



Chemical Exposures and Impacts at the Local Public Health Level

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Public Health – Seattle & King County

Overview of today's presentation:



Public Health – dealing with chemical exposures at the local level



Community perspective on chemicals and health



Environmental Justice – thinking about vulnerabilities and sensitive populations



Challenges



Needs



Public Health -Seattle & King County

- Most populated county in WA (over 2.2 million residents)
= Seattle + 38 other incorporated cities
= 2,134 square miles
=13th most populous county in US

Local Health Jurisdiction Perspective



Current focus

- Reducing/eliminating exposures to harmful chemicals
- Local/State Policy to remove exposure risks
- Expensive approach (health, time, funding)



Need to move upstream

Move away from Exposure Reduction as our focus



Ultimate public health goal

**Preventing hazardous chemicals
from entering the market**



Major Gaps in Focusing only on Exposure Reduction

- **Hazard assessment needs more weight –**
 - Not all real-world exposures are accounted for
 - Safer chemicals should be prioritized
- **Cumulative and aggregate impacts – disparities are clear**
 - Regulatory assays may address sensitive life stages to some extent, but should better account for cumulative and aggregate exposures to chemicals and other stressors
- **Classes of chemicals –**
 - local and state regulators are constantly working to understand/prevent exposures to new forms of similar chemicals. More weight on hazard within chemical classes needed
- **Lack of information about what chemicals are in products –**
 - Little to no information on what chemicals are in products sold, used, disposed of locally
- **Many chemicals impact neurodevelopment in our communities –**
 - Can be devastating on a personal level for parents and families exposed
 - Many communities are overburdened and experiencing many exposures to chemicals and other stressors
 - Causal relationships are difficult to establish in hindsight

An Example from King County: Neurodevelopmental Disabilities

Public Health practitioners address developmental disabilities in a broad swath

Not all kids receive referrals for therapies to improve outcomes – **numbers are under-reported**

Most disabilities are life-long

Better prevention of potential causes needed.

Number of Children in Special Education Services under the Individuals with Disabilities Education Act (IDEA) Part B (November 2021)

Diagnostic Category	3-21 yo
Developmental Delays	17217
Emotional/Behavioral Disability	5183
Orthopedic Impairments	364
Health Impairments	28082
Specific Learning Disabilities	45083
Intellectual Disability	4627
Multiple Disabilities	3112
Deafness	293
Hearing Impairments	901
Visual Impairments	438
Deaf-Blindness	20
Communication Disorders	22738
Autism	18390
Traumatic Brain Injury	302
TOTAL WA State 2021	146750
Estimate King County 2021	48,917
Reported King County 2010	30, 641

→ ~8.6%

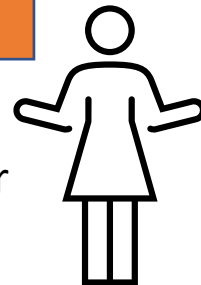
WA State Kids 0-21 years old (2020) = 2,086,685
King County Kids 0-21 years old (2020) = 567,460

Community Perspective

Hazardous Chemical Exposures are Impacting Lives

I appreciated the action that government is doing to clean up some area where is contaminated with chemicals to protect humans, animals, and environment, But I don't feel that the government is doing enough to protect the communities from those harmful chemicals in preventing from it happen in the first place. I feel that the government can do more on chemicals regulations, especially to the manufactures who produce chemicals harmful to the humans, animals, and environment.

Refugee Community Leader



There are so many different chemicals that people are exposed to on a daily basis and the regulation should be more protective for people. Even when a study finds a certain threshold for exposure, I think there should be extra measures taken to protect the community. It is important that any chemicals that are thought to be safer are continually monitored in the event that they cause unexpected harmful effects down the line.



Khmer Community Member

2022 WA State (Health and Ecology Depts) Community Survey on Toxics in Products

95% are concerned
about toxic chemicals in products.



SURVEY SAYS...

Our Safer Products for Washington program asked for community and public input through a survey that closed in January 2022.



Three themes stuck out...

- Remove all toxics from all products.
- More education is needed.
- Consumer products with toxics threaten the environment.

