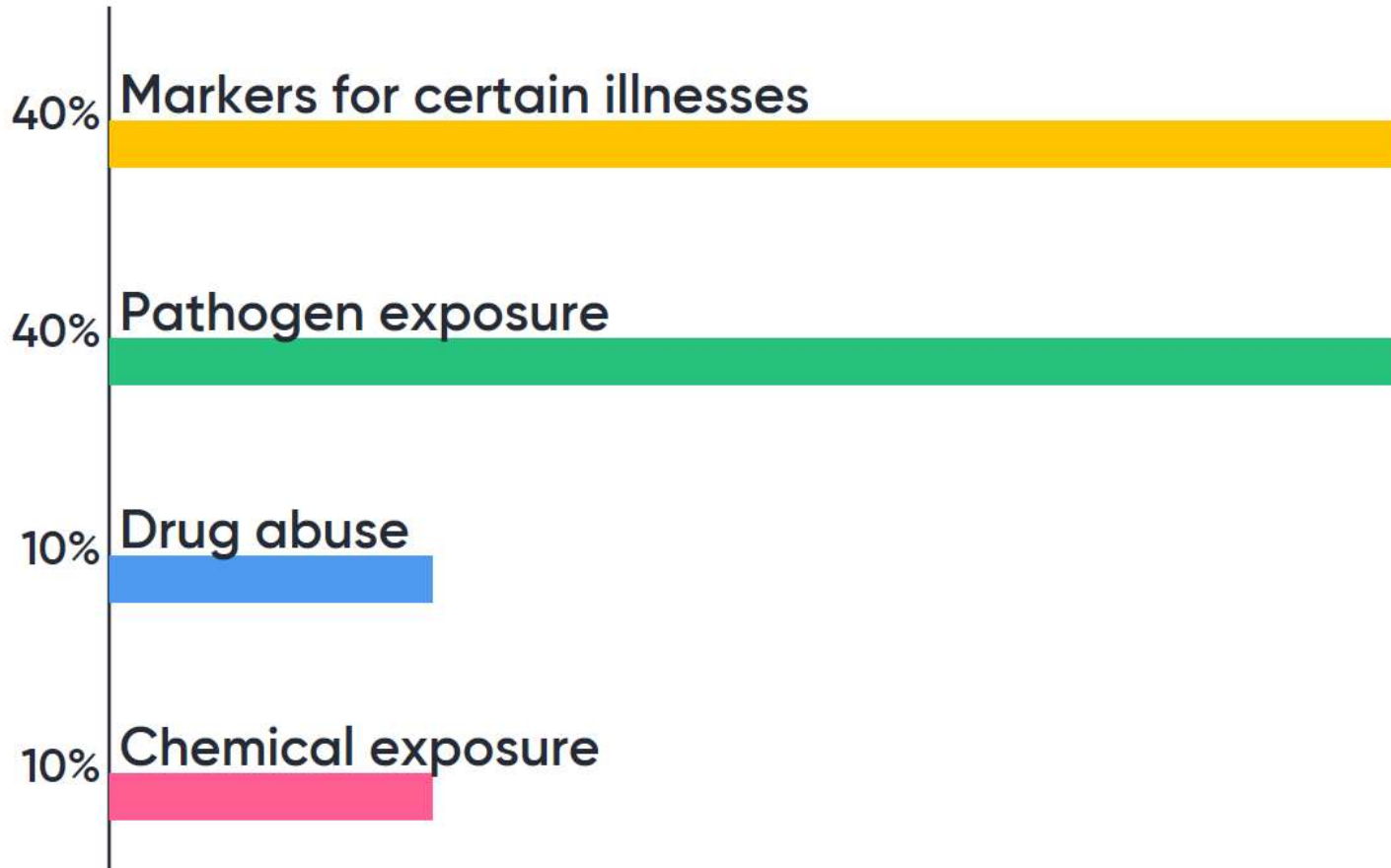


Go to www.menti.com and use the code 36 49 65

In your community, what public health problems need to be monitored? how are resources allocated?

 Mentimeter



Voting is closed

[Open voting](#)



Slide is not active

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Testing wastewater for better community health and safety

