Biomonitoring in the Northeast – Opportunities for Collaboration?

Experience from the Last Ten Years - New York PHL

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OUTLINE

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• Projects
  • CHANES
  • Great Lakes
  • Newborn Screening
• Developing Capabilities
• Collaborations
  • Research
  • Method development
• North East Opportunities?
NYS Biomonitoring Timeline

2001 Biomonitoring CDC Planning Grant (2 years)
   25 states and state consortia funded
2003 3 Awards (NH, Rocky Mt. Consortium, NY)

2003-2008 Biomonitoring Implementation Funding
   – Purchase of GC/HRMS + funded one analytical staff
   NYS Tobacco Control Program – State Legislation
   NYC CHANES Study (Trace elements, cotinine, pesticides)
   Pilot Projects (PFC, PBDE, OH-PAHs, trace element speciation, etc)

2009-2015 Expanding NY PHL Capability & Capacity
   Method development and validation (DU, Speciation, Emerging Organics)
   Staff, Automation, Instrumentation
   Expanding funding & collaborations
Proposed to develop trained staff and purchase suitable instrumentation for human biomonitoring studies important to NYS public health. (2003)
New York City CHANES

• Population-based, cross-sectional survey of ~2000 civilian, non-institutionalized adults.
• Conducted Jun 2004 – Dec 2004
• Serum Cotinine measured in ~1,800 people
• Analyses by LC/MS/MS
• Blood metals (Pb, Cd and Hg) and Urine Hg were measured in ~1,800 people.
• Analyses performed by ICP-MS


NYC CHANES 2004

Whole Blood
- Heavy Metals – Lead , Cadmium , Mercury (1,811)
- Mercury Speciation (438)
- Manganese & Selenium (method development)

Serum
- Cotinine (1,800)
- PCBs, DDT, DDE, PBDEs (1,052)

Urine
- 21 Trace Elements (1,876)
- Mercury (1,876)
- Dialkylphosphates (886)
- Hydroxy PAHs (~1,000) (method development/validation)

*2013 CHANES Targets
Trace Element Analysis Biomonitoring Methods

- Blood Metals
  - Lead, Cadmium and total Mercury (ICP-MS); Manganese
- Urine Trace Elements: The “NHANES” suite
  - cobalt; cadmium, lead, uranium; antimony; barium; beryllium; cesium; molybdenum; platinum; thallium; and tungsten.
- Urine Mercury by ICP-MS
- Mercury Speciation in Blood by GC-ID-ICP-MS
  - Blood (MeHg, iHg, EtHg).
- Arsenic Speciation in Urine by LC-ICP-MS
- Depleted Uranium in Urine by SF-ICP-MS
BIOMONITORING AND THE GREAT LAKES

- ATSDR Funded study with NYSDOH EPHT.
- Areas of Concern (AOC) related to lake contamination with “legacy” chemicals (PCBs, PAHs, Mirex, Dechlorane)
- Vulnerable populations (sport and subsistence fishermen (ethnic communities - Burmese refugees)
- Study planning completed, participants identified and clinics set up, samples collected.
- Laboratory assisted with sample collection
- Possible Collaborative projects with other Great Lake State Departments of Health.
Biospecimens (blood, urine) collected from subsistence fish eaters living close to areas of concern. Includes ethnic refugee Burmese populations.
List of required and optional analytes to be measured in blood and urine specimens.

