Welcome to this week's presentation and conversation
hosted by the
Canadian Association for the Club of Rome,
a Club dedicated to intelligent debate and action on global issues.

Improving Environmental Protection and Public Health: opportunities during Canadian legal and policy reform

Our speakers today are physician Dr. Richard van der Jagt and environmental health expert Dr. Meg Sears. Both have been interested for many years in the management of toxic substances in Canada. They will provide a perspective on health risks of environmental toxins and costs to the Canadian taxpayer, illustrating the urgent need to improve environmental public health. Current legal and policy initiatives aim to reform environmental protection and pest control (pesticides) by updating two-decade-old laws. These open up opportunities to improve public and environmental health through modern science-based decision-making, and validation (or not) of "no harm" hypotheses with broader data analyses.

The presentation will be followed by a conversation, questions, and observations from the participants.

CACOR acknowledges that we all benefit from sharing the traditional territories of local Indigenous peoples (First Nations, Métis, and Inuit in Canada) and their descendants.

2022 Aug 10

Zoom #111

Inspired by research. Driven by compassion. Inspiré par la recherche. Guidé par la compassion.

ENVIRONMENTAL PROTECTION AND PUBLIC HEALTH

HOW CAN CANADA IMPROVE?

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AUGUST 10,2022

The Ottawa Hospital RESEARCH INSTITUTE | L'Hôpital d'Ottawa INSTITUT DE RECHERCHE

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OVERVIEW

CONCERNS

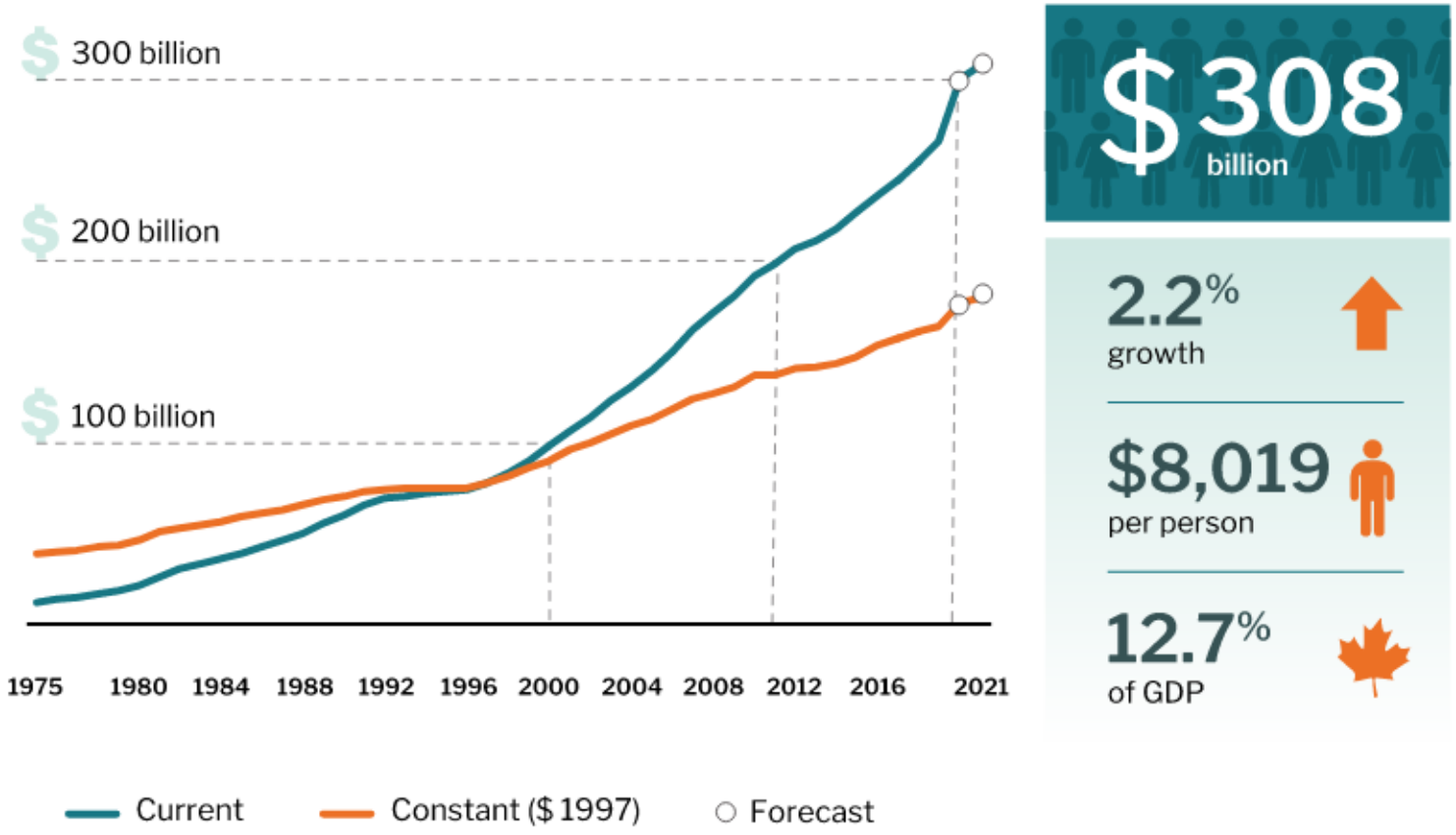
- Escalating healthcare (sick care) costs
- A hematologist's perspective on environmental contributors to disease
- Examples of chemical contributors