The 2nd Annual Community Information Exchange Summit
San Diego, CA

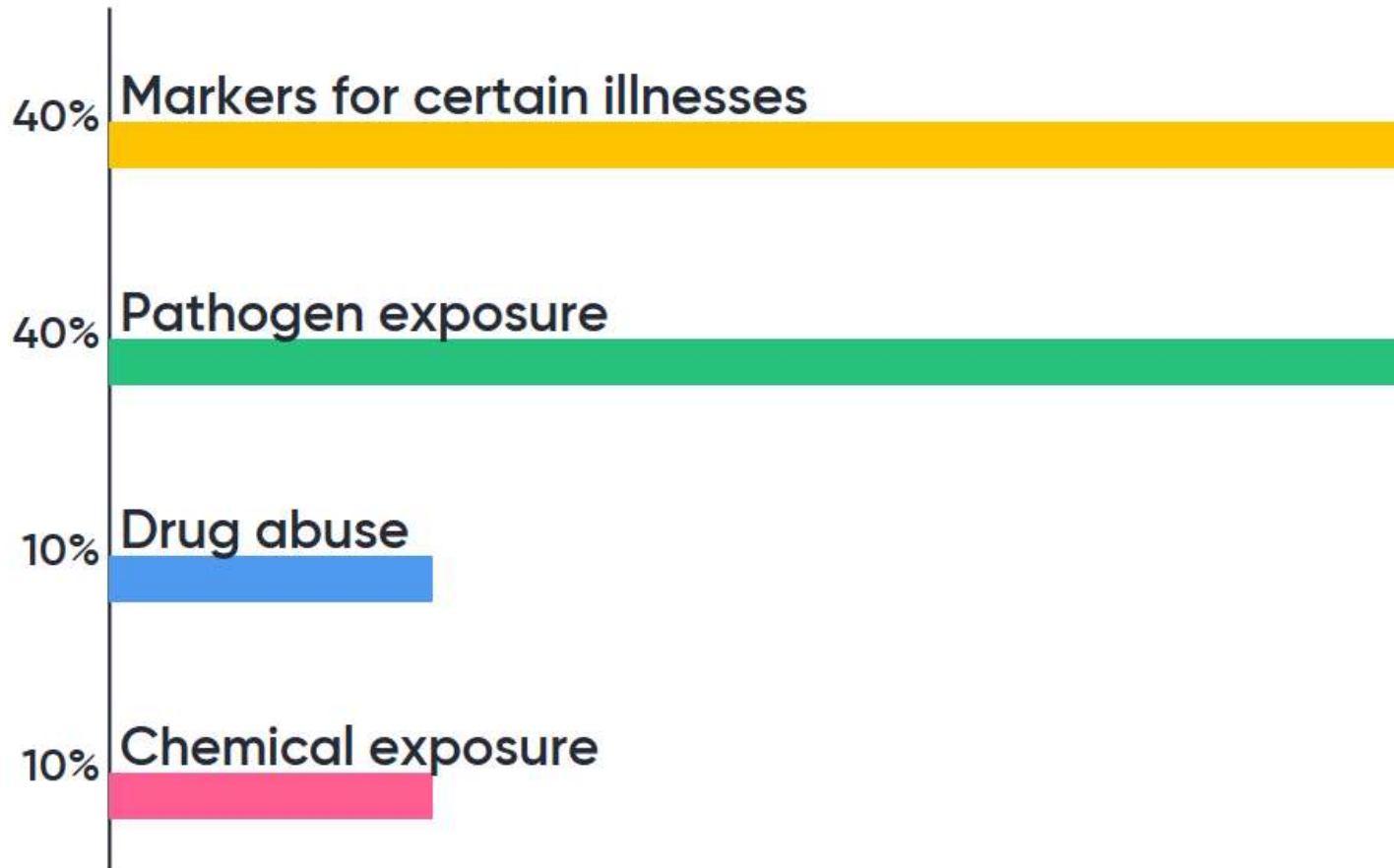
April 24, 2019

Cindy Hu, ScD
chu@mathematica-mpr.com
Mathematica

Go to www.menti.com and use the code 36 49 65

In your community, what public health problems need to be monitored? how are resources allocated?

 Mentimeter



Voting is closed

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Wastewater: a “new” data source

