Bridging the evidence-practice divide: The science and policy of bisphenol A

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National Collaborating Centre for Environmental Health
Centre de collaboration nationale en santé environnementale

BC Centre for Disease Control
An Agency of the Provincial Health Services Authority

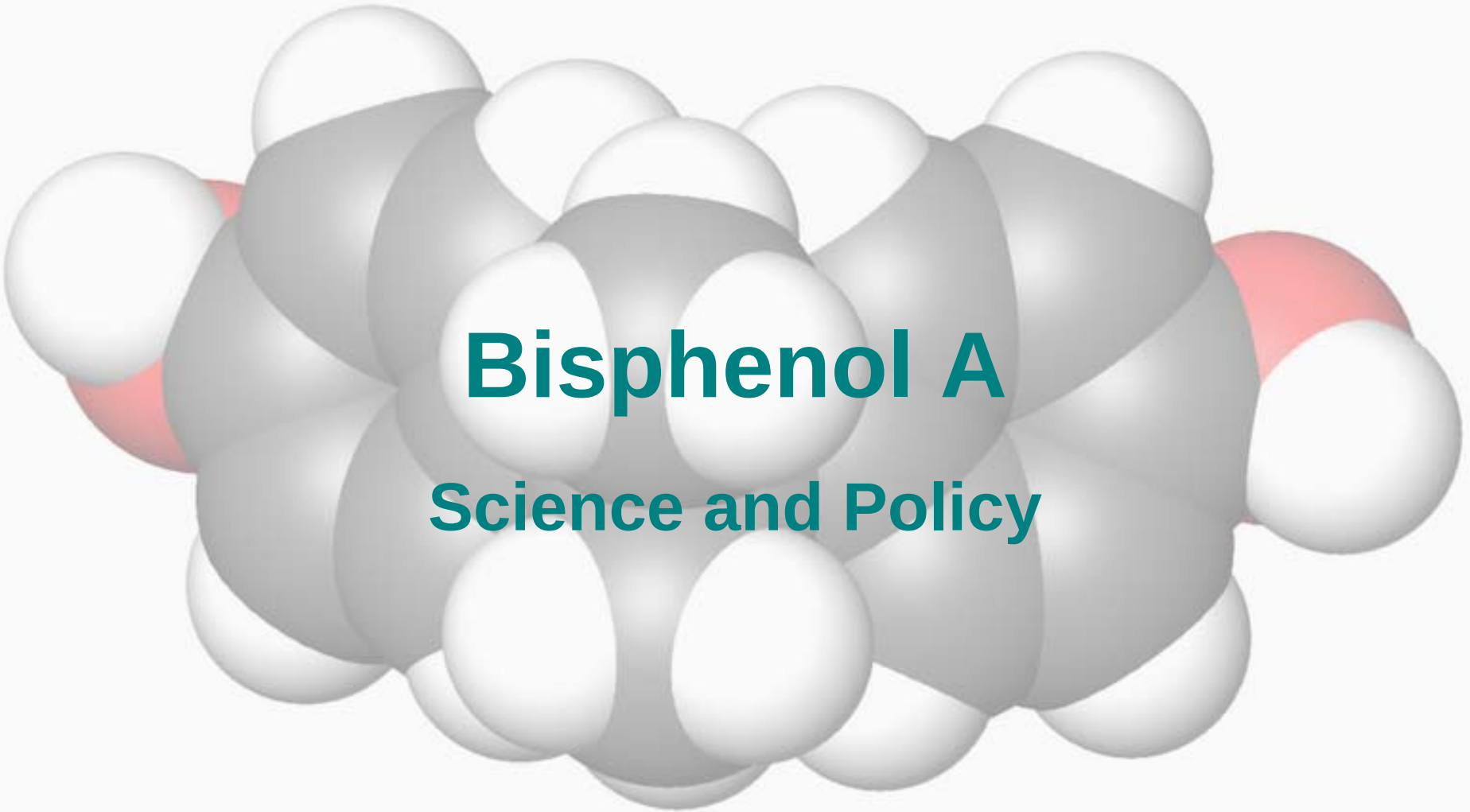
outline

- NCCEH – who we are
- Introduction to bisphenol A
- Health risks
  - Gaps
- Human exposure
  - Vulnerable populations
- Legislation and politics
- Alternatives for action
  - BPA substitutes
- Public health responses