You called for more:

- Outreach to consumers and businesses
- Labeling and transparency in the market
- Enforcement and testing
- Information about safer alternatives

Environmental Justice Perspective on Community Impacts of Chemical Exposures/Effects, Socioeconomics, and Health

Environmental Exposures

- NOx-Diesel Emissions (Annual Tons/Km2)
- Ozone Concentration
- PM2.5 Concentration
- Populations near Heavy Traffic Roadways
- Toxic Releases from Facilities (RSEI Model)

Environmental Effects

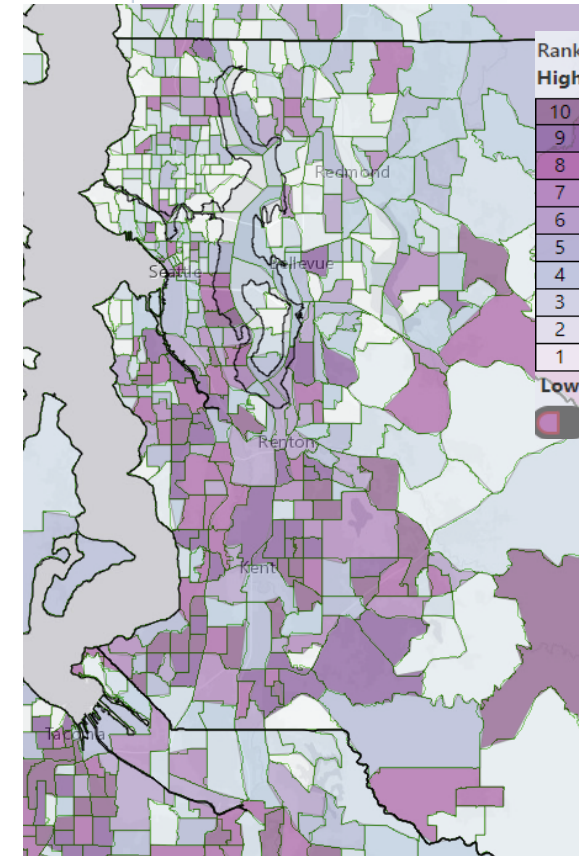
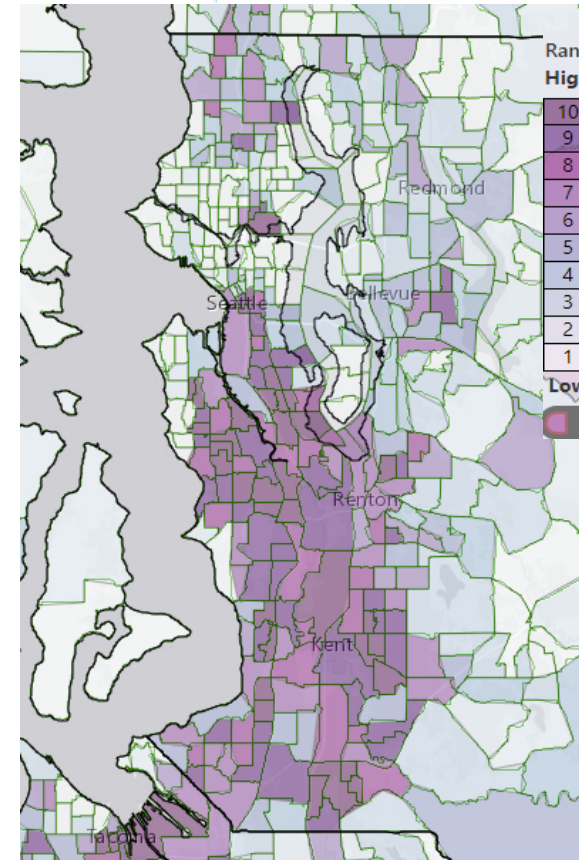
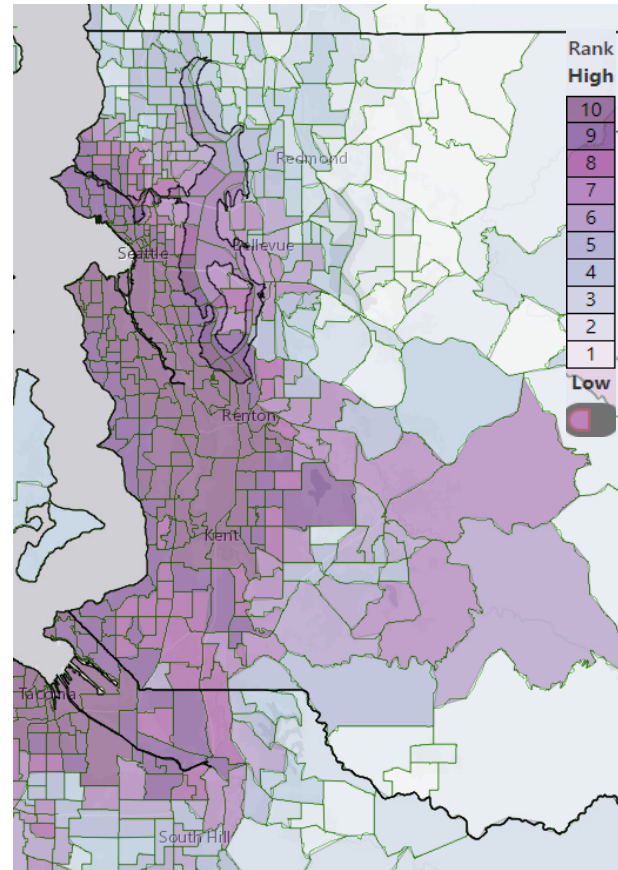
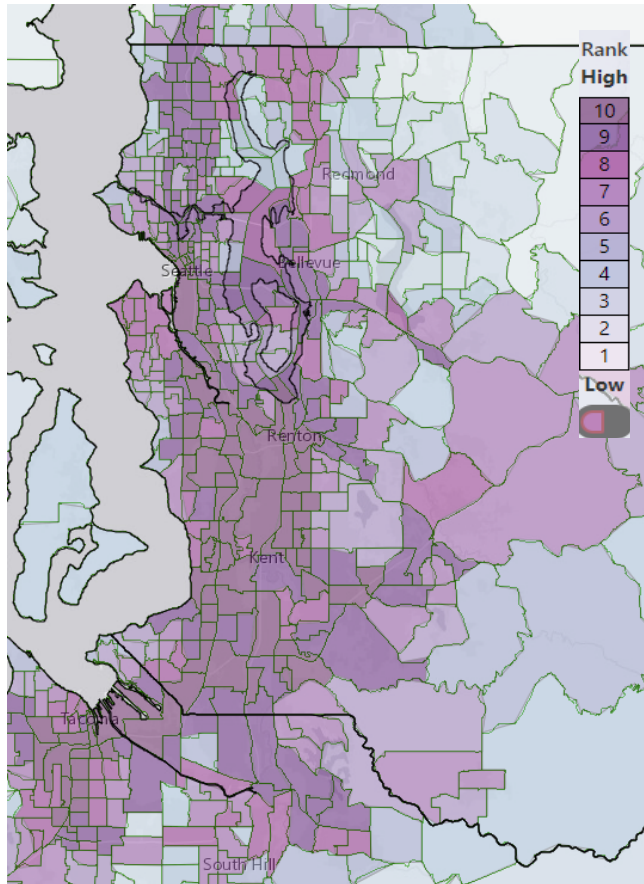
- Lead Risk From Housing (%)
- Proximity to Hazardous Waste Treatment Storage and Disposal Facilities (TSDFs)
- Proximity to National Priorities List Facilities (Superfund Sites)
- Proximity to Risk Management Plan (RMP) Facilities
- Wastewater Discharge