PROTECTING HEALTH IN LAW AND POLICY

- Updates on ongoing reforms:
  - *Canadian Environmental Protection Act*
  - Pesticides legislative and regulatory reform
  - Public health protection *hypothesis*

EVIDENCE FOR HEALTH-PROTECTIVE REGULATION

CANADIAN PROJECTED HEALTHCARE SPENDING - 2021



https://www.cihi.ca/en/national-health-expenditure-trends-2021-snapshot

ENVIRONMENTAL CLUES: CLUSTERING OF EXPOSURES REVEALS ENVIRONMENTAL LINKS TO ILL HEALTH

- Dementia and air pollution
- Birth defects in agricultural areas
- Hypothyroidism and water contamination
- Diabetes in northern populations
- Classes of chemicals cause similar diseases

COST OF MYELOMA THERAPY

- Incidence of myeloma has steadily increased ~ 2.5% per year (correlated with obesity, and pesticide use)
- Treatment of multiple myeloma remains a challenge as patients eventually progress through several lines of therapy, requiring use of multiple drug classes
- Average US $34 K per month healthcare costs
- Total treatment costs approx. US $671,000 are attributable mostly to drug and infusion costs
- Symptoms: fatigue, bone pain, kidney problems

Oncol. Ther. 2022
https://link.springer.com/article/10.1007/s40487-022-00198-0

COST OF ACUTE MYELOID LEUKEMIA TREATMENT

- Approximately 1/3 of patients receive only best supportive care. => Premature loss of life
- Three major costs are hospitalization/medical costs, stem cell transplant and cellular therapies, and drugs.
- Single infusion of chimeric antigen receptor Rx may be US $475 K
- Many patients require prolonged maintenance therapy

https://www.dovepress.com/getfile.php?fileID=69103

COST OF LYMPHOMA THERAPY

- Cost of therapy for low grade NHL (first line treatment) is ~US $212 K

https://www.sciencedirect.com/science/article/pii/S0006497118716819

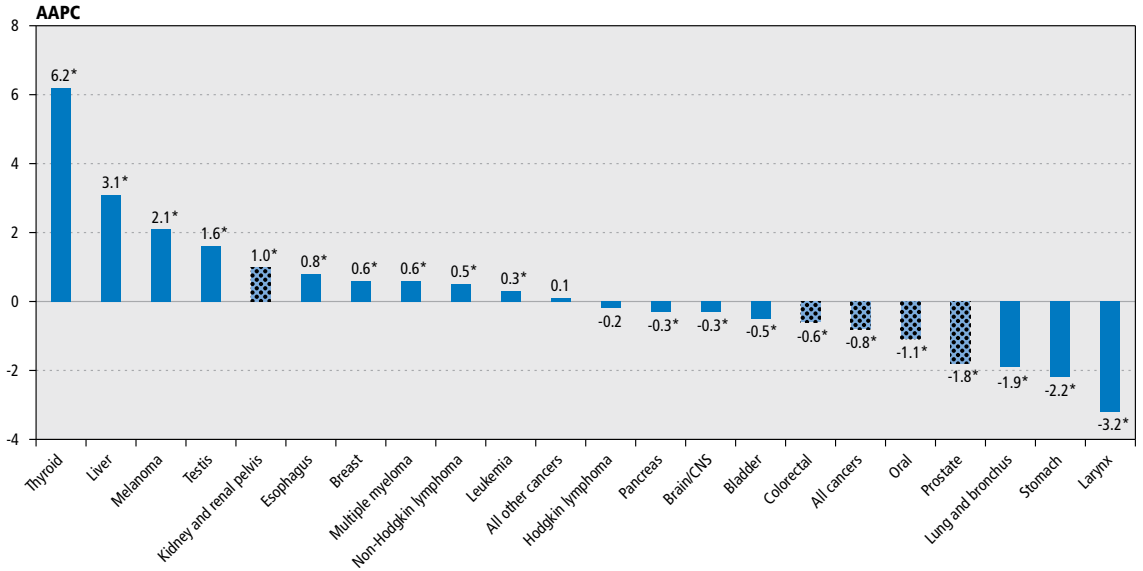
- Although survival is improving, many patients require multiple lines of therapy resulting in costs that can approach US $500K for one infusion of Customized Antigen Receptor Therapy (CART cells), in patients for whom multiple prior therapies failed