Photo: marktwang@gmail.com

The NCCs

- One of six national collaborating centres
- Funded by the Public Health Agency of Canada (PHAC) – at arm's length
- Each is hosted by a different institution
- Each focuses on a different aspect of public health



Bisphenol A

Science and Policy

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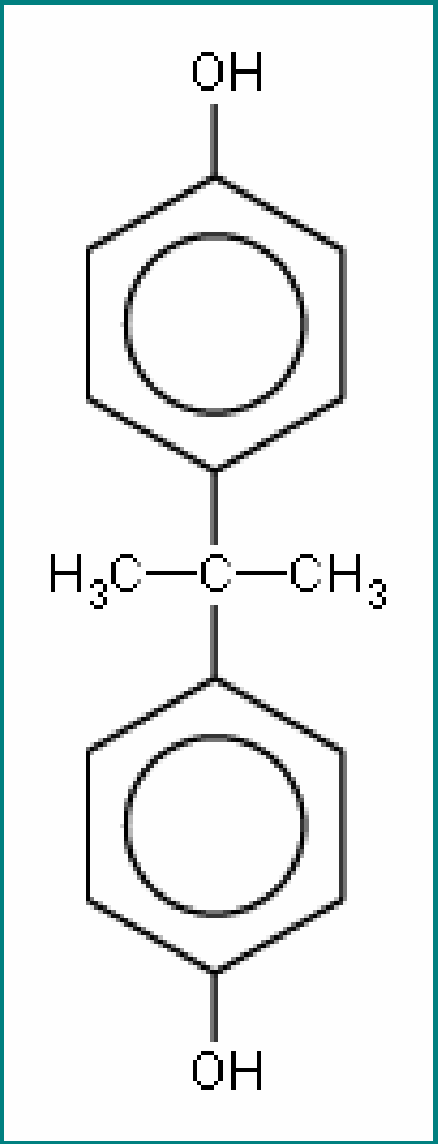
bisphenol A

- Media and policy attention related to potential endocrine disrupting properties
- Lack of consensus on health risks
- Policy makers, practitioners, industry, and consumers must make choices based on uncertain information



bisphenol A

- Hardness + heat resistance + transparency
  - polycarbonate plastics (e.g. water bottles & baby bottles)
  - epoxy resins (e.g. can linings)
  - dental sealants
  - other food contact applications (e.g. plastic wrap, PET bottles)
  - PVC plastics
- Widespread production for >50 yrs
- >2 billion kg produced in 2006

evidence for public health risks

NTP–CERHR Monograph on the Potential Human Reproductive and Developmental Effects of Bisphenol A	
Some concern	•developmental toxicity in foetuses, infants, children (neurobehavioural & prostate effects)
Minimal concern	•developmental toxicity in foetuses, infants, children (mammary gland effects & early female puberty) •reproductive toxicity in occupationally exposed adults
Negligible concern	•reproductive toxicity in adults •foetal/neonatal mortality or birth defects •reduced birth weight and growth

body burden & exposure

Most people carry detectable BPA

Exposure — adults

- EU 2003: <0.02–59 µg/kg/d
- NTP: 0.008–1.5 µg/kg/d

Exposure — infants

- EU 2003:
  0.2 µg/kg/d (breastfed)
  13 µg/kg/d (formula fed from polycarbonate bottles)
- NTP 2008:
  0.2–1 µg/kg/d (breastfed)
  1–11 µg/kg/d (formula fed)

Body burden — adults

- NHANES data, US
  2.6 µg/l urine
  (Range: 0.4–149 µ/l)
  BPA detected in 92.6% of people