Socioeconomic Factors

- ACS: Limited English (LEP)
- No High School Diploma (%)
- People of Color (Race/Ethnicity)
- Population Living in Poverty <=185% of Federal Poverty Level (%)
- Transportation Expense
- Unaffordable Housing (>30% of Income)
- Unemployed (%)

Sensitive Populations

- Death from Cardiovascular Disease
- Low Birth Weight - Combined (%)



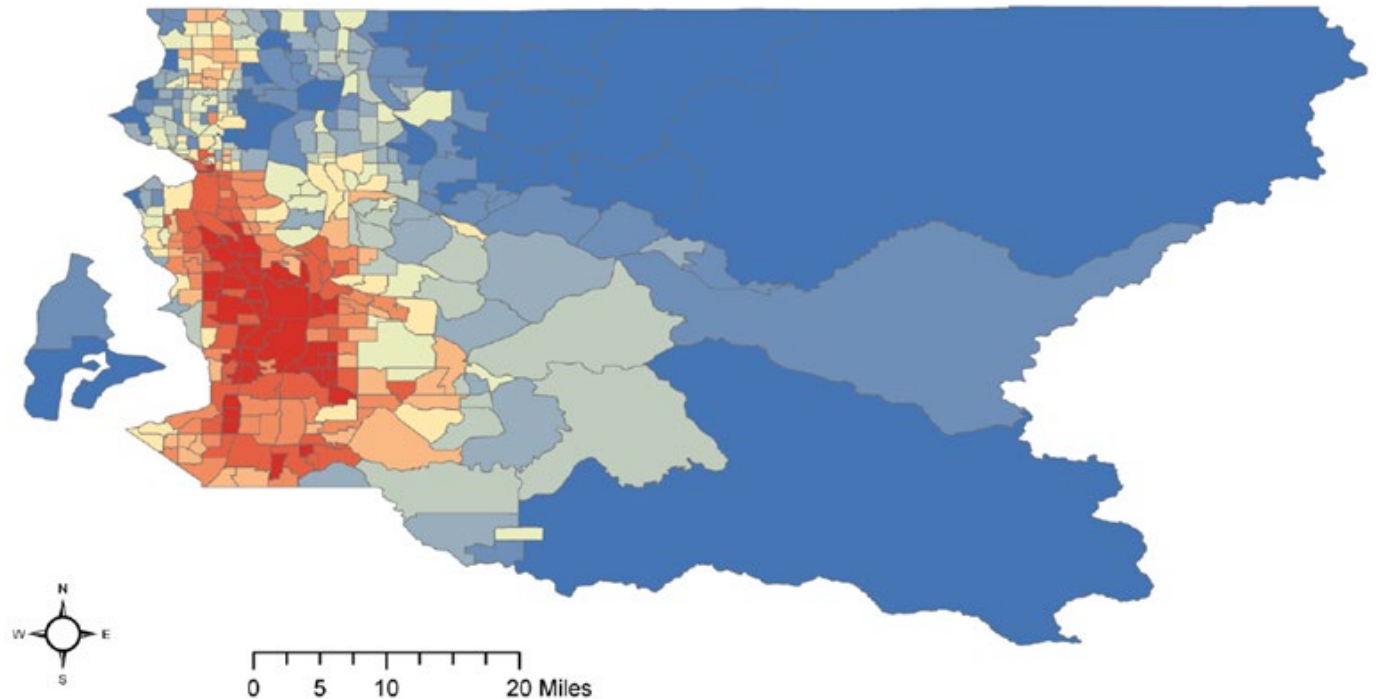
Washington State Department of Health Environmental Health Disparity Map: <https://fortress.wa.gov/doh/wtnibl/WTNIBL/>

Risk = Threat x Vulnerability

Mapping demonstrates disparities across King County

- Uneven burden of exposures fall on communities of color, low-income, refugee and immigrant communities, and sensitive groups
- Not just the case for legacy chemicals
- Cumulative and aggregate exposures and stressors impact individual's response to chemicals – more consideration of hazards needed to limit exposures.
 - Fishers/hunters
 - Imported products
 - Cheaper products
 - 2nd hand goods
 - Small businesses often employing immigrant communities - construction, gardening
 - Occupations with higher chemical exposure risks

King County WA Environmental Health Disparity Map



<https://www.kingcountyhazwastewa.gov/-/media/hazwaste/lhwmp-documents/technical-reports/rsh-developing-enviro-health-disparities-map.pdf>

Environmental Justice Perspective

Community Workshop on Safer Products for Washington



Is there a plan for 2nd hand materials? That is what low-income communities are buying... they should not have to be the repository for items that are more toxic and disposed of when others replace their items for safer ones

It has become a luxury to buy healthy food, have the education, and not be exposed to toxic chemicals. It is a privilege. Our community eats whatever food you can get from the foodbank, puts in the cheapest carpets and replaces them every time you move into a new unit, and use bargain laundry detergent. We don't have the luxury to avoid these chemicals



Community Conclusions



“I thought everything on the market was tested and well-regulated, why isn’t it?”



Better detection of chemical hazards → safer products!



More regulation → prevent non-essential uses of hazardous chemicals in the first place.



Don’t put the burden of avoiding exposures to hazardous chemicals on communities.



Hazardous chemical exposures affect lives → developmental impacts are life-long and require resources and knowledge to address.