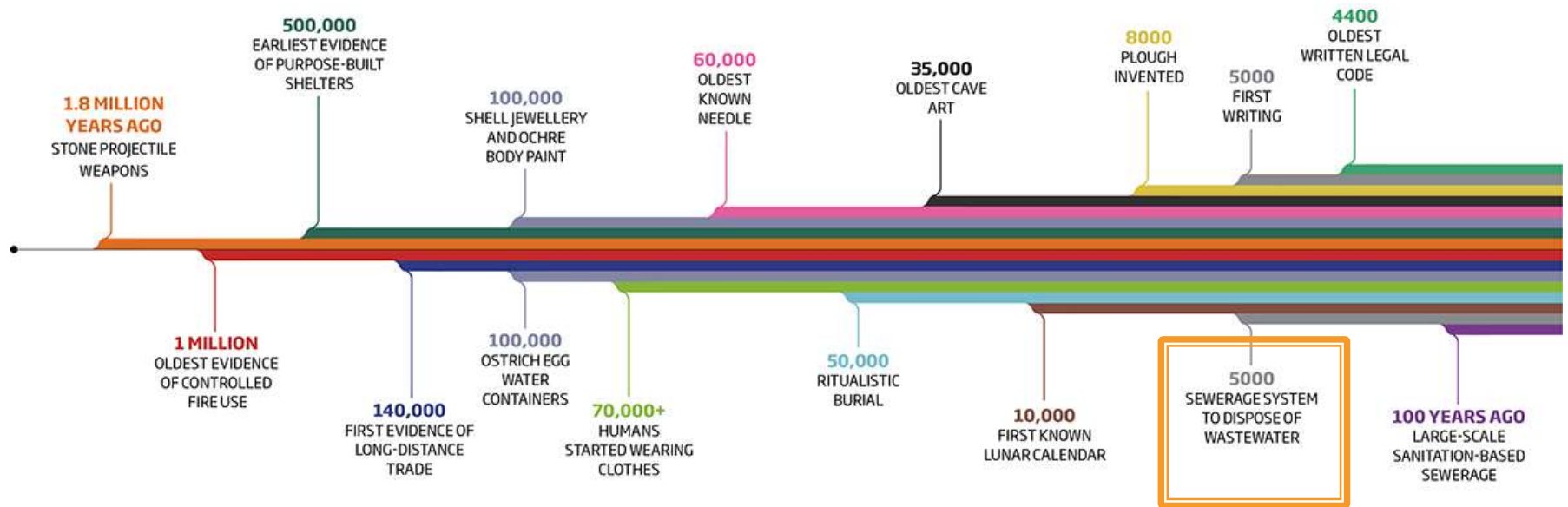
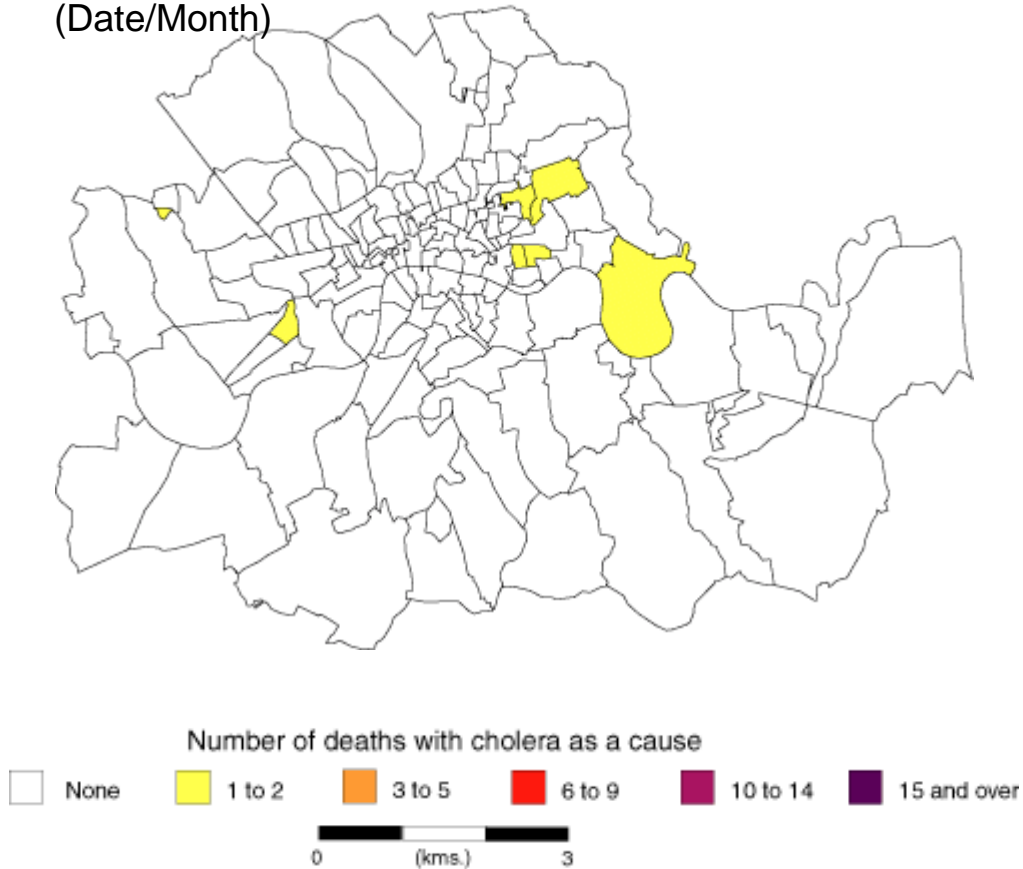


Figure from NewScientist.com

1854 Broad Street cholera outbreak

19/7 to 26/7
(Date/Month)



John Snow (1813 – 1858)