Body burden — infants

- NICU patients
  30.3 µg/l (Range: 1.6–946 µg/l)
  BPA detected in ¾ of infants
  >90% conjugated metabolite

routes of exposure

- Food
  - Cans with epoxy resin lining, including baby formula
  - Polycarbonate storage containers, e.g. baby bottles, water bottles, food storage containers
  - Other food contact materials, e.g. paper towels, single-use containers
- Dental composites containing:
  - bisphenol A dimethyl acrylate (bis-DMA)
  - bisphenol A glycidyl methacrylate (bis-GMA)
- Water
  - PVC piping
  - Plastic water bottles

migration

- BPA migrates from food storage containers into food/beverage
- Factors affecting migration:
  - Fat content
  - Temperature
    - Migrates during can processing
  - Caffeine, salt, glucose
  - Repeated use??

Photo: Sun Ladder

infants and bisphenol A

1. Dose – infants consume more food relative to body weight
2. Dose – potentially receive entire diet from canned formula via polycarbonate bottles
3. Metabolism – lower hepatic enzyme activity to convert BPA to glucuronidated metabolite
4. Timing – infancy is key time for neurodevelopmental health risks

research gaps

- Epidemiology & low dose effects
- Mechanism & endpoints of BPA activity
- Data
  - rat strain
  - dosing method
  - analytical methods
- Conflicting conclusions
  - industry *vs* university

Canadian response

- Health Canada
  - April 2008: Initiated process to ban BPA in baby bottles, find alternatives, and list BPA as CEPA toxic
  - May 2008: No recommendations to change behaviour re consumption of canned foods
  - August 2008: No expected health risks from dietary exposure. Risk assessment suggests design flaws in research showing neurodevelopmental and behavioural effect, but indicative of vulnerable population of infants, so ALARA applied

Canadian response

- Health Canada
  - October 2008: 1. Proceeding with ban on importation, sale and advertising of polycarbonate baby bottles containing BPA; 2. Taking action to limit environmental release; 3. $1.7M to research over 3 years
  - 2009: Regulations expected this year

Photo: Health Canada

Canadian response

- Environment Canada
  - March 2008: Agree with Health Canada draft screening assessment on risks
  - CEPA toxic, section 64a (not bioaccumulative but acutely toxic to aquatic organisms)

Photo: Health Canada

international response

US — FDA, NTP

- April 2008: FDA reviewed NTP & Canadian risk assessment and found no need to take action
- Sept 2008 NTP-CERHR: Some concern for developmental neuro-behavioural effects
- FDA feels current exposures are safe but additional research on low dose exposure imp.
- June 2009: FDA will re-examine BPA issue

City/State-level actions

- Minnesota – prohibiting sale of containers with BPA for children <3 as of 1 Jan 2010
- California – bill passed Senate
- NY – bill pending
- Connecticut – bill to ban BPA passed Senate vote, pending re-approval by House
- Chicago – city may ban containers for children

international response

EU — EFSA

- Jan 2007 TDI = 0.5 µg/kg bw
- July 2008: reviewed NTP & Canadian risk assessments and found no reason to change TDI
- Oct 2008: closely monitoring new findings, but no ability to find causal link with chronic illness

BPA alternatives

- Glass/porcelain
- Stainless steel
- BPA-free plastics
  - Acrylic
  - Polystyrene
  - Styrene-acrylonitrile copolymer
  - Polypropylene
  - Polyamide
  - Tritan™ copolyester
- BPA-free can coatings
  - Some non-epoxy coatings approved

chemical substitution

- Polycarbonate plastics are being replaced by BPA-free plastics
- Substitution: effective health protection mechanism IF a known hazard is replaced with a less hazardous known chemical
- Replacing a suspected hazard with an untested substitute MAY be more hazardous
- **Careful design and testing is essential**

