First Nations Biomonitoring Initiative (FNBI)

Toronto, ON
February 3-5, 2014
First Nations & Environmental Health

No representative baseline information on the extent of human exposure of First Nation peoples on reserve in regards to environmental contaminants.
What is Biomonitoring?

• Biomonitoring is the measurement of chemicals in the body.
• Usually measured through blood, urine, hair and nail samples or breast milk.
• Lets you assess exposure.
Canadian Health Measures Survey (CHMS)

- National survey being led by Statistics Canada in cooperation with Health Canada and the Public Health Agency of Canada - most comprehensive, direct measures health survey conducted in Canada.
- Designed to represent the Canadian population.
- Collects information on the general health and lifestyle of Canadians through interviews and direct physical measurements.
• Includes a biomonitoring component, where blood and urine samples are collected to provide information on exposure to environmental chemicals.

• *It does not include First Nations people living on reserve.*
What is the First Nations Biomonitoring Initiative (FNBI)?

- Health survey exclusively for adult First Nations living on reserve (south of 60°), to complement the CHMS.
- Partnership between HC (FNIHB) and the Assembly of First Nations (AFN).
- Being led by the AFN.
FNBI

- Two resolutions (2009-2010) – continued support of the FNBI.
- Compliance with Ownership, Control, Access and Possession principles (OCAP)
  - Communities own their data
  - Participant confidentiality
  - Community Research Agreements
  - Consent forms
Goals of the FNBI

- Establish baseline information of environmental chemicals in First Nations peoples living on reserve.
- Compare exposure levels of First Nations to the general Cdn population and track trends over time.
- Promote understanding of biomonitoring, environmental chemicals and how to reduce exposure to these chemicals.
- Prioritize chemicals and future research.
Phases of the Project

1. 2009-2010 Community interest assessment
2. 2009-2011 Study development/planning
3. 2011 Pilot project in 2 communities
4. 2011 Main study in 13 First Nation communities across Canada – sample collection
5. 2012 Data analysis
6. 2012 Reporting back to communities and participants – data delivered to participating FN communities
7. 2013 National Report (overall of 13 FN communities)
FNBI Pilot Project

- A total of 257 participants were surveyed to yield community-level estimates and the pilot was conducted between January 23 – February 23, 2011. The survey was met with much interest and enthusiasm from both communities, and response rates were much better than expected.

- Overall, the pilot scale study was successful in both communities. In the process, however, issues were encountered and had to be overcome.
• Ecozone approach (5)
• 13 FN communities across Canada selected – minimum 2 per ecozone
• Approximately 500 First Nation randomly selected participants – 40 to 45 participants per community
• Criteria for participant selection:
  - First Nation living on reserve
  - 20+ years old
• 97 environmental contaminants
Overall FNBI Results
## Environmental Chemicals Measured

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Exposure Sources</th>
<th>Health Risk/Concerns</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bisphenol-A (BPA)</strong></td>
<td>Plastics, e.g. water bottles</td>
<td>Endocrine disruptor</td>
</tr>
<tr>
<td><strong>Cotinine</strong></td>
<td>Biomarker for exposure to tobacco smoke</td>
<td>Valuable indicator of tobacco smoke exposure</td>
</tr>
<tr>
<td><strong>- Heavy Metals, including Lead &amp; Cadmium</strong></td>
<td>- Food, drinking water, fish, pesticides, building materials, etc.</td>
<td>- Some are carcinogens; neurological disorders, etc.</td>
</tr>
<tr>
<td><strong>- Mercury</strong></td>
<td>- Exposure to methylmercury from consumption of contaminated fish or mammals</td>
<td>- Neurological effects</td>
</tr>
<tr>
<td><strong>Perfluorinated Compounds (PFOS, PFOA)</strong></td>
<td>Used to make materials stain, oil and water resistant, e.g. non-stick surfaces for cookware</td>
<td>PFOA: carcinogen; PFOS: affect immune system</td>
</tr>
<tr>
<td><strong>Pesticides (OCs, OPs, Phenoxy Herbicides, Pyrethroid Pesticides)</strong></td>
<td>Substances intended for preventing, repelling or mitigating pests. OCs Banned</td>
<td>Possible carcinogens; nerve damage</td>
</tr>
<tr>
<td><strong>Phthalates</strong></td>
<td>Plastics, cosmetics, perfumes, industrial paints and solvents</td>
<td>Endocrine disruptors</td>
</tr>
<tr>
<td><strong>Polybrominated Diphenyl Ethers (PBDEs)</strong></td>
<td>Used as flame retardants in building materials, electronics, furnishings, textiles, plastics, etc.</td>
<td>May posses liver toxicity, thyroid toxicity, and neurodevelopmental toxicity (Source US EPA's IRIS)</td>
</tr>
<tr>
<td><strong>Polychlorinated Biphenyls (PCBs)</strong></td>
<td>Used as dielectric fluids in transformers, capacitors, and coolants, etc. Banned</td>
<td>Carcinogens</td>
</tr>
</tbody>
</table>
Participants received one of two letters: (i) a standard letter, or (ii) an early notification letter.
Dear Mr. Simpson:

Thank you for participating in the First Nations Biomonitoring Initiative (FNBI). Your contribution will help us and your community better understand the health of First Nations people.