Figure from UNESCO

The Broad Street pump and cholera

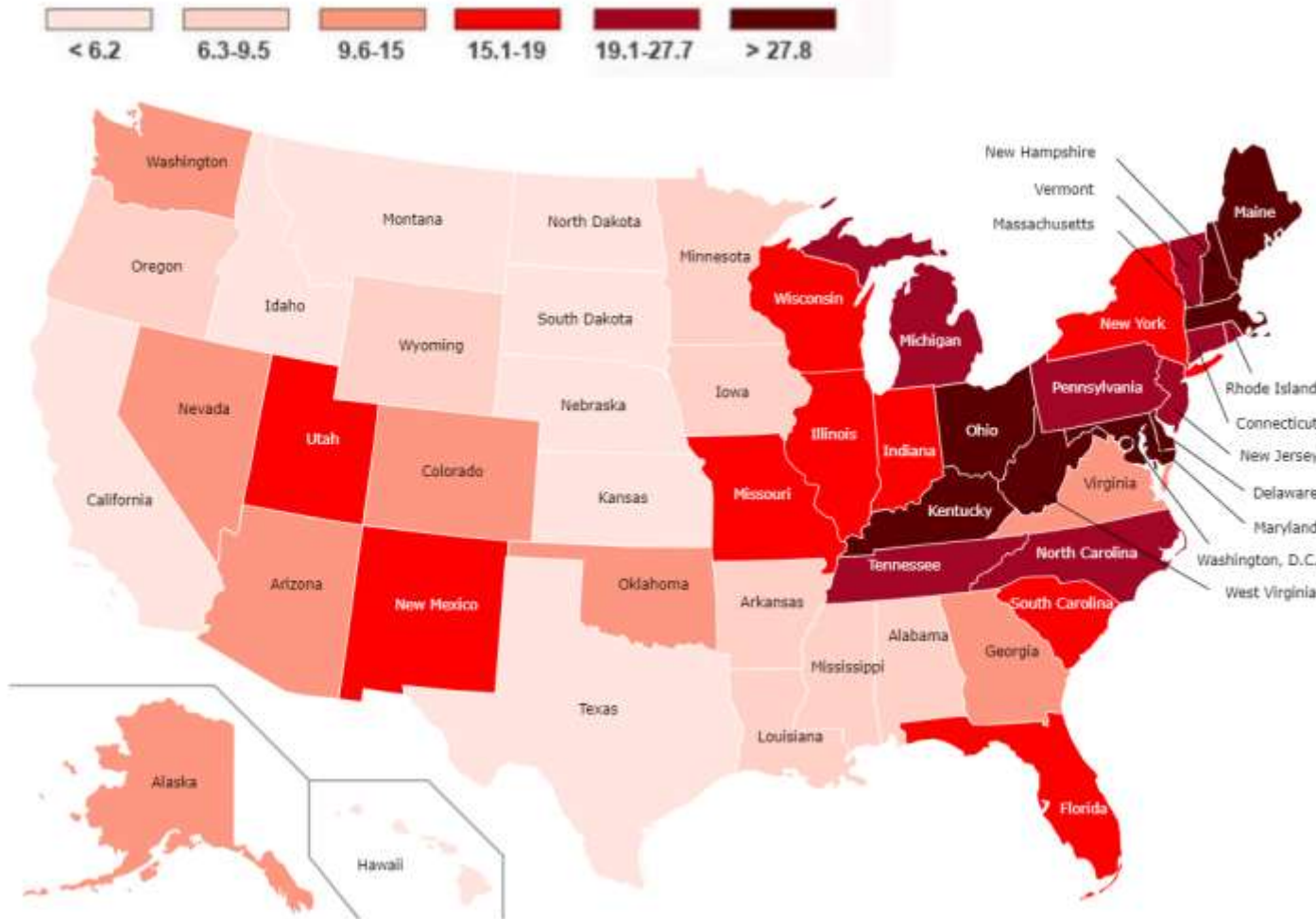


Lessons learned:

- Geographic precision in data → targeting of needs + causes of disease → resource allocation + prevention
- Combining different types of information and different methods

Misuse of opioids is a serious national crisis

2017 Opioid-Related Overdose Death Rates (per 100,000 people)¹



Overdose deaths
(>130/day)

Spread
(rural & urban)