questions remain

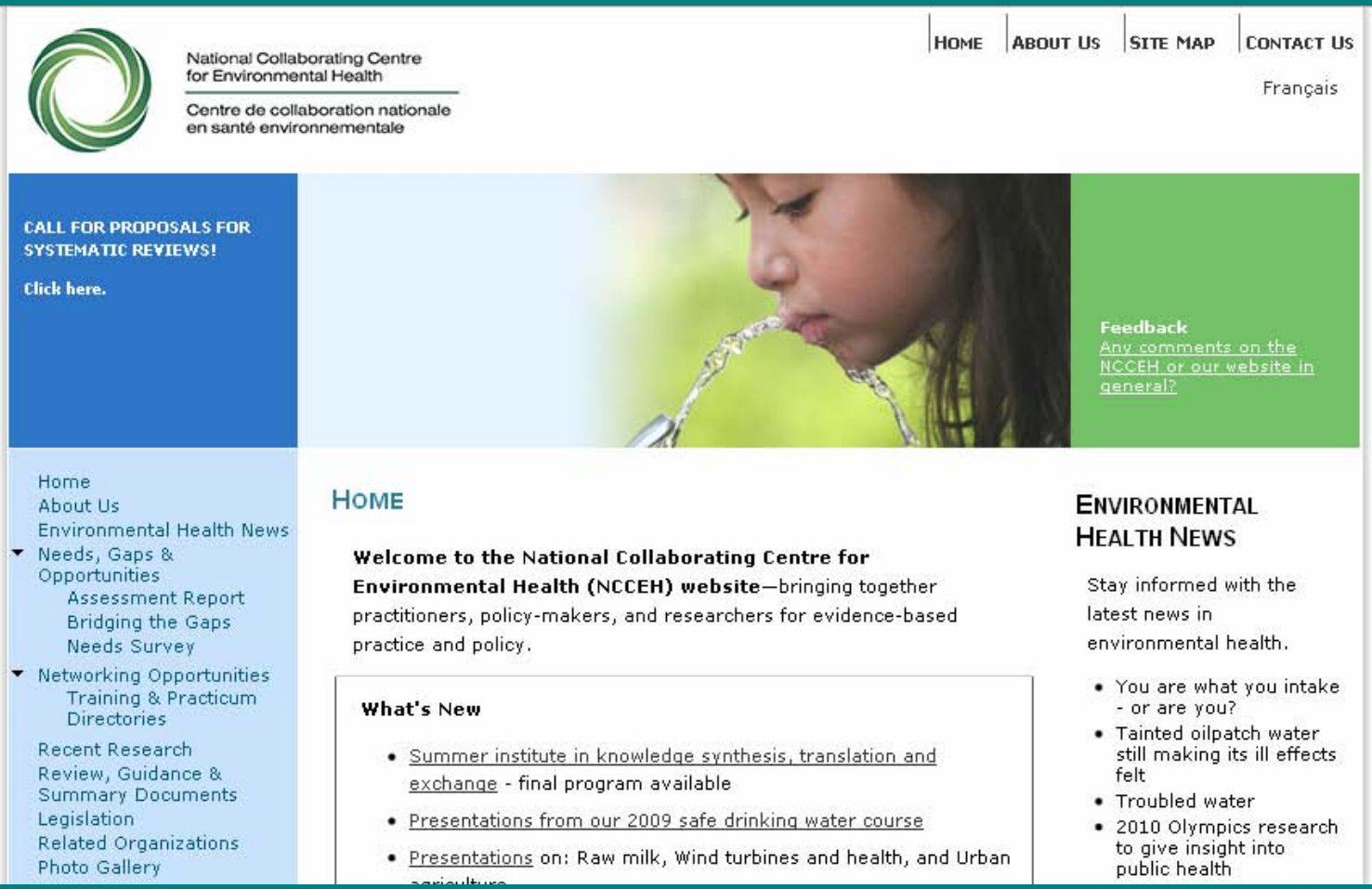
- Research gaps remain
- Exposure control challenging
  - BPA is ubiquitous
  - Non-monotonic dose-response?
- The devil you sort of know…
  - Substitution effects – What's in the new plastic?
  - Efficacy of alternatives to epoxy resins
- New evidence → more questions

it’s not black and white

- Political issue
  - public outrage requires action or explanation
  - science alone does not determine political response
  - health policy = science + politics + economics
- Appropriate public health responses consider:
  - weight of evidence
  - effectiveness of interventions

Photo: Nigel Cox @ Fast Company

www.ncceh.ca www.ccnse.ca



Thank you!

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