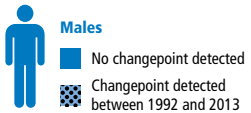
https://onlinelibrary.wiley.com/doi/full/10.1002/ajh.25696

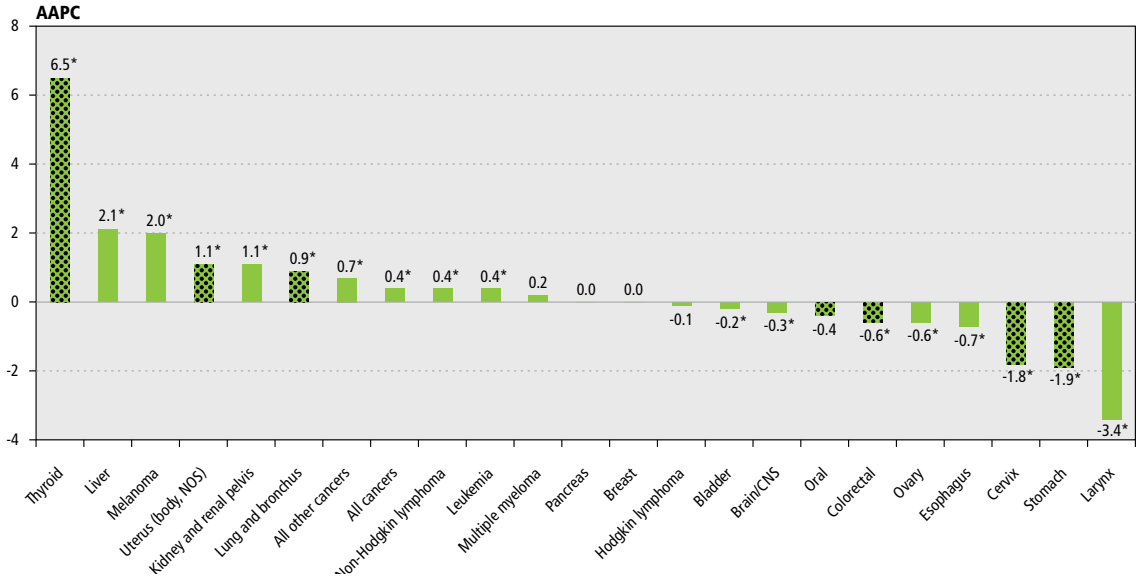
AVERAGE ANNUAL PERCENT CHANGE (AAPC)† IN AGE-STANDARDIZED INCIDENCE RATES (ASIR), BY SEX, CANADA, 1992–2013 (CCS 2017)

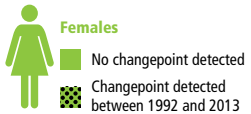
Decreasing: **t**obacco-associated cancers

Increasing: thyroid, liver, melanoma, testis, uterus, kidney/renal, eosophagus, breast, hematological, "all cancers"









ELUSIVE PLAN FOR ONCOLOGISTS TO BE OBSOLETE

- Personally witnessed increasing incidence of malignancies
- Veterans Affairs requested reviews of patients exposed to “Rainbow Herbicides” at CFB Gagetown. Genotoxins caused nHL and other diseases recognized for disability in USA. https://www.va.gov/disability/eligibility/hazardous-materials-exposure/agent-orange/
- Firefighters exposed to combustion products, and flame retardants