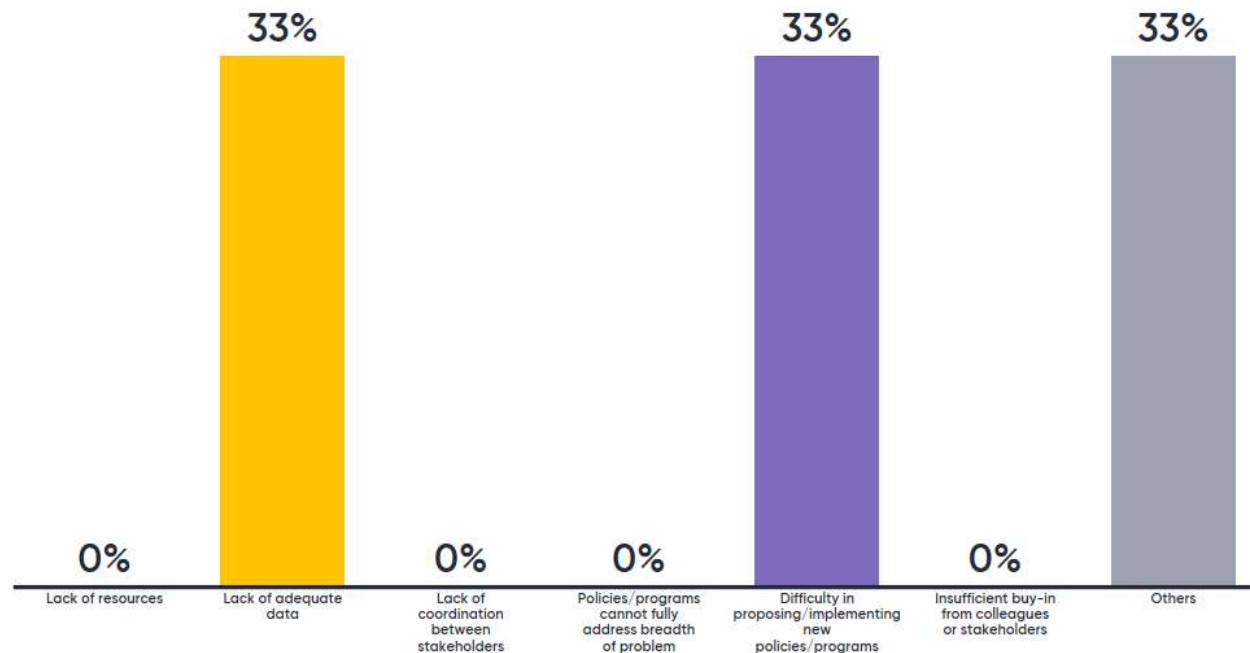
Cost
(\$78B)

¹ Source: Centers for Disease Control and Prevention, CDC WONDER.

Go to www.menti.com and use the code 36 49 65

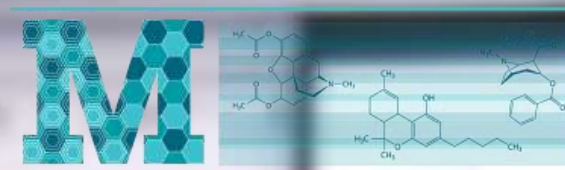
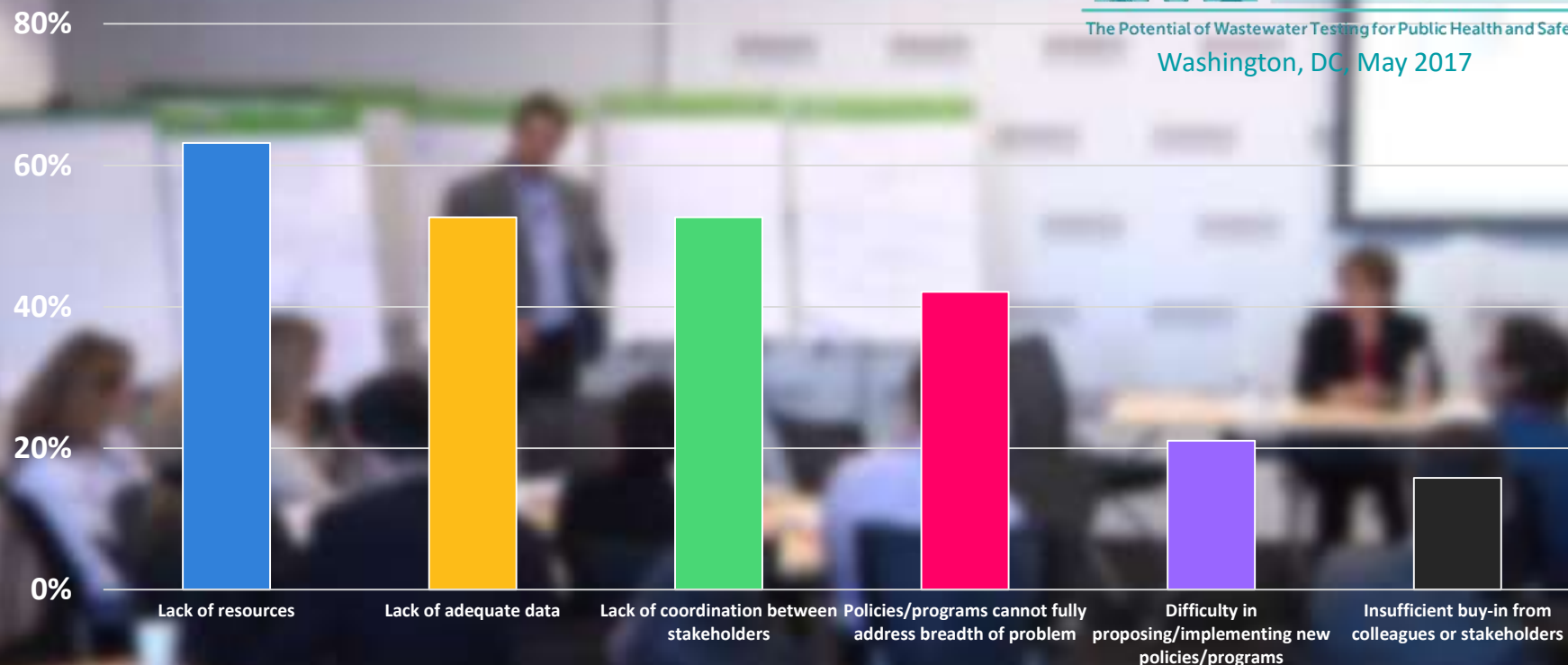
 Mentimeter

