Biomonitoring California’s Results Communication Approach

Association of Public Health Laboratories Webinar
August 27, 2015
Biomonitoring California Presenters

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APHL disclosure of conflicts of interest/financial relationships with commercial entities: All speakers in this session have nothing to disclose.
Biomonitoring: An essential public health function

• Provides a measure of toxic chemical exposures which may adversely affect health status
  ✓ Population level
  ✓ Communities impacted by particular industries/pollutants
  ✓ Vulnerable sub-groups, such as pregnant women, children, and workers

• Proven scientific tool to demonstrate successes or failures of regulatory and public health efforts to reduce chemical exposures

• Offers important information to inform and educate decision-makers and the public
Biomonitoring California

- Established by state legislation (SB 1379)
- Tri-departmental program, including two labs
- Formal public involvement
  - Scientific Guidance Panel
  - Stakeholder consultation
  - Maintain public website
    [http://www.biomonitoring.ca.gov/](http://www.biomonitoring.ca.gov/)
- Participants entitled to receive their individual results – “results return”
Biomonitoring California: Goals

• Determine chemical levels in Californians using science-based surveys:
  ✓ Representative of California population
  ✓ Community studies (demographic and/or geographic)

• Examine trends in chemical levels over time

• Help assess the effectiveness of:
  ✓ Environmental regulations
  ✓ Public and occupational health interventions
  ✓ Safer consumer product efforts
Priority Initiatives

• Work toward statewide representative sampling
• Continue biomonitoring of targeted populations – workers, pregnant women
• Conduct biomonitoring intervention studies
• Carry out consumer product case studies
• Incorporate environmental justice as a guiding principle
Overview of presentation

• Background – overarching principles and early efforts
• What participants want to know – basic elements of packet
• Constructing fact sheets
• Context for results – comparison values
• Special protocols for elevated levels
• Refining materials – usability testing (UT) and evaluation
• Communicating results – a tour of our packet
• Future directions
Overarching principles for results communication approach

**Legal mandate to return results to all participants who request them**

Materials should be:

- Understandable
- Scientifically accurate
- Transparent about uncertainties
Groundwork – early efforts

• Workshop on results communication with Scientific Guidance Panel (SGP), guest speakers, and public
  – http://www.biomonitoring.ca.gov/events/scientific-guidance-panel-meeting-july-2009

• Pilot materials and usability testing
  – Maternal and Infant Environmental Exposure Study (MIEEP)
  – Collaboration with UC Berkeley (UCB), UC San Francisco (UCSF), and Health Research for Action (HRA)

• Foundation for materials developed for subsequent studies
  – Firefighter Occupational Exposures (FOX) Project
  – Biomonitoring Exposures Study (BEST)
What do participants want to know?*

• What were my results?
• Are my levels high?
• How was I exposed?
• Can the chemicals affect my health?
• What actions can I take?

*Adapted from Rachel Morello-Frosch, UCB
Basic elements of packet

• Cover letter
• Project description page
• Chemical results
  – With comparison values and text explanation
• Chemical-specific fact sheets
Constructing fact sheets

- Determining topics and format
- Conducting underlying research
- Developing understandable, scientifically accurate language
- Providing advice for action and links for more information
- Obtaining feedback from participants and refining
- Carrying out collaborative review and approval with Program departments
Format and topics

• Single page
• “One-liner” describing the chemical
• Topics covered
  – Where a chemical is found – link to likely exposure sources
  – Possible health concerns – focus on low dose effects
  – Possible ways to reduce exposure - with caveats
  – Special topics where needed (e.g., for essential nutrient)
• Links for more information
Conducting underlying research

- Review scientific literature and documents
  - Original research publications
  - Secondary sources as appropriate (e.g., OEHHA, CDC documents)
- Identify other sources
  - For example, industry websites to understand chemical use
- Retain electronic file of all references used
FACT SHEET EXAMPLES

Full set available at:

http://www.biomonitroing.ca.gov/chemicals/fact-sheets
Arsenic Fact Sheet

Arsenic is found in soil and water in some areas, and in some foods. It occurs naturally and from human activity. Arsenic compounds were used extensively as pesticides and wood preservatives, but these uses have been mostly phased out. There are different forms of arsenic, some of which may cause health problems and others that are not a health concern.