More Robust Chemical Assessment Needs

Capturing complex temporal and spatial events is a challenge

- Low dose effects;
- non-monotonic dose responses (NMDR);
- Delayed outcomes and those not obvious until later stages in development;
- Sensitive exposure windows for critical developmental stages;
- Generational and epigenetic effects;
- Imbalances and reactive/feedback changes (e.g. hormone synthesis, transport and metabolism);
- Upstream effects that may indicate adversity;
- Population variability in susceptibility



Analyses of EPA's first 10 Evaluations under amended TSCA

Toxic Substances Control Act (TSCA) Implementation: How the Amended Law Has Failed to Protect Vulnerable Populations from Toxic Chemicals in the United States

Swati D.G. Rayasam, Patricia D. Koman, Daniel A. Axelrad, Tracey J. Woodruff, and Nicholas Chartres*

Cite This: <https://doi.org/10.1021/acs.est.2c02079>

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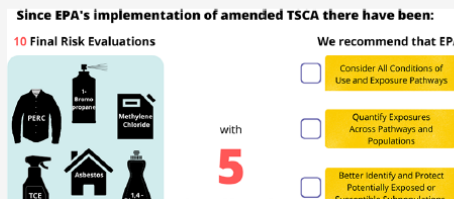
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Metrics & More

Article Recommendations

Supporting Information

ABSTRACT: Exposures to industrial chemicals are widespread and can increase the risk of adverse health effects such as cancer, developmental disorders, respiratory effects, diabetes, and reproductive problems. The amended Toxic Substances Control Act (amended TSCA) requires the U.S. Environmental Protection Agency (EPA) to evaluate risks of chemicals in commerce, account for risk to potentially exposed and susceptible populations, and mitigate risks for chemicals determined to pose an unreasonable risk to human health and the environment. This analysis compares EPA's first 10



Rayasam et al. 2022 (<https://doi.org/10.1021/acs.est.2c02079>)

Commentary

A Section 508-conformant HTML version of this article is available at <https://doi.org/10.1289/EHP9649>.

Charting a Path Forward: Assessing the Science of Chemical Risk Evaluations under the Toxic Substances Control Act in the Context of Recent National Academies Recommendations

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BACKGROUND: In 2016, Congress enacted the Frank R. Lautenberg Chemical Safety for the 21st Century Act ("the Lautenberg Act"), which made major revisions to the main U.S. chemical safety law, the 1976 Toxic Substances Control Act (TSCA). Among other reforms, the Lautenberg Act mandates that the U.S. Environmental Protection Agency (U.S. EPA) conduct comprehensive risk evaluations of chemicals in commerce. The U.S. EPA recently finalized the first set of such chemical risk evaluations.

OBJECTIVES: We examine the first 10 TSCA risk evaluations in relation to risk science recommendations from the National Academies to determine consistency with these recommendations and to identify opportunities to improve future TSCA risk evaluations by further implementing these key approaches and methods.

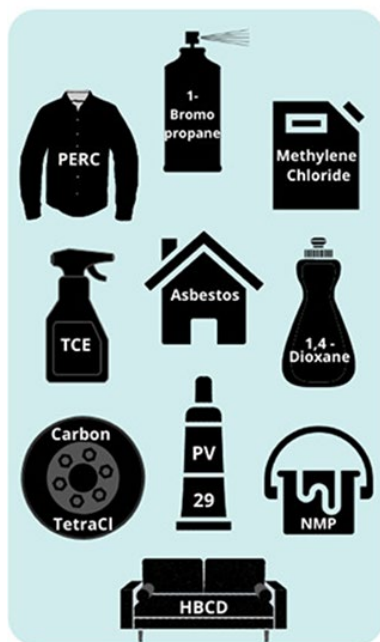
DISCUSSION: Our review of the first set of TSCA risk evaluations identified substantial deviations from best practices in risk assessment, including overly narrow problem formulations and scopes; insufficient characterization of uncertainty in the evidence; inadequate consideration of population variability; lack of consideration of background exposures, combined exposures, and cumulative risk; divergent approaches to dose-response assessment for carcinogens and noncarcinogens; and a flawed approach to systematic review. We believe these deviations result in underestimation of population exposures and health risks. We are hopeful that the agency can use these insights and have provided suggestions to produce chemical risk evaluations aligned with the intent and requirements of the Lautenberg Act and the best available science to better protect health and the environment—including the health of those most vulnerable to chemical exposures. <https://doi.org/10.1289/EHP9649>

McPartland et al. 2022. (<https://doi.org/10.1289/EHP9649>)

Key Findings: Can NAMs Help Address These?