In your opinion, what are the most critical challenges to address the opioid crisis?



Show image

“Most critical needs” answered by symposium participants



The Potential of Wastewater Testing for Public Health and Safety
Washington, DC, May 2017

Source: “Most critical needs” answered by participants in the Wastewater Symposium hosted by Mathematica in May 2017.

Limitations of traditional drug surveillance



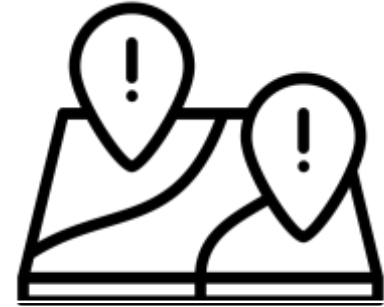
Population surveys

1-2 year lags
Geographically
limited
Underreporting



Healthcare data

“Consequence”
data
Miss those outside
healthcare system

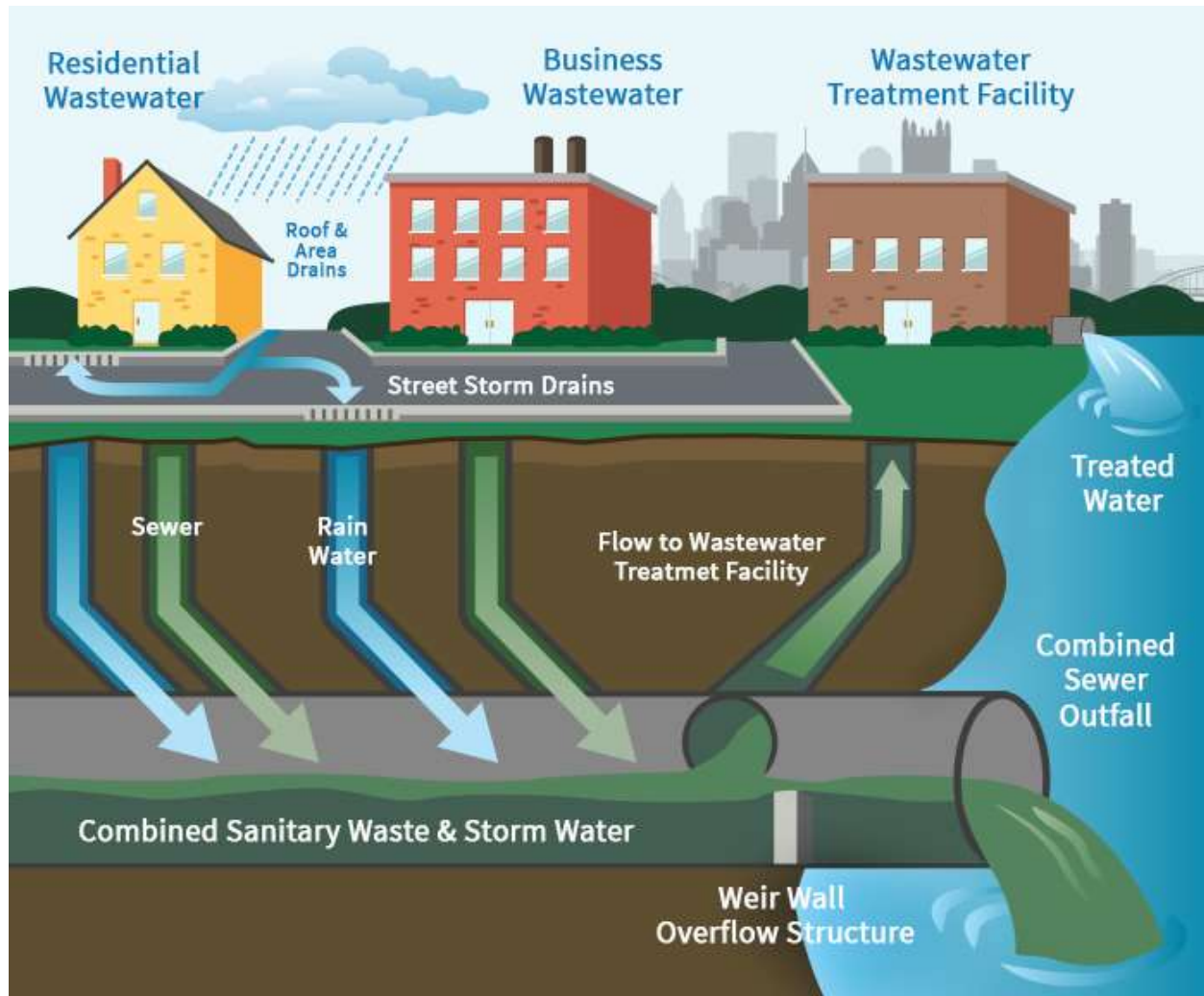


Crime statistics

↑ crime or
↑ policing?
Few “events”

Icons from Noun Project.

Overview of wastewater testing



- Covers 81% of households
- Environmental Protection Agency-mandates testing for 90+ contaminants
- Identity-blind (aligns ~ county)
- Compound-specific (panel of 1-2 dozen drugs)