### Arsenic is found in

- Some foods, including:
  - Seafood, especially shellfish. The main form of arsenic in seafood is not considered to be a health concern.
  - Rice and foods with rice-based ingredients, such as some hot and cold cereals, some infant formulas, and rice cakes. Rice plants can take up arsenic from water or soil.
  - Hijiki seaweed (short, black, noodle-like seaweed).
- Some drinking water sources, such as in some places in the Central Valley and Southern California.
- Some pressure-treated wood used in outdoor structures, such as decks and playground equipment. Arsenic-treated wood was phased out in 2004.
- Cigarette smoke.
- Additives put in some chicken and turkey feed to prevent parasites.
- Some herbal medicines and other traditional remedies, especially from China and India.
- Some herbicides in limited use on golf courses, cotton, and at sod-growing facilities.

### Possible health concerns

Some forms of arsenic:

- May harm the developing fetus.
- May harm the nervous system and may affect learning in children.
- May contribute to cardiovascular disease and may affect lung function.
- Can increase cancer risk.

### Possible ways to reduce exposure to forms of arsenic that may affect health

- Include plenty of variety in your and your children’s diets.
- Breastfeed your infant if you can. Include alternatives to rice-based foods in your infant’s diet.
- Do not burn older pressure-treated wood (manufactured before 2004) and avoid using it for home projects.
- Have children wash their hands after they play on or around older wooden play structures or decks. If you own such a structure or deck, apply a sealant or coating every one to two years.
- If your water comes from a private well, have it tested for arsenic. (If your water comes from a public water supplier, it is already tested regularly for arsenic.)
Highlights of Arsenic fact sheet

- Extensive database of information
  - Many potential sources of exposure and wide range of health effects

- Chemical identity
  - “There are different forms of arsenic, some of which may cause health problems and others that are not a health concern.”

- Known human carcinogen
  - “Some forms of arsenic can increase cancer risk.”

- Practical advice, targeted to specific scenarios
  - Children as a special concern: “Breastfeed your infant if you can. Include alternatives to rice-based foods in your infant’s diet.”

- No links to external fact sheets

http://www.biomonitoting.ca.gov/sites/default/files/ArsenicFactSheet.pdf
Manganese Fact Sheet

Manganese is an essential nutrient that we get mainly from food. It is normal and healthy to have some manganese in the body. Manganese is also a metal used in many industries and products. The most common way to be exposed to excess manganese is through jobs that involve working with metals, such as welding.

<table>
<thead>
<tr>
<th>Manganese is found in</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Certain foods, such as nuts, grains, beans, and leafy green vegetables.</td>
<td></td>
</tr>
<tr>
<td>• Some drinking water sources.</td>
<td></td>
</tr>
<tr>
<td>• Certain metal alloys, such as steel.</td>
<td></td>
</tr>
<tr>
<td>• Some welding rods.</td>
<td></td>
</tr>
<tr>
<td>• Certain chemicals used in agriculture to kill fungus.</td>
<td></td>
</tr>
</tbody>
</table>

| Manganese is an essential nutrient                          | Some manganese is needed to support many vital processes in the body, such as building bones and healing wounds. |