Enclosed, you will find:

- A copy of the Report of Measurements provided to you at the FNBI clinic;
- Your Laboratory Results;
- Brief summary of chemicals being measured.

The laboratory results are not intended to replace regular visits to a doctor or a health professional. The results only provide you with a “snap shot” or record of natural and synthetic compounds and the levels found in your blood or urine on the date that the samples were collected. I would recommend that you follow up with a health professional if any of your laboratory results are higher than the normal range.

Clear guidelines for interpreting test results do not exist, at this time, for all chemicals and substances we tested for. Consequently, only those laboratory results for which guidelines exist (mercury (Hg), lead (Pb), and cadmium (Cd)) are provided with special attention. Results of the remaining laboratory tests are provided without interpretation by the First Nation Biomonitoring Initiative.
Since no guidelines exist for most of the compounds in this study, we are unable to provide you with any advice or interpretation of the results. However, in order to provide some context, we have used the averages found in the Canadian Health Measures Survey, a study which tested urban Canadians for the same substances. From that study, you will be able to see how your results compare with a person who lives in an urban centre, indicated by an “↑” if your result is higher or “↓” if your result is lower. Once again, if one of your results is higher, it does not necessarily mean that you will develop any health problems.

Your personal confidential results are in the enclosed sealed envelop. You may wish to provide your doctor or health care professional with a copy of your laboratory results to be included in your health records. We would recommend that you keep the results in a safe place for long-term storage. The information contained in the report may be of some value and assistance to you in the future.

For questions about the material you have received or about the First Nations Biomonitoring Initiative, please feel free to contact me at: 613-241-6789 or toll-free at 1-866-869-6789.

I hope you find the information we have provided useful. Thank you again for taking part in the First Nations Biomonitoring Initiative.
Dear Mr. Simpson,

Recently, you participated in the First Nations Biomonitoring Initiative (FNBI). Blood and urine samples were taken as part of your examination on January 26, 2011. We have reviewed your test results and found that one value is in exceedance of Health Canada’s accepted guidelines and require your attention. The exceedance is reported below:

Test: Lead  
Your Result: 16 µg/dL  
Guideline: 10 µg/dL (Health Canada Guideline for Lead in Blood)  
Average Range for the General Population*: 1.24-1.44 µg/dL  

*For ages 6-79

The levels of lead measured in your blood were above the guideline level. Lead has been known to cause adverse health effects. You should consult a doctor or regulated health professional for further information and for advice on your level of risk and if/how to reduce the amount of lead in your body. Please see the attached document for additional information on lead.

The tests performed as part of the FNBI are not intended to be used to diagnose any specific medical condition nor as a substitute for a visit to a doctor or regulated health professional. You will receive a full report of your results in the near future.

If you have any questions about this report or the FNBI, please contact me at 613-241-6789 or toll-free at 1-866-869-6789.
Laboratory results

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Blood (μg/L)</th>
<th>Guideline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mercury (Total)</td>
<td>13.04</td>
<td>&lt;20.0 a</td>
</tr>
<tr>
<td>Lead (μg/dL)</td>
<td>1.55</td>
<td>&lt;10.0 b</td>
</tr>
<tr>
<td>Cadmium</td>
<td>0.33</td>
<td>5.06 c</td>
</tr>
</tbody>
</table>

*na - Lab result not available  
<LOD - Less than what can be detected  
a - Health Canada Guideline  
b - Health Canada Guideline  
c - Occupational Exposure Guideline

Other metals and trace elements
Metals and trace elements are naturally occurring substances found in our environment. You can be exposed to metals and trace elements from both natural sources and human activities.