The mechanisms of wastewater testing

SAMPLING

- Metabolite vs parent compound
- 24-hour composite

CHEMICAL ANALYSIS

- Analyzed right away
- Frozen for later

BACK-CALCULATIONS

- Mass of compound per 1,000 people
- Metabolic factors
- Population estimates

DETECTION

Difficult / Unreliable

Inconsistent

Reliable / Easy

Fentanyl

Heroin

Cannabis

Rx opioids

Cocaine, Ecstasy,
Methamphetamine,
Amphetamine

Benefits and uses



Snapshots of drugs being used

- Provide an early warning for new drug threats



Trends in use over time

- Assess effectiveness of new program or policy



Geographic hotspots of use

- Target resources to support those in need



Cost-effective & scalable

- ~\$150 per sample for storage, shipping, & testing
- million + people represented in a single 24-hour sample

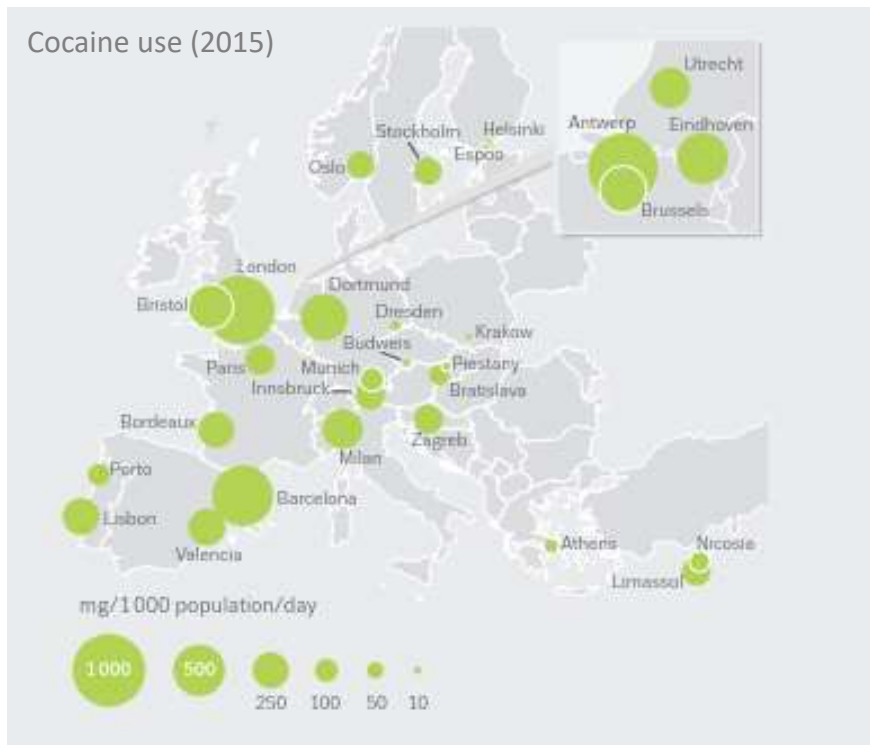
Wastewater-based epidemiology in Europe and Australia