<table>
<thead>
<tr>
<th>Possible health concerns of too much manganese</th>
<th>Too much manganese:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• May be associated with learning and behavior problems in children.</td>
<td></td>
</tr>
<tr>
<td>• Can harm memory, thinking, mood, and balance in adults.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Possible ways to avoid exposure to too much manganese</th>
<th>Eat a well-balanced diet with adequate iron, which can help you maintain a healthy level of manganese.</th>
</tr>
</thead>
<tbody>
<tr>
<td>• If you do any welding or metalworking, be sure that your work area is well ventilated and use proper protective equipment.</td>
<td></td>
</tr>
<tr>
<td>• Keep children away from welding fumes and other metal vapors and dusts.</td>
<td></td>
</tr>
</tbody>
</table>

For more information:
Highlights of Manganese fact sheet

• **Essential nutrient…**
  – “Manganese is an essential nutrient that we get mainly from food. It is normal and healthy to have some manganese in the body.”
  – “Some manganese is needed to support many vital processes in the body, such as building bones and healing wounds.”

• **…that can also be toxic**
  – “Manganese is also a metal used in many industries and products. The most common way to be exposed to excess manganese is through jobs that involve working with metals, such as welding.”
  – “Too much manganese may be associated with learning and behavior problems in children.”

• **Advice on how to maintain an appropriate level**

### Benzophenone-3 (Oxybenzone) Fact Sheet

Benzophenone-3 (oxybenzone) is used in many sunscreens and some other personal care products to protect skin from sun damage. Benzophenone-3 is also added to packaging and some consumer products, such as cosmetics and paints, to protect the products from sun damage.

#### Benzophenone-3 is found in
- Many sunscreens.
- Sun-protective personal care products, such as some lotions, lip balms, and cosmetics.
- Some perfumes, shampoos, conditioners, and nail polish.
- Plastic packaging for some food and consumer products.
- Some protective coatings, such as varnish and oil-based paint.

#### Possible health concerns
Scientists are still studying how benzophenone-3 may affect people’s health. There is concern that benzophenone-3:
- May interfere with the body’s natural hormones.

#### Possible ways to reduce exposure
- Wash off sunscreen and sun-protective products once you are out of the sun.
- Eat more fresh food and less packaged food, which might help reduce exposure to benzophenone-3 from some plastic packaging.

#### Importance of sun safety
Sun exposure is known to damage skin and increase skin cancer risk. Applying a broad-spectrum sunscreen is only one of the important ways to shield against the sun’s ultraviolet (UV) rays. You should also:
- Reduce or avoid exposure to direct sunlight when UV rays are strongest, usually between 10 am and 4 pm. When possible, seek shade.
- Wear protective clothing, including a wide-brimmed hat and sunglasses.

For more information:
Sun safety tips: [www.healthychildren.org/English/safety-prevention/at-play/Pages/Sun-Safety.aspx](http://www.healthychildren.org/English/safety-prevention/at-play/Pages/Sun-Safety.aspx)
Highlights of Benzophenone-3 fact sheet

• Health concerns less well understood
  – “Scientists are still studying how benzophenone-3 may affect people’s health. There is concern that benzophenone-3 may interfere with the body’s natural hormones.”

• Providing advice on possible ways to reduce exposure, while addressing concerns about sun safety

Context for results - comparison values

• How to answer the question, “Is this level high?”
  – Consultation with SGP, outside experts, and the public
    http://www.biomonitoring.ca.gov/events/biomonitoring-california-workshop-march-2011
  – Usability testing

• Biomonitoring California comparison values
  – National median and 95th percentile, when available
  – Study range (min to max)
  – Levels of concern established by federal or state agencies
Special protocols for elevated levels

- Contaminants with levels of known health concern established by federal or state agencies:
  - Arsenic
  - Cadmium
  - Lead
  - Mercury

- Biomonitoring California protocols developed for following up on elevated levels
  - Targeted for contaminant and demographics
Overview

• Background – overarching principles and early efforts
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• Special protocols for elevated levels
• Refining materials – usability testing (UT) and evaluation
• Communicating results – a tour of our packet
• Future directions
FOX: usability testing and survey

- Firefighters from Southern California
- UT interviews at wellness/fitness appointments or fire stations
- Individuals or small groups
- Online survey after receipt of packets
BEST: usability testing and survey

