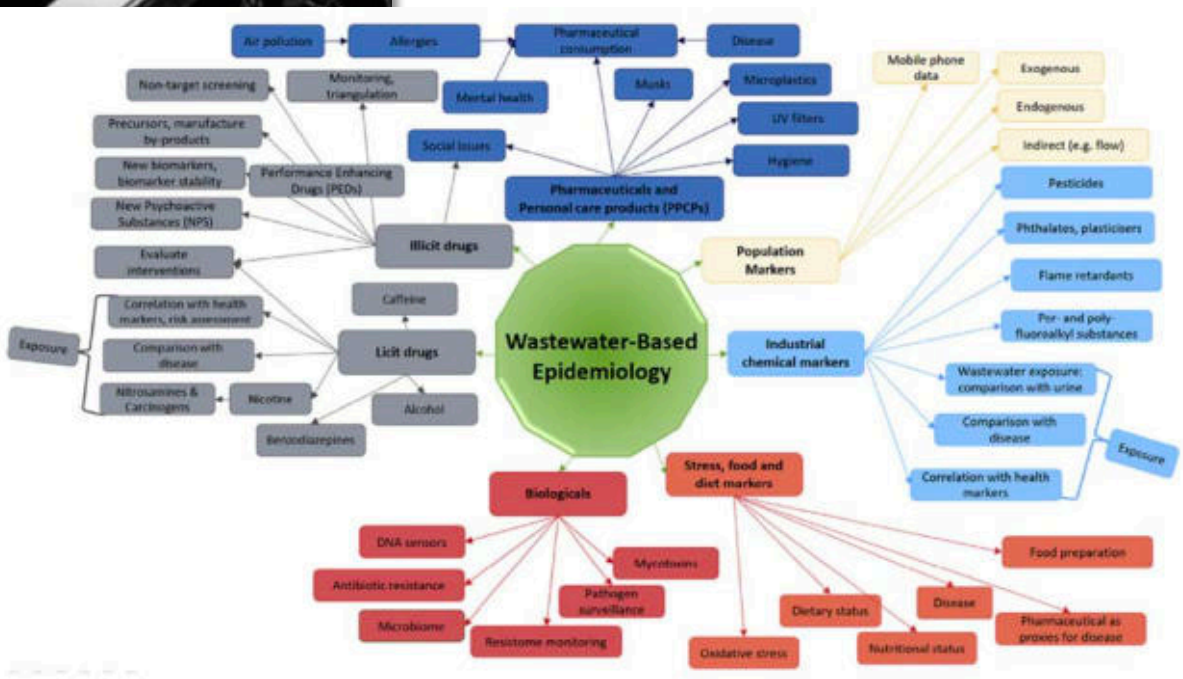
- 7 consecutive daily samples during 2nd week of each month
- Week aggregates based on daily flow rates
- Samples extracted (SPE) and analyzed by LC-HRMS
- Concentrations and flow rates sent to Statistics Canada for data analysis

Estimates for a population of 8,4M



Book chapter "The estimation of cannabis consumption through wastewater analysis" in Analysis of Cannabis (In Press)

How can this be expanded to inform public health decisions?



Choi et al. (2018) Trends in Analytical Chemistry 105: 453-469

POLIO GLOBAL ERADICATION INITIATIVE

Global Polio Surveillance Action Plan, 2018-2020

How can this be expanded to inform public health decisions?

SARS-CoV-2

March 30, 2020

Presence of SARS-Coronavirus-2 in sewage.

Authors and their affiliations

Gertjan Medema; KWR Water Research Institute, Nieuwegein, The Netherlands

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Goffe Elsinga; KWR Water Research Institute, Nieuwegein, The Netherlands

Ronald Italiaander; KWR Water Research Institute, Nieuwegein, The Netherlands

April 5, 2020

Title: SARS-CoV-2 titers in wastewater are higher than expected from clinically confirmed cases

Authors: Wu FQ(1); Xiao A(1); Zhang JB(1); Gu XQ(2); Lee WL(2); Kauffman K (3); Hanage WP(4); Matus M (5); Ghaeli N(5); Endo N(5); Duvallet C(5); Moniz K(1); Erickson TB(6); Chai PR (6); Thompson J(7); Alm EJ(1,2,5)

1: Center for Microbiome Informatics and Therapeutics, Departments of Biological Engineering and Civil & Environmental Engineering, Massachusetts Institute of Technology
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4: Center for Communicable Disease Dynamics, Department of Epidemiology, Harvard T. H. Chan School of Public Health, Boston
5: Biobot Analytics, Cambridge MA
6: Division of Medical Toxicology, Department of Emergency Medicine, Brigham and Women's Hospital
7: Singapore Center for Environmental Life Sciences Engineering, Asian School of the Environment, Nanyang Technological University, Singapore

COVID19WBEC.ORG

Poop could be the key to tracking COVID-19 outbreaks
27 April 2020, Kate Baggaley, Popular Science

Coronavirus found in Paris sewage points to early warning system
21 April 2020, Christa Lesté-Lasserre, Science Magazine

New research examines wastewater to detect community spread of Covid-19
7 April 2020, Shraddha Chakradhar, STAT News

One Way to Potentially Track Covid-19? Sewage Surveillance
7 April 2020, Gregory Barber, WIRED

How sewage could reveal true scale of coronavirus outbreak
3 April 2020, Smriti Mallapati, Nature News Article

Few initiatives on Environmental Surveillance of COVID-19 Indicators in Sewersheds

Canadian Water Network

Supporting Public Health Decisions through Wastewater Surveillance for COVID-19

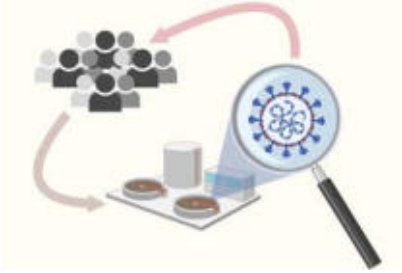
CANADIAN COALITION ON WASTEWATER-RELATED COVID-19 RESEARCH

THE Water Research FOUNDATION

Virtual International Water Research Summit on COVID-19

Closing Session

Thursday, April 30, 2020 - 3:00 pm (EDT) / 1:00 pm (MDT)



COVID-19 WBE Collaborative

In partnership with the Sewage Analysis CORe group Europe (SCORE) and the Global Water Pathogen Project.

Benefits of wastewater surveillance

- Provides faster, cheaper and less invasive way of monitoring of populations
- Offers a way to monitor changing patterns in quasi-real time
- Can serve as a tool for public health officials,
  eg. Monitoring the emergence of a 2nd wave of Covid-19

BUT some research is still needed in order to deploy the approach and to produce coherent, replicable, and sufficiently accurate estimates, especially for new biomarkers.