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Blood (μg/L)</th>
<th>CHMS Range**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arsenic</td>
<td>1.50</td>
<td>0.63 - 1.95</td>
</tr>
<tr>
<td>Copper</td>
<td>0.89</td>
<td>0.2393 - 0.99642</td>
</tr>
<tr>
<td>Molybdenum</td>
<td>0.42</td>
<td>0.55 - 0.93</td>
</tr>
<tr>
<td>Nickel</td>
<td>0.83</td>
<td>0.47 - 0.92</td>
</tr>
<tr>
<td>Selenium</td>
<td>197.4</td>
<td>186.16 - 223.22</td>
</tr>
<tr>
<td>Uranium</td>
<td>&lt;LOD</td>
<td>&lt;LOD &lt; LOD &lt; LOD</td>
</tr>
<tr>
<td>Zinc</td>
<td>6,540.9</td>
<td>6,179.6 - 7,313.1</td>
</tr>
<tr>
<td>Mercury (Inorganic)</td>
<td>2.91</td>
<td>&lt;LOD &lt; LOD &lt; LOD</td>
</tr>
<tr>
<td>Manganese</td>
<td>14.28</td>
<td>7.15 - 10.82</td>
</tr>
</tbody>
</table>

*na - Lab result not available  
<LOD - Less than what can be detected  
** Canadian Health Measures Surveys (CHMS) age-specific results, 2007-2009

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Urine (μg/dL)</th>
<th>CHMS Range**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arsenic</td>
<td>14.61</td>
<td>7.88 - 29.82</td>
</tr>
<tr>
<td>Copper</td>
<td>15.84</td>
<td>10.15 - 14.76</td>
</tr>
<tr>
<td>Molybdenum</td>
<td>15.01</td>
<td>29.42 - 61.46</td>
</tr>
<tr>
<td>Nickel</td>
<td>1.12</td>
<td>0.98 - 2.43</td>
</tr>
<tr>
<td>Selenium</td>
<td>91.28</td>
<td>47.96 - 79.31</td>
</tr>
<tr>
<td>Uranium</td>
<td>&lt;LOD</td>
<td>&lt;LOD &lt; LOD &lt; LOD</td>
</tr>
<tr>
<td>Zinc</td>
<td>978.6</td>
<td>262.25 - 597.37</td>
</tr>
<tr>
<td>Mercury (Inorganic)</td>
<td>1.64</td>
<td>&lt;LOD &lt; 0.94</td>
</tr>
<tr>
<td>Manganese</td>
<td>&lt;LOD</td>
<td>&lt;LOD &lt; 0.23</td>
</tr>
<tr>
<td>Vanadium</td>
<td>&lt;LOD</td>
<td>&lt;LOD &lt; LOD &lt; LOD</td>
</tr>
<tr>
<td>Antimony</td>
<td>&lt;LOD</td>
<td>&lt;LOD &lt; 0.07</td>
</tr>
<tr>
<td>Lead (μg/dL)</td>
<td>0.86</td>
<td>0.61 - 1.43</td>
</tr>
<tr>
<td>Cadmium</td>
<td>0.54</td>
<td>0.43 - 1.11</td>
</tr>
</tbody>
</table>

*na - Lab result not available  
<LOD - Less than what can be detected  
Adjusted by creatinine values  
** Canadian Health Measures Surveys (CHMS) age-specific results, 2007-2009

Assemblée des Premières Nations
www.afn.ca
Laboratory results

- There are *only guideline levels for lead, mercury, and cadmium*. Aside from lead, mercury, and cadmium, a “safe level” for all of the other chemicals is still unknown.

- All participants were sent a letter of their results for all chemicals.

- Any participant who exceeded the Health Canada guidelines for lead or mercury (or the Occupational Safety and Health guideline for cadmium) was sent a letter notifying them of these exceedances.

- Limitation: This project was for participants 20 years of age or older (pregnant women/children were excluded).
General Findings – *Metals (13)*

Overall *lower or comparable to CHMS*

- Antimony
- Arsenic
- Molybdenum
- Nickel
- Selenium
- Uranium
- Vanadium
General Findings –
Overall *lower or comparable to CHMS*

- Perfluorinated Compounds – PFCs (9)
- Polychlorinated Biphenyls – PCBs (25)
- Polybrominated Flame Retardants – PBDEs (10)

- Insecticides/Herbicides:
  - Organochlorines (7)
  - Phenoxy herbicides (1)
  - Chlorophenol (1)
  - Organophosphate insecticides (6)
  - Pyrethroid Insecticides (5)
General Findings

Overall *higher levels compared to CHMS*

- **Copper** – around 1.5 times higher
  - No guidelines to assess health effects
  - Values higher than other studies (Females)
  - Sources of exposure: ingestion of food, water, and others.

- **Manganese** – around 1.5 times higher
  - No guidelines to assess health effects
  - Comparable to normal ranges from other studies
  - Sources of exposure: ingestion of food, drinking water, and others.
General Findings

Overall *higher levels compared to CHMS*

- **Zinc** – urine – around 1.7 times higher
  - No guidelines to assess health effects
  - Comparable to what has been found in other studies
  - Sources of exposure: ingestion of food; drinking water from pipes and fittings leaching zinc; occupational: mining, smelting, welding.