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Required by ATSDR or optional</th>
<th>Specimen type</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Organic chemicals</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PCBs (8 required congeners 28, 52, 101, 105, 118, 138, 153, and 180)</td>
<td>Required and Optional</td>
<td>Blood/Serum</td>
</tr>
<tr>
<td>PBDEs (predominant congeners)</td>
<td>Optional</td>
<td>Blood/Serum</td>
</tr>
<tr>
<td>Perfluorinated compounds (PFOS, PFOA)</td>
<td>Optional</td>
<td>Blood/Serum</td>
</tr>
<tr>
<td>DDT/DDE</td>
<td>Required</td>
<td>Blood/Serum</td>
</tr>
<tr>
<td>Mirex</td>
<td>Required</td>
<td>Blood/Serum</td>
</tr>
<tr>
<td>Hexachlorobenzene (HCB)</td>
<td>Required</td>
<td>Blood/Serum</td>
</tr>
<tr>
<td>Toxaphene (Parlar 26, 50)</td>
<td>Optional</td>
<td>Blood/Serum</td>
</tr>
<tr>
<td>Chlordane</td>
<td>Optional</td>
<td>Blood/Serum</td>
</tr>
<tr>
<td>Oxychlordane and trans-nonachlor</td>
<td>Optional</td>
<td>Blood/Serum</td>
</tr>
<tr>
<td>Dieldrin*</td>
<td>Optional</td>
<td>Blood/Serum</td>
</tr>
<tr>
<td>Dechlorane Plus*</td>
<td>Optional</td>
<td>Blood/Serum</td>
</tr>
<tr>
<td><strong>Metals</strong></td>
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<td></td>
</tr>
<tr>
<td>Mercury (total)</td>
<td>Required</td>
<td>Blood</td>
</tr>
<tr>
<td>Lead</td>
<td>Required</td>
<td>Blood</td>
</tr>
<tr>
<td>Cadmium</td>
<td>Optional</td>
<td>Blood</td>
</tr>
<tr>
<td>Mercury (total inorganic)</td>
<td>Optional</td>
<td>Urine</td>
</tr>
<tr>
<td><strong>Nutrient</strong></td>
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<td></td>
</tr>
<tr>
<td>Omega-3 fatty acids*</td>
<td>Optional</td>
<td>Blood</td>
</tr>
<tr>
<td><strong>Adjustment measurements</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cholesterol/triglycerides</td>
<td>Optional</td>
<td>Blood/Serum</td>
</tr>
<tr>
<td>Creatinine</td>
<td>N/A</td>
<td>Urine</td>
</tr>
</tbody>
</table>

* Will be analyzed in the future using archived blood specimens.
Newborn Blood Spots – Biomonitoring Resource

- Blood Spot Cards – stored at 4°C
- NYS Program Archive for ~10 years
- Use for stable compound trend analysis
- Limited amount of sample from punched disc (0.25” dia)
- Each sample used 24 discs from selected dates
- 10 samples were collected for each year from 1997-2007
  Total samples 110 (2640 discs)
- Extract and analyze by LC/MS/MS using $^{13}$C-labeled I.S.
- Perfluorinated compounds analyzed
  - PFOS perfluorooctane sulfonate
  - PFOA perfluorooctanoic acid
  - PFOSA perfluorooctane sulfonamide
  - PFNA perfluorononanoic acid
  - PFOA perfluorooctanoic acid
  - PFHxS perfluorohexane sulfonate
Use of Blood Spots in detecting declining levels of PFCs in New York State Infants (1997 – 2007)

Production of these PFCs was phased out 2000 - 2002
Samples composite of 24 spots, 10 sample each year

Developing Biomonitoring Capabilities

What are your current strengths?
Are there existing methods that can be expanded?
Specific needs not being addressed?
Training on new methods

State/regional initiatives that could benefit from Biomonitoring
External requests?
Funding?

Research and Publications
Developing Collaborations

• Intermural
  • Other state and city program areas
    • Tobacco Control
    • Epidemiology

• Extramural
  • Federal Partners
    • CDC, ATSDR, NIH, NIEHS, NICHD,
  • Academic Partners
    • State Universities, other colleges
Current Biomonitoring Infrastructure

- Trained Staff – (investment)
- Facilities – Biosafety Hoods, Clean Rooms
- Instrumentation (dual-use)
  - detection
  - sample preparation
  - automation – high throughput
- Network(s)
  - for collaboration, support and expertise
SECTION I: LABORATORY INFRASTRUCTURE
Instrumentation

SECTION II: BIOMONITORING STUDY DESIGN
Study Protocol Development – Epi, EPHT

SECTION III: BIOMARKER SELECTION
Biomarker specificity
Analytic specificity and sensitivity
Correction for Urine Dilution
Lipid Adjustment

SECTION IV: ANALYTICAL PROTOCOL AND METHODOLOGY
Quality Management System
Initial Considerations in Analytical Method Selection
Specimen Collection
Method Validation
Analytical Testing

SECTION V: RESULTS REPORTING
Generating Laboratory Result Reports
Results Interpretation
Results Communication
Communication with the Community
External Coordination