European Monitoring Centre
for Drugs and Drug Addiction

score

Sewage Profiling Project

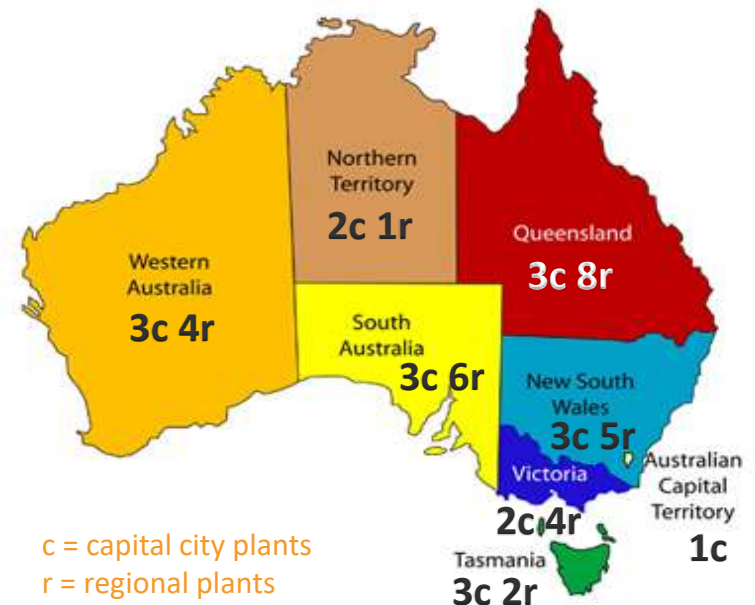


Figures from Liesbeth Vandam (EMCDDA) & Dr. Jochen Mueller (University of Queensland)



AUSTRALIAN
CRIMINAL
INTELLIGENCE
COMMISSION

National Drug Wastewater Monitoring Program



Wastewater studies are still catching on in the U.S.



Marijuana Legalization Impact

Washington

WHO Puget Sound University & University of WA

DATA Wastewater estimates + Retail sales data to estimate size of black market
(Illicit use = Total use – Legal use)



Drug Use vs. Demographics

Northeast

WHO University of Massachusetts, Lowell

DATA Opioids (heroin, fentanyl, methadone, codeine, hydrocodone)
+ Other (cocaine, marijuana, amphetamines, tobacco, alcohol)



Portable Robot Samplers

North Carolina

WHO MIT's Biobot & Town of Cary
(supported by Bloomberg Philanthropies)

DATA Study of opioids in 10 locations (3,000-5,000 people)



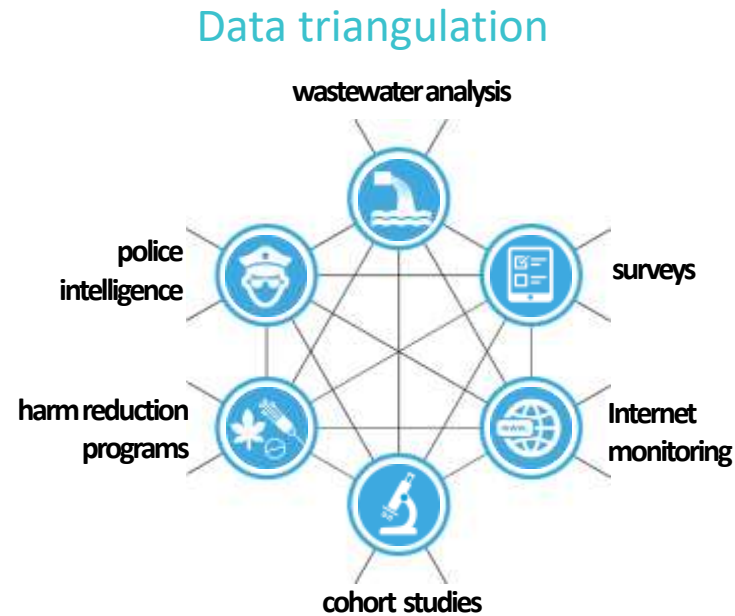
Policy value of wastewater

Wisconsin

WHO **Mathematica Policy Research**
University of Wisconsin
Dane County/Madison Public Health Department
Dane County Narcotics Task Force
Madison Metropolitan Sewerage District

DATA Monthly estimates of ~20 drugs of abuse

Wastewater testing provides a window to study our health



Drug use

- Opioids
- Marijuana

Disease prevalence

- Obesity
- Biomarkers of stress

Pathogen exposure

- Polio & Zika
- Antibiotic resistance

Chemical exposure

- Triclocarban (antibacterial soaps)

Figure from Dr. Frederic Been (University of Antwerp) Text from Dr. Kevin Bisceglia (Hofstra University)

Acknowledgements

- Mathematica
 - Aparna Keshaviah
 - So O’Neil
- Stewards of Change Institute
 - Daniel Stein

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