Since EPA's implementation of amended TSCA there have been:

10 Final Risk Evaluations



with

5

major problems where
EPA underestimated
risk and could harm
public health

We recommend that EPA

- Consider All Conditions of Use and Exposure Pathways
- Quantify Exposures Across Pathways and Populations
- Better Identify and Protect Potentially Exposed or Susceptible Subpopulations
- Gather Health and Toxicity Data to Fill Data Gaps
- Use a Valid Systematic Review Method

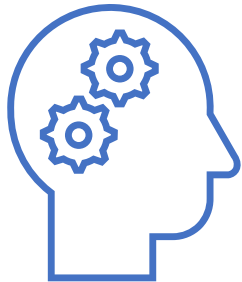
Key recommendations from McPartland et al. 2022

- Obtain more data through TSCA's authority
- Employ probabilistic approaches that consider distributions of uncertainty and variability that can address limitations with uncertainty factors
- Apply cumulative risk (at minimum co-exposures to other relevant chemicals)
- Use established systematic review methods
- Characterize/determine risk based on most sensitive end point

Image source: Rayasam et al. 2022. Toxic Substances Control Act (TSCA) Implementation: How the Amended Law Has Failed to Protect Vulnerable Populations from Toxic Chemicals in the United States. Environ. Sci. Technol. 2022, 56, 17, 11969–11982



How Can NAMs Improve Risk Evaluations



- Ensure NAMs are “scientifically reliable, relevant, and capable of providing information of equivalent or better scientific reliability and quality to that which would be obtained from vertebrate animal testing”
- NAMs cannot represent the biological signaling during development – but could be useful for interpreting and strengthening in vivo data
- Explore ways to organize NAMs and in vivo data using approaches such as key characteristics to highlight strengths and gaps in data streams along with a systematic review approach.

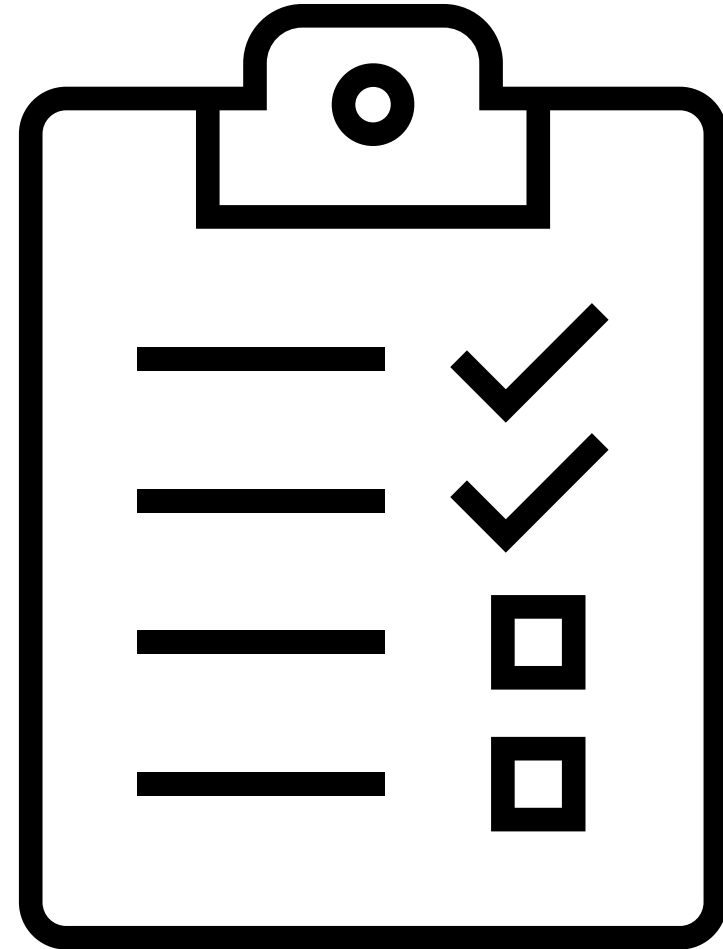


How could NAMs improve Risk Evaluations?

- *Screening to indicate (but not eliminate) hazard;*
- *Upgrading hazard concern/increasing adjustment factor(s);*
- *Evaluating classes of chemicals – to avoid regrettable substitutions;*
- *Evaluating mixtures;*
- *Evaluating cumulative and aggregate exposures to chemicals and stressors;*
- *Informing data gaps, strengthening data (esp for susceptible/vulnerable subpopulations);*
- *Improve estimates of vulnerabilities across population;*
- *Inform in vivo testing and help interpret in vivo data;*
- *Help identify safer alternatives, particularly where little data exist;*
- *Help consider all pathways (legacy, by-products, those regulated under other statutes).*

Can NAMs Improve Use of In Vivo Testing?