• Pilot BEST participants from Central Valley
• Kaiser Permanente members
• Individual UT interviews at home or other location convenient for participant
• Evaluation survey – paper copy mailed after final results return
Key outcomes of usability testing and survey

• Adjustments to materials
  – Removed graphs
  – Added project description, information about how chemical levels can change
  – Changed form of fact sheets to Q&A

• Participants:
  – Demonstrated understanding of results
  – Found materials useful and informative
  – Appreciated opportunity to advance research
Basic elements of packet

• Cover letter
• Project description page
• Chemical results - with comparison values and explanation
• Chemical-specific fact sheets
Tour of our current packet
Date

Name
Address
City, State Zip

Dear [Name]:

Thank you very much for taking part in the Biomonitoring Exposures Study (BEST) in 2013. As part of this study, we are measuring the levels of up to about 90 chemicals in blood and urine.

Your participation in this important project is helping us learn more about the presence of chemicals in California residents and possible environmental sources of these chemicals.

The first set of laboratory tests has been completed and your results are enclosed. This mailing includes results for 15 chemicals we measured in your blood. If we analyze your blood or urine samples for additional chemicals, you will receive your remaining test results at a later date, after laboratory analyses are completed.

This mailing includes:

Part 1: Metals in blood – lead, mercury, cadmium, and manganese. For each metal, you will find a summary of your results and information about that metal.

Part 2: Perfluorochemicals, or PFCs, in blood. This section includes a summary of your results, a list of the 11 PFCs that we looked for, and information about these chemicals.

You can compare your results to:

- Results for other participants who participated in BEST in 2013.
- Results from a study of the general U.S. population.
- Levels of concern. If you had a result above a level of concern, you should already have heard from us about this. If needed, we provided advice on ways to reduce your exposure to protect your health. For the chemicals in this packet, levels of concern have been set for lead, mercury, and cadmium. There is not enough scientific information available to set levels of concern for the other chemicals.

Thank you again for your participation in this study – you are helping us lay the foundation to measure chemicals in people throughout California. Ultimately, information from biomonitoring studies, combined with other research, can be used to learn how chemicals may affect our health and to support efforts to prevent exposure to harmful substances.

If you have any questions, please feel free to call either of us at the numbers listed below.

Sincerely,
Frequently Asked Questions about the Biomonitoring Exposures Study

What can I learn from the Biomonitoring Exposures Study (BEST) about chemicals in my body?

As a participant in the BEST biomonitoring project, you are receiving in this packet the levels of 15 chemicals our laboratory tested for in your blood. We also provide information on ways you might have been exposed to these chemicals. Many of the chemicals we test for are widespread in the environment and consumer products, and it is difficult to avoid exposure to them. For each chemical in this packet, we also provide information about actions you could take to help reduce your exposure.

For most of the chemicals that we biomonitor, there is not enough scientific information available to know how much can be in anyone’s body without causing harm. Therefore, we cannot tell you whether the chemical levels measured in your body might affect your health.

Can I compare my results to others?

You can compare your chemical levels to those of other Kaiser members who participated in BEST in 2013. You can also compare your results to those from a national study of U.S. adults. Some chemicals may be higher in BEST participants than in people from the rest of the country, while others might be lower. Comparing your results to those of other people cannot tell you what level of any chemical might be a health concern.

How does my participation make a difference?

BEST will help us learn more about chemical levels in Central Valley residents and lay the foundation for a larger statewide biomonitoring study. Information from biomonitoring studies, combined with other research, can be used to learn more about how chemicals may affect health. Biomonitoring can also support government efforts to reduce exposures to harmful chemicals.

Can the amount of a chemical in my body change over time?

Yes. The amount of a chemical in your body depends on many factors, including how much and how often you have had contact with that chemical, and how long it takes for your body to remove it.

What is the Biomonitoring Exposures Study (BEST)?