Drive for change, from developing new therapies to a new paradigm

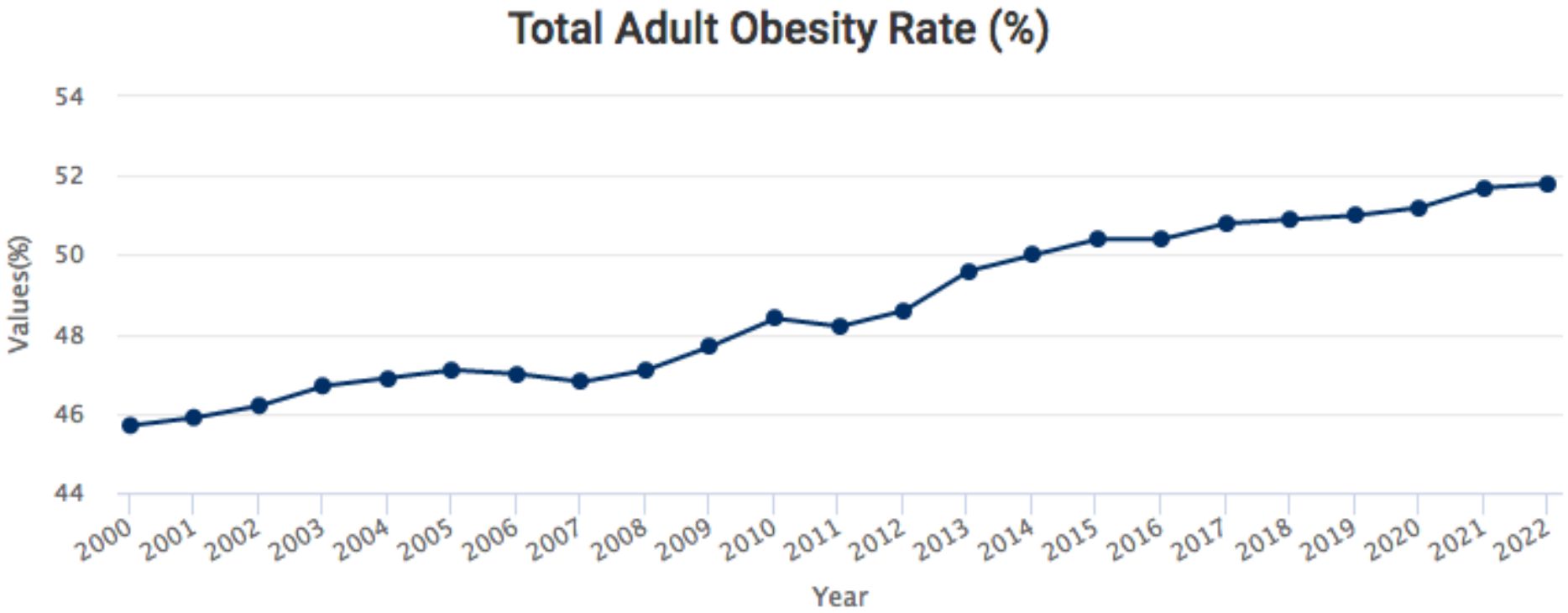
=> protect public health & prevent disease

CANADIAN ADULT OBESITY; INCREASING "OBESOGENS"

Obesity is the leading condition correlated with preventable early death

https://worldpopulationreview.com/country-rankings/most-obesecountries

Many endocrine disrupting chemicals in products are "obesogens"