- New *in vivo* approaches should be explored
 - Smarter more efficient testing
 - More sensitive endpoints for guideline studies
- Adopt usage of the most protective testing strategies for broad range of endpoints –
 - not solely the traditional guideline study endpoints which miss many developmental stages, sensitivities, real world disease outcomes



Questions to Address...



NAMs

- How to capture complex temporal and spatial events
- How can biological process, hormonal signaling, multi-generational effects be captured?
- How can context dependent features such as tissue, receptor type, and co-factors that may affect hormone signaling be captured?
- How will use of NAMs be validated to demonstrate real world predictability?

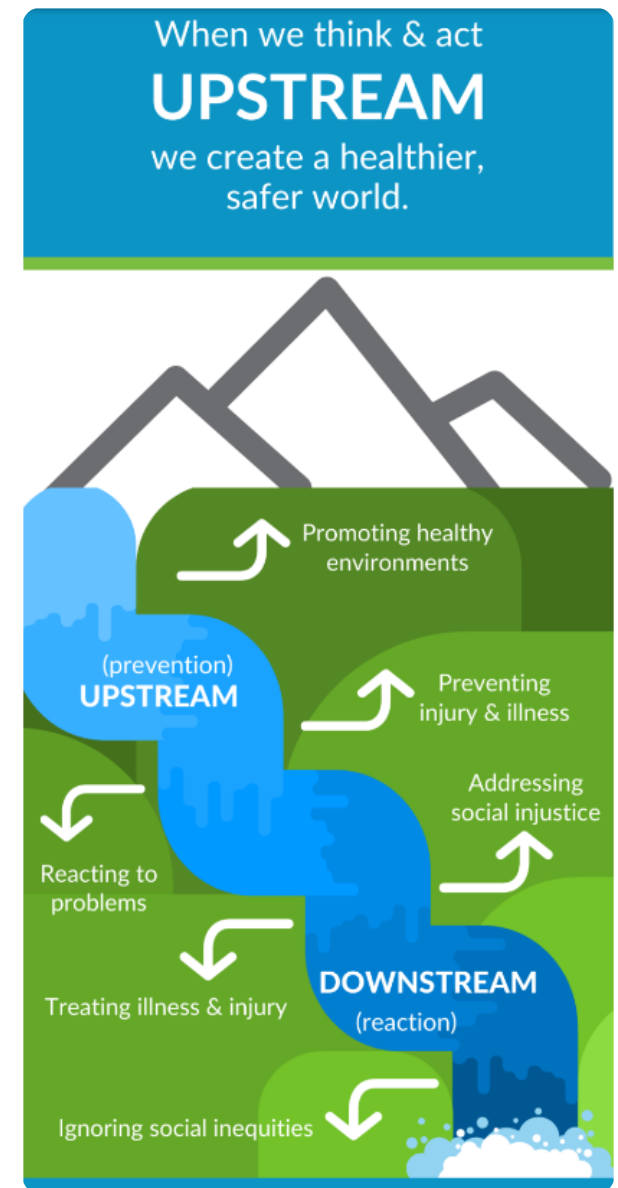
Guideline Studies

- More sensitive endpoints?
- Too much flexibility in how/when to perform an assay? (proprietary info, species selection)
- Are there novel in vivo tests and endpoints that can/should be used?
- Can disease outcomes that track with epidemiology be incorporated?

What needs to change to improve the current paradigm?

Public Health Goals

- Vulnerable and sensitive populations are falling through the cracks
- Use all scientific evidence to take protective action
 - Do not wait for clear evidence of impacts
 - Any indication (epidemiological, toxicological, mechanistic) → regulatory action
 - Paradigm shift in how chemicals are regulated
 - Regulators to err more heavily on the side of caution
 - Required testing for all chemicals on the market
 - Consider environmental health disparities (risk = threat x vulnerability)
- Regulate based on chemical class – avoiding the regrettable substitution cycle
- **Ultimate goal – address exposures upstream before they happen:**
 - **Do not burden individuals with the downstream health impacts and cleanup costs.**
 - **Do not require individuals to know how to avoid exposures on their own!**



<https://bccdcfoundation.org/upstream-101-decoding-public-health/>

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