Researchers at Kaiser Permanente and Biomonitoring California conducted BEST to learn about levels of certain chemicals in residents of California’s Central Valley. We chose these chemicals based on many factors, including whether: (1) they are commonly found in the environment or consumer products, and (2) there are known or suspected health concerns about them.

Individuals were recruited after being randomly selected from adult Kaiser Permanente members in seven Central Valley counties.

About 300 Kaiser Permanente members completed questionnaires and donated blood and urine samples. These samples will have been tested for up to about 90 chemicals by the end of the study.

Biomonitoring Exposures Study 2013
Your **Lead** Lab Result

We tested your blood for lead. Lead is a metal that is found in nature and is used in many industries and products.

<table>
<thead>
<tr>
<th>Your lead result</th>
<th>Lowest result found in this study</th>
<th>Highest result found in this study</th>
<th>Number of participants in this study with lead found in their blood</th>
<th>Middle level in the U.S.</th>
<th>95th percentile in the U.S.</th>
<th>Level of concern*</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5</td>
<td>0.14</td>
<td>10.7</td>
<td>All 311</td>
<td>1.1</td>
<td>3.4</td>
<td>10 and above</td>
</tr>
</tbody>
</table>

All the numbers above are in micrograms per deciliter (µg/dL).

**Did you find lead in my blood?**

Yes. Your lead result was 2.5 µg/dL.

**What can I compare my result to?**

You can use the table above to compare your lead result to:

- **Other participants in this study.** We found lead in all 311 participants tested. The results ranged from 0.14 to 10.7 µg/dL.
- **Middle level in the U.S.** Half the adults tested in the U.S. had a result below 1.1 µg/dL and half above.
- **95th percentile in the U.S.** 95% of adults tested in the U.S. had a result below 3.4 µg/dL.

The U.S. middle level and 95th percentile do not tell us anything about what level of lead in blood might be a health concern. We are providing this information so that you can compare your result to those of other U.S. adults.

- **Level of concern.** Your lead result was below the level of concern.

The next page explains more about lead.

*This is the level of concern for men age 18 and older, and women age 50 and older.
Your PFC Lab Results

Perfluorochemicals (PFCs)

We tested your blood for 11 perfluorochemicals (PFCs). Perfluorochemicals are used to make various products resistant to oil, stains, grease, and water.

Did you find PFCs in my blood?

Yes. We found 8 PFCs in your blood.

What can I compare my results to?

You can use the table on the next page to compare each PFC result to:

- Other participants in this study. We found some PFCs in most of the 311 participants tested.
- Middle level in the U.S. Half the adults tested in the U.S. had a result below the middle level and half above.
- 95th percentile in the U.S. 95% of adults tested in the U.S. had a result below the 95th percentile.

The U.S. middle levels and 95th percentiles do not tell us anything about what levels of PFCs in blood might be a health concern. We are providing this information so that you can compare your results to those of other U.S. adults.

No state or federal agency has established a level of concern for any PFC. Scientists are still studying how PFCs might affect people’s health. The next page contains a table with your PFC results, followed by a page that explains more about PFCs.
# Your PFC Lab Results