- **BPA** – Females – around 1.5 times higher
  - No guidelines to assess health effects
  - Source of exposure: ingestion of food (migration from food packaging, and from repeat-use polycarbonate containers).
General Findings
Overall *higher levels compared to CHMS*

- **Phthalates** (1 of 11 substances – mono-benzyl phthalate (BzBP))
  - Newer chemicals
  - No guidelines to assess health effects
  - Source of exposure: used in products such as adhesives, vinyl tile, sealants, car care products, and to a lesser extent, some personal care products. Food crops take up BzBP, and diet is the major source for general population exposure (http://www.cdc.gov/biomonitoring/BzBP_BiomonitoringSummary.html)
Current Health Canada guideline for lead is 10 ug/dL (this guideline is under review).

Overall (blood) lead concentrations are below the levels of the general Canadian population.

Recent research indicates that there are no safe levels for exposure to lead.

Geometric mean blood lead concentration 1.18ug/dL for FNBI
Lead – CHMS vs. FNBI

Geometric mean blood lead (µg/dL)

Total >20 years

CHMS Cycle 1 (2007-2009)

FNBI (2011)
Lead exposure – community specific

- % population over 10ug/dL:
  - CHMS: < 1%
  - FNBI Community: ~ 8%
Mercury

- Current Health Canada guideline is 20 ug/L for adults and provisional guidance value of 8 ug/L for children (18 years and younger) and women (18-49 years old) of child-bearing age.

- Overall (blood) total mercury concentrations: coefficient of variation very high (large spread of results).

- Comparisons done on a community basis: 6 out of 13 FN communities had higher levels than the Canadian population – they have been informed.

- For most people, mercury intake is largely diet related.

- Geometric mean blood mercury concentration 0.95 ug/L
Mercury – CHMS vs. FNBI

Assemblée des Premières Nations

Ellen Lye – Chemicals Surveillance Bureau

www.afn.ca
Mercury – Regional variability

National FNBI:
Geometric mean blood mercury concentration 0.95 ug/L

CHMS:
Geometric mean blood mercury concentration 0.83 ug/L

Community X:
Geometric mean blood mercury concentration 3.30 ug/L

Community Y:
Geometric mean blood mercury concentration 4.19 ug/L
Cadmium

✔ Current provincial Occupational Safety and Health guideline is 5.1 ug/L.

✔ Overall (blood) cadmium concentrations are around 2 times higher than the general Canadian population.

✔ Higher cadmium levels related to smoking rates (around 4 times higher than the Canadian population):
  ✔ Overall smoking rate in FNBI participants 65%
  ✔ CHMS participants smoking rate 17%

✔ Occupational exposure
Cadmium

- Geometric mean of 1.03 µg/L in blood (ages 20 years and over)
- Geometric mean of 1.34 µg/L in blood (ages 20-39)
- Geometric mean of 0.76 µg/L in blood (ages 40-99)
Assembly of First Nations

Cadmium – CHMS vs. FNBI

Geometric mean urinary cadmium (µg/L)

Total >20 years

CHMS Cycle 1 (2007-2009)

FNBI (2011)

Ellen Lye – Chemicals Surveillance Bureau
Bisphenol A (BPA)

- Geometric mean of 1.55 µg/L in urine (age 20 years and over)

- Currently, there are no guidance values available for the general population for bisphenol A

- BPA – Females – around 1.5 times higher
Bisphenol A – CHMS vs. FNBI

Geometric Mean Urinary BPA (µg/L)

Total >20 years

CHMS Cycle 1 (2007-2009)

FNBI (2011)
More Findings…

- Mirex and PCB’s levels slightly higher in Elders compared to their peers in the CHMS.
- However, younger people showed no difference from CHMS results.
- Conclusion: likely a historical exposure.
How has the data been used?

1. Establishing baseline information for environmental contaminants of First Nations peoples living on-reserve 2011 – snapshot which can be used in the future to compare to other or similar populations.

2. Address lead issue in community with elevated levels.

3. Correlated data with the First Nations Food Nutrition and Environment Study (FNFNES).

4. Investigations to determine why an increase/decrease in exposure (i.e. community with manganese issue).
How has the data been used?

5. This provides a baseline for future studies to compare exposure levels and track trends. Allows other interested FN communities to conduct their own biomonitoring – FN communities replicating study.


7. Dissemination at the international level: conference presentation and three abstracts accepted.
Contact Information

Contact us:
Assembly of First Nations
Telephone: 1-613-241-6789

Visit http://www.afn.ca
Thank You!

FNBI National Report