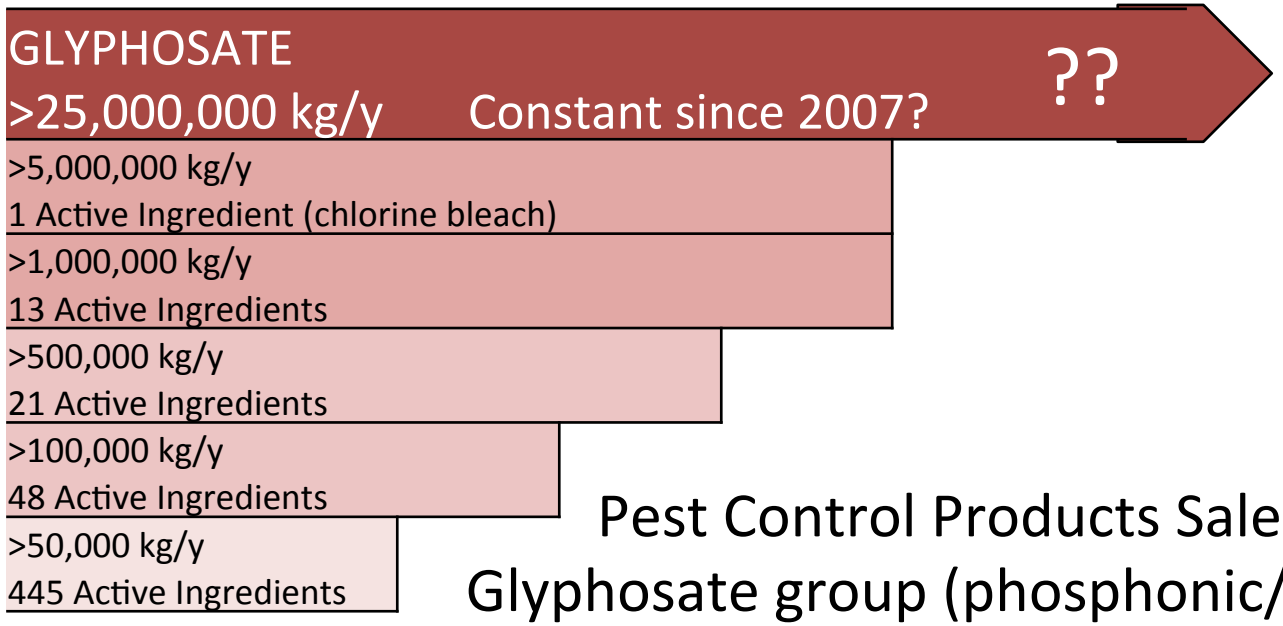


https://www.ibisworld.com/ca/bed/adult-obesity-rate/15005/

PESTICIDE EXAMPLE: GLYPHOSATE

- Bayer paying >US $10 B to settle ~95,000 claims following litigation linking glyphosate and non-Hodgkin's lymphoma
- Current assessments rely on animal studies conducted decades ago, that were not interpreted rigorously. https://doi.org/10.1186/s12940-020-00574-1
- Court-disclosed "Monsanto papers" highlight industry pressure on the regulators (US EPA) and scientific misconduct.

Annual Pesticide Sales (2007 – on)



Pest Control Products Sales Reports (PMRA)
Glyphosate group (phosphonic/phosphinic acids)
49,000,000 kg/y in 2016

Glyphosate use in USA increased approx. 100-fold since mid-70s (Vandenberg *et al.* 2017. *J Epidemiol Community Health*)

GLYPHOSATE CONTINUED – REGISTRATION CHALLENGES

Urgently needed:

1. human biomonitoring;
2. prioritization of glyphosate and GBHs for state-of-the-art hazard assessments;
3. epidemiological studies, especially of agricultural workers, pregnant women and their children; and
4. evaluations of commercial GBH formulations – mixtures can have effects not predicted by studying glyphosate alone.

(Vandenberg L, et al: Jech.bmj.com/content/71/6/613)

GLYPHOSATE CONTINUED

- Glyphosate found in 80% of children's food samples https://environmentaldefence.ca/report/whats-in-your-lunch/
- Glyphosate based herbicides cause testicular damage resulting in male reproductive toxicity, and changes gut commensal microbiome https://sciencedirect.com/science/article/abs/pii/S0048969721054450
- Glyphosate detected in urine of 1885/2310 (82%) of participants in the US National Health and Nutrition Examination Survey. https://wwwn.cdc.gov/Nchs/Nhanes/2013-2014/SSGLYP_H.htm
- ***No data on glyphosate in Canadians*** – continues to be planned for "the next" Canadian Health Measures Survey

CHEMICAL EXAMPLE:
PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS)

- ~9000 chemicals
- Ubiquitous - found in tap water, food packaging, textiles, cookware, soaps and cosmetics, fire-fighting foams (enters groundwater – military and airport uses)

https://www.niehs.nih.gov/health/topics/agents/pfc/index.cfm

- PFAS attributable costs of US $5.52 B for five primary diseases (upper limit US $62.6 B)

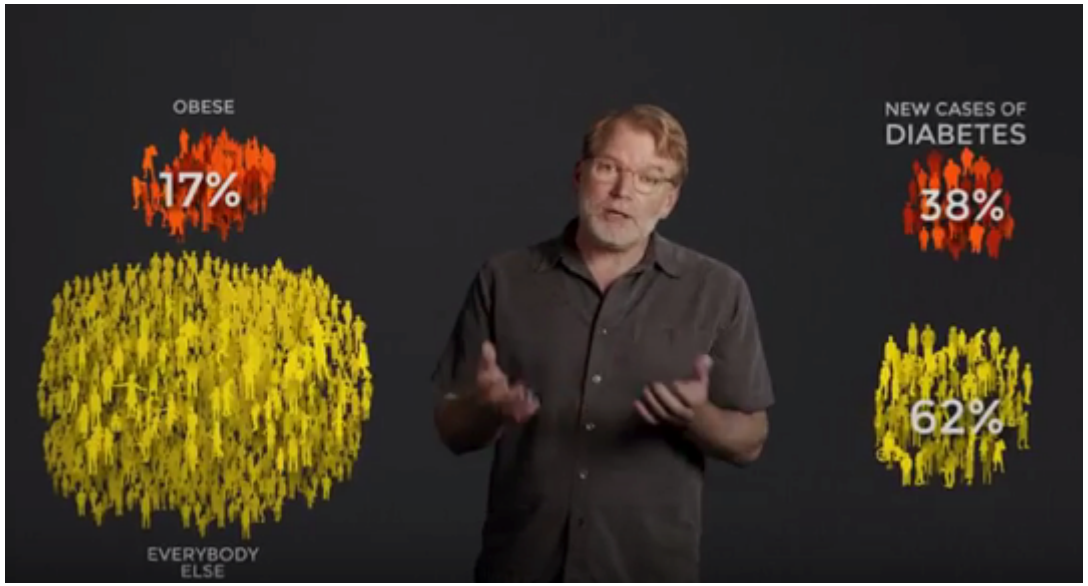
https://link.springer.com/article/10.1007/s12403-022-00496-y

- Conditions include high cholesterol, ulcerative colitis, kidney, breast and testicular cancer, thyroid disease, impaired immune function, low birthweight, childhood obesity, type 2 DM, gestational diabetes, endometriosis, polycystic ovarian syndrome, infertility

TO PREVENT DISEASE, ADDRESS POPULATION-WIDE, UNDERLYING CONTRIBUTORS

EXAMPLE: 95% of health care dollars are dedicated to treatment.
5% or less are dedicated to prevention.

Prevention Paradox: e.g. tackling obesity to reduce diabetes will not address 62% of new cases, that are in normal weight Canadians.



See “The Prevention Paradox” with Dr. Bruce Lanphear
https://www.youtube.com/watch?v=Rx6HljDFqlQ

TOXIC CHEMICAL LAWS – PESTICIDES AND OTHER CHEMICALS

Pesticides and other chemicals are regulated under separate laws in Canada. *Both* are presently under review:

1. Pest Management Regulatory Agency – PMRA – "Transformation"
   Pest Control Products Act, regulations, practices
2. Bill S-5: Strengthening the *Canadian Environmental Protection Act* (passed from the Senate to the House of Commons, June 2022)

In the USA and the EU these are covered by a single agency

CHEMICALS REFORM – OVERARCHING ISSUES

Chemicals inventory is unmanageable.

We're exceeding planetary boundaries for novel resource extraction, manufacturing, chemicals use and disposal

- Outstripping capacity for assessment and monitoring
- Complicated by persistence of many substances.

https://doi.org/10.1021/acs.est.1c04158

The EU aims to reduce numbers of substances in commerce:

- Restrict *classes* of substances – e.g., PFAS, bisphenols, certain types of pesticides
- Halve the number and quantities of pesticides by 2030

Canada has not announced such ambition; still registering probably-toxic chemicals

CONSIDERATION OF ENVIRONMENTAL AND HUMAN HEALTH

of course, these are intimately related

Right to a Healthy Environment was introduced in CEPA preamble, but it is qualified and not operationalized.

Endocrine disruption has been listed since 2007 for study under CEPA – still not considered a toxic trait

- A subset – reproductive and developmental effects – is considered under CEPA and PCPA
  - Many effects such as obesity, dysbiosis are discounted as not "adverse"
  - Other receptors associated with chemical sensitivities are not mentioned

https://www.degruyter.com/document/doi/10.1515/reveh-2021-0043/html

Peer-reviewed academic research usually not incorporated.

SPATIAL, OCCUPATIONAL, SES, TRENDS AND EFFECTS

High dose research doesn't predict low dose effects, or vice versa

Hormonally active / endocrine-disrupting chemicals (EDCs) in pesticides, plastics, household and personal products, cleaners, foods, long-standing pollution and toxic sites …

- Test at low and environmentally relevant doses
- New, rapid lab tests and computer models

SOME PESTICIDES CONCERNS DURING "TRANSFORMATION"

Litigation reveals intimate relationships with industry – results?

1. PMRA PITCH

- International "harmonization" to highest common residue limits in foods => remove importation trade barriers

THE CATCH

- High contamination with pesticides and toxic metals in Canadian commodities results in EU rejection

2. GMO PROPOSAL

- Canada proposing not to require scrutiny and tracking of gene-edited plants (often pesticide-resistant)
- **This threatens the organic sector, as gene-edited commodities are forbidden, will be hidden, with unknown long term effects**

BILL S-5: *CANADIAN ENVIRONMENTAL PROTECTION ACT* (1999)

IMPROVING CHEMICALS MANAGEMENT

1. **Accelerate slow and piece-meal action to achieve optimum (least-toxic) solutions:**
   a) Assess *need* (termed "essentiality" in the EU)
   b) Include a "climate lens"
   c) Acting on groups (classes) of chemicals
   d) Functional substitution
2. **Establish scientific capabilities to link exposures with human and environmental health.**

IT IS NOT JUST CHEMICALS – ALSO NOVEL RADIATION

- Telecommunications radiofrequency radiation is 1,000,000,000,000,000,000 (a quintillion) times natural background levels (2018)
- Strong evidence of environmental harms as well as human health effects – e.g., tree damage, insects and birds "get lost." Insects damaged at frequencies with wavelengths similar to body size
- This radiation can magnify chemical toxicities
- Standards are to prevent excessive tissue heating in humans
- Fibre/cable is safer, faster, more resilient and secure

https://preventcancernow.ca/canada-has-no-due-process-in-law-to-assess-and-regulate-wireless-radiation/

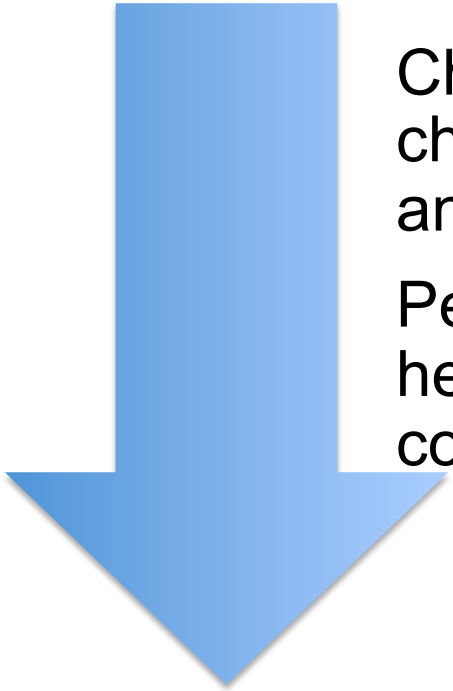
FOLLOWING SCIENCE – NUMBERS RICH, BUT DATA POOR

- Little if any systematic review in environmental health
- E.g., Lyme framework was missing *all* publications from Canada's foremost tick / *Borrelia* researcher
- Data (e.g., water contamination) missing from pesticide assessments
- Substances in commerce not screened in a precautionary manner (i.e., require proof of harm *before action*)
- Data not FAIRER. E.g., near-illegible industry data on scanned hand-written forms – e.g. AB air, water, soil quality; Ontario golf course pesticide data in pdfs, jpegs

… and much more

We can do better!

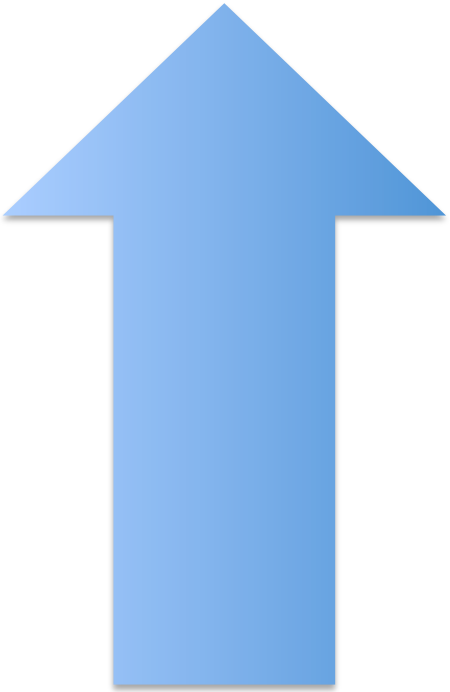
EVIDENCE TO STEER REGULATORY ACTIONS, AND RE-ACTIONS



Child-onset and chronic disease, and early death

Personal and health care costs

Prompt responses to accelerating changes, with research, education and regulation



Map exposures

Map and relate health outcomes

Link exposures (beneficial and adverse) to health outcomes

DATA FOR DISEASE PREVENTION

We cannot always say why one particular person got sick, but across a group we can say that more would be healthy, with PREVENTION.

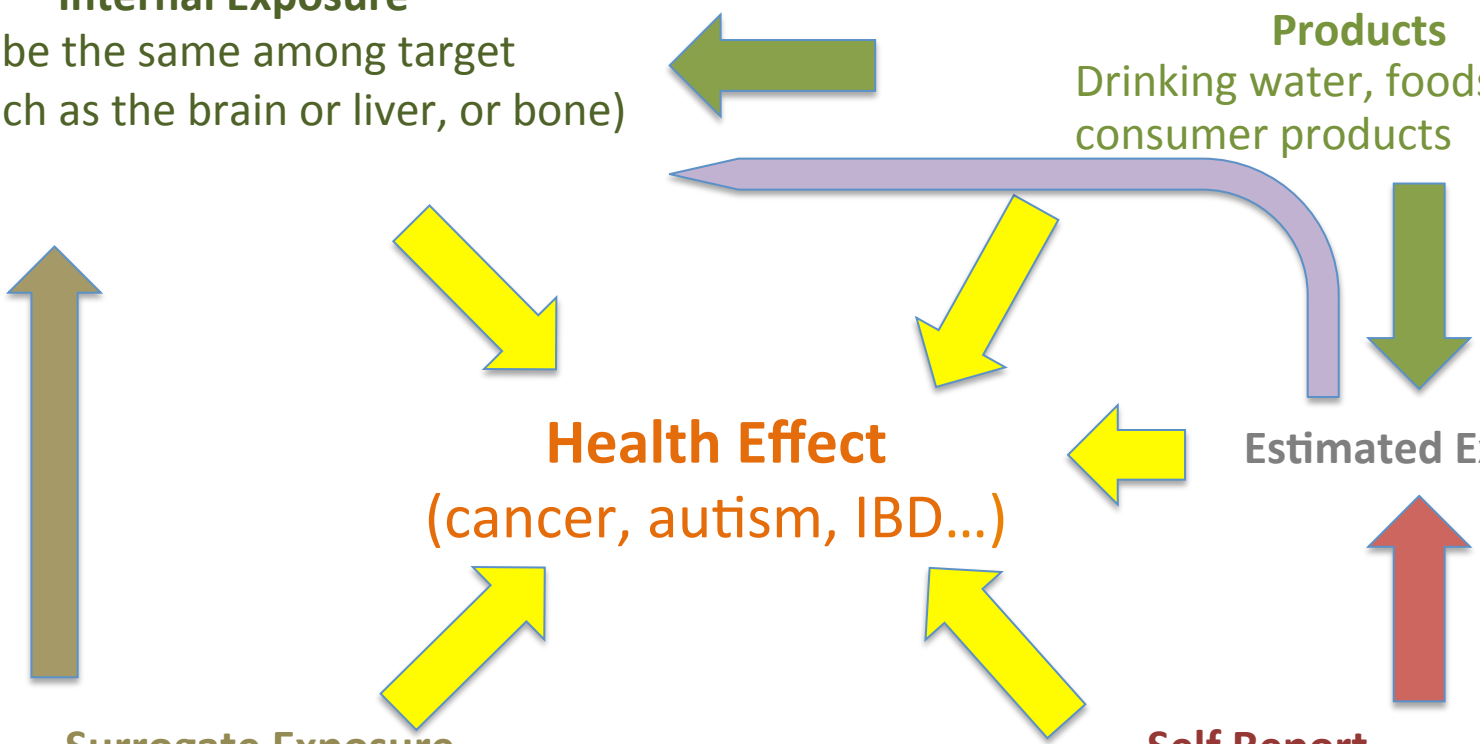
- More and younger Canadians have environmentally linked diseases
- Suffering and heartbreak, costs, lost productivity and healthcare are over-burdening society and health care system
- With extensive data, air pollution is known to be harmful
- ***Missing data?***

"Exposure" information to mesh with health data

SOME STRATEGIES TO RELATE ENVIRONMENT TO HEALTH

Internal Exposure
(may not be the same among target organs such as the brain or liver, or bone)

Levels in Environment, Products
Drinking water, foods, consumer products



Health Effect
(cancer, autism, IBD…)

Estimated Exposure

Surrogate Exposure
Distance from major road
Distance from farm fields
Need additional data – e.g. air quality peaks and averages, pesticide use, water quality

Self Report
e.g. Occupation, Diet, Habits, Product use

Adjust for beneficial factors – exercise, diet, etc.

SOME POSSIBLE NEXT STEPS

1. Formulate stepwise costed plan, with milestones and targets.
2. Together, map out and confirm potential:
   - Collaborators; many expressed written support from across Canada
   - Initial resources / data sources.
3. Proof of principal project (possibilities include):
   - Reconstruct early-century data sources
   - Perfluorinated chemicals in impacted areas (e.g., groundwater west of Ottawa) or workers (e.g., firefighters)
   - Antimicrobial chemicals
   - Groundwater quality – Geological Survey data

Informed by modern methodologies

FOLLOWING HYPOTHESES IN ENVIRONMENTAL HEALTH

1. **Fill "exposure" data gaps** in studies with:
   - Environmental and biomarker data (Including federal "open data")
   - Clinical tool and research on personal exposures.
2. **Electronic Platform** to house environmental exposure data, that can then be linked with health data
   - Environmental exposures (beneficial and adverse; many data sources) – will grow and be updated

AND

- Personal exposure data – e.g. surveys, aggregated data

Export exposure data to secure system (e.g. ICES) for individual level analyses, or sentinel network (CPCSSN) for clinical history

HOW MUCH EVIDENCE IS ENOUGH?

When action awaits proof of human harm, how much harm is done before:

1. Links are researched, then recognized?
2. Actions are taken?

Generations of people are exposed and harmed before a human carcinogen is recognized; longer before it is acted upon.

ETHICS

- PRECAUTION and PREVENTION require a shift to permitting only *least-toxic approaches / best practices*
- Individuals can make *some* personal choices, but education, opportunities and resources are challenging

THANK YOU! …. QUESTIONS?

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