## Part 2: PFCs in Blood

<table>
<thead>
<tr>
<th>PFC tested</th>
<th>Your PFC result (µg/L)</th>
<th>Lowest result found in this study (µg/L)</th>
<th>Highest result found in this study (µg/L)</th>
<th>Number of participants in this study with this PFC found in their blood</th>
<th>Middle level in the U.S. (µg/L)</th>
<th>95th percentile in the U.S. (µg/L)</th>
<th>Level of concern</th>
</tr>
</thead>
<tbody>
<tr>
<td>PFOS</td>
<td>12.3</td>
<td>0.33</td>
<td>49.8</td>
<td>304 of 311</td>
<td>10.1</td>
<td>34.1</td>
<td></td>
</tr>
<tr>
<td>PFOA</td>
<td>3.1</td>
<td>0.19</td>
<td>47.7</td>
<td>307 of 311</td>
<td>3.3</td>
<td>7.7</td>
<td></td>
</tr>
<tr>
<td>PFHxS</td>
<td>3.6</td>
<td>0.08</td>
<td>17.6</td>
<td>308 of 311</td>
<td>1.7</td>
<td>6.0</td>
<td></td>
</tr>
<tr>
<td>PFDeA</td>
<td>0.29</td>
<td>0.07</td>
<td>3.4</td>
<td>269 of 311</td>
<td>0.30</td>
<td>0.90</td>
<td></td>
</tr>
<tr>
<td>PFDoA</td>
<td>Not found</td>
<td>0.15</td>
<td>3.5</td>
<td>8 of 311</td>
<td>*</td>
<td>0.10</td>
<td></td>
</tr>
<tr>
<td>PFHpA</td>
<td>Not found</td>
<td>0.03</td>
<td>0.46</td>
<td>197 of 311</td>
<td>*</td>
<td>0.20</td>
<td></td>
</tr>
<tr>
<td>PFNA</td>
<td>0.91</td>
<td>0.08</td>
<td>4.7</td>
<td>309 of 311</td>
<td>1.2</td>
<td>3.9</td>
<td></td>
</tr>
<tr>
<td>PFOSA</td>
<td>0.18</td>
<td>0.04</td>
<td>0.19</td>
<td>88 of 311</td>
<td>*</td>
<td>**</td>
<td></td>
</tr>
<tr>
<td>Et-PFOSA-AcOH</td>
<td>0.27</td>
<td>0.02</td>
<td>3.4</td>
<td>165 of 311</td>
<td>*</td>
<td>0.10</td>
<td></td>
</tr>
<tr>
<td>Me-PFOSA-AcOH</td>
<td>0.19</td>
<td>0.03</td>
<td>3.7</td>
<td>303 of 311</td>
<td>0.17</td>
<td>0.96</td>
<td></td>
</tr>
<tr>
<td>PFUA</td>
<td>Not found</td>
<td>0.02</td>
<td>1.2</td>
<td>275 of 311</td>
<td>0.20</td>
<td>0.90</td>
<td></td>
</tr>
</tbody>
</table>

* The middle level in the U.S. cannot be calculated because this PFC was not found in enough people.

** The 95th percentile in the U.S. cannot be calculated because this PFC was not found in enough people.

No state or federal agency has established a level of concern for any PFC.
Producing Results Return Packets

- Receive individual chemical results from laboratory
- Prepare results return template with fixed text (such as comparison values and fact sheets), and empty tables for chemical results and dynamic text
- Create dynamic text options for all possible report back scenarios
- Merge table with template
- Use Visual Basic in MS Word to create individual PDFs. Carry out quality control (check individual values, rounding, dynamic text, etc.)
- Use SAS code to assign appropriate dynamic text (English and Spanish) and format values
- Generate single table with appropriate dynamic text and formatted values
- Generate summary statistics for study
- Determine appropriate NHANES comparison values
Rounds of Results Return

January 2012
FOX Round 1

June 2013
FOX Round 2

December 2012
Pilot BEST Round 1

July 2014
Pilot BEST Round 2

October 2012
MIEEP Round 1

December 2012
MIEEP Round 2

April 2013
MIEEP Round 3

May 2013
Expanded BEST Round 1

August 2014
Expanded BEST Round 2
Future directions

• Secure log-in on website

• Community meetings for study results

• One-on-one meetings with participants
Acknowledgements

• Biomonitoring California staff
• Project collaborators
  – MIEEP: UCB, UCSF, HRA
  – FOX: UC Irvine and Southern CA Fire Authority
  – BEST: Kaiser Permanente Division of Research
• Participants
• Funders: State of California and Centers for Disease Control and Prevention (CDC)
QUESTIONS AND